



The art of concrete

BUILDING THE SOUTH BANK ARTS CENTRE

www.buildingworkersstories.com

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Front cover: Constructing the raked seating for the Queen Elizabeth Hall.
Source: Photograph courtesy of Rod Bond

PREFACE

This pamphlet is the fifth in a series produced as part of a two-year University of Westminster research project entitled 'Constructing Post-War Britain: Building Workers' Stories, 1950-1970', which began in August 2010. The project is funded by the Leverhulme Trust and aims to collect oral history testimonies from construction workers who were employed on five of the highest profile sites and developments of that era: Stevenage New Town; Barbican development, City of London; South Bank arts complex; Sizewell A power station; and the M1 motorway. The aim of the research is both to gain a greater understanding of the processes of change within the construction industry during these decades and to highlight the role that construction workers played in the creation of the post-war built environment.

For more information see project website www.buildingworkersstories.com

The researchers on the project are: Christine Wall, Linda Clarke, Charlie McGuire and Olivia Muñoz-Rojas

The research for this pamphlet was conducted during May 2011-June 2012.
Seven ex-workers were interviewed:

Graham Sargent
former site engineer,
interviewed in London on 3 May 2011

Peter Day
former site engineer,
interviewed in London on 3 May 2011

Michael Houlihan
former scaffolder,
interviewed in Lostwithiel (Cornwall)
on 22 March 2011 and 27 June 2011

Rodney Bond
former assistant project manager,
interviewed in London on 29 June 2011

Ted Newbery
former site foreman,
interviewed in Canvey Island on
10 August 2011

Jim McDonald
former carpenter,
interviewed in London on 14 March 2012

Glan Davies
former general foreman on the Queen
Elizabeth Hall, interviewed in Surrey on
12 June 2012

INTRODUCTION

The South Bank arts centre was not just a major political and cultural achievement; it was also architecturally and technically ground-breaking. A masterpiece of in situ concrete, for the men who worked on the Queen Elizabeth Hall, the Purcell Room and the Hayward Gallery it meant challenging work. Draughtsmen, shutterers, setting-out engineers, scaffolders, carpenters and steel-fixers were all involved in a well-defined series of stages, leading to each finished concrete element of the complex. It was not only the concrete work that was highly skilled; the finishing carpentry and joinery work inside the concert halls demanded high skills as well. The South Bank was for the most part a trouble-free site in terms of industrial relations. One reason may have been that the main contractors did not make use of labour-only subcontracting; indeed, some of the men who worked on the site considered that it would not have been possible to complete such a demanding concreting scheme had this been used. The elaborate, interlocking shapes of the Queen Elizabeth Hall and the Hayward Gallery demanded discipline and coordination at all points in the building process.



Graham Sargent



Peter Day



Michael Houlihan



Rodney Bond



Ted Newbery



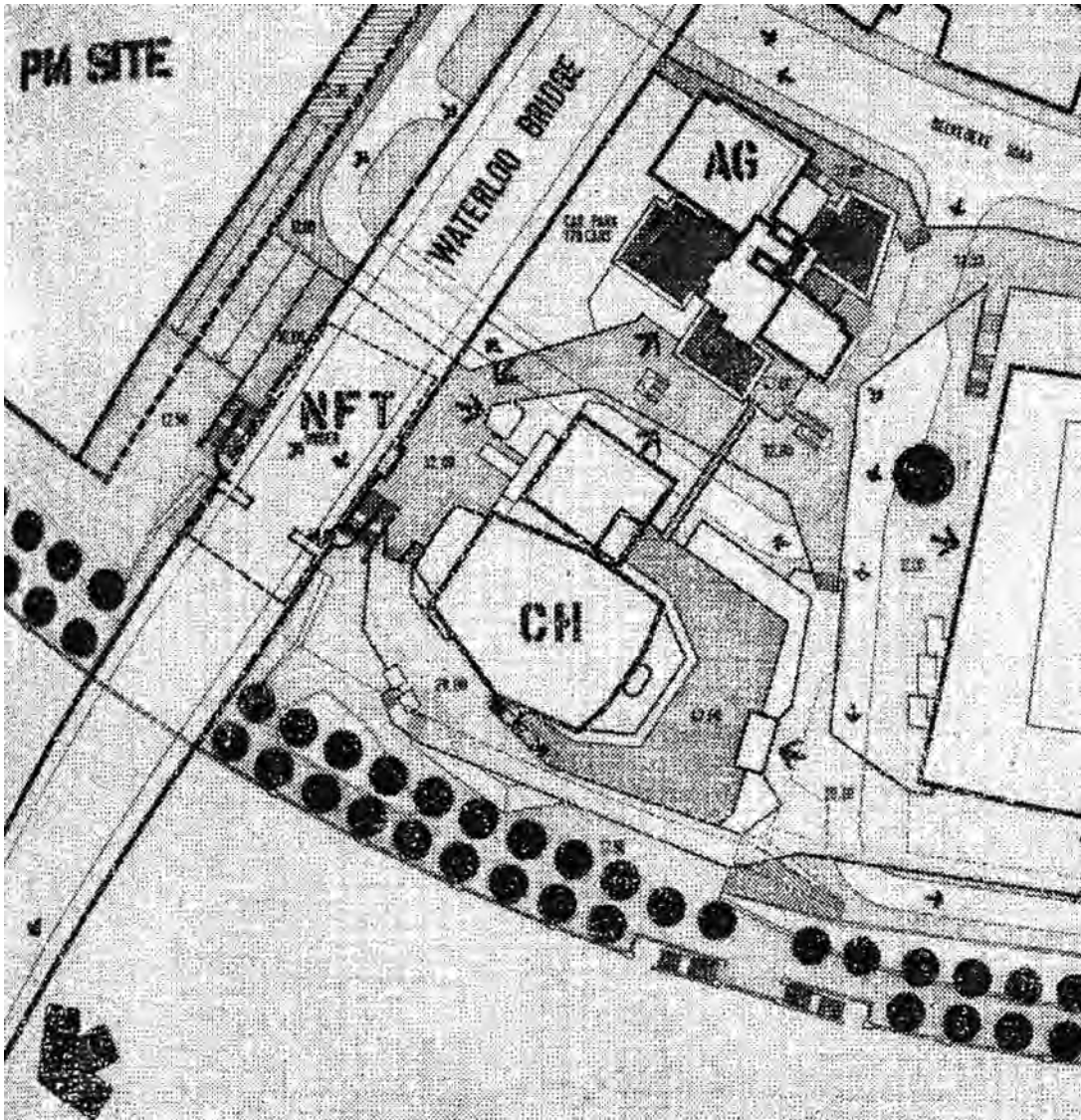
Jim McDonald



Glan Davies



Foyer of the Queen Elizabeth Hall c. 1970. Source: © Henry Grant Collection/Museum of London



Site plan showing relationship of concert hall and art gallery to the Royal Festival Hall.
Source: *The Builder*, 13 July 1962, reproduction courtesy of *Building magazine*.

THE SCHEME FOR A SOUTH BANK ARTS CENTRE

On 23 March 1961 the plan for a new £4 million arts centre on the South Bank was revealed by the London County Council (LCC). The design of the arts complex included extending the Royal Festival Hall and constructing a new concert hall, a recital room and an exhibition gallery. The aim was ambitious: to turn the South Bank Festival Hall area into 'the greatest centre of culture in the world.'¹ The scheme finally approved for the South Bank arts centre was not just a major political and cultural achievement; it was also architecturally and technically groundbreaking. Seen by many as 'the most extreme example of brutalism'² – with its different connotations – there is nonetheless general agreement on the unique quality of its concrete work, "a major feat of craftsmanship".³ For the men who worked on the site, it involved challenging work, and today, several decades later, as revealed in the oral testimonies recounted here, they still recall in detail exactly how demanding it was.

The concert halls and the gallery were a continuation of a decades-old venture. From the mid-1930s, and especially after the celebration of the Festival of Britain in 1951 and the opening of the Royal Festival Hall, the LCC's idea had always been to expand and develop the area, adding new residential, public and office buildings. Between 1935 and 1950 seven uncommissioned schemes for the South Bank were published, including William Goodesmith's 1935 proposal, Gordon Cullen's in 1949 and Clive Entwistle's Le Corbusier-inspired design shortly after.⁴ Yet none of these plans went forward and the redevelopment of the area was repeatedly

postponed. It has been argued that one of the main reasons for this was the LCC's search for designs of the highest quality. This meant that either the projects failed to receive LCC approval or they failed to find a developer that the LCC would sanction.⁵ As a result, by 1960, the design was less ambitious and no longer included residential buildings, a hotel, an air terminus, an opera-house site and plans to relocate St Martin's School of Art.⁶ It would take another decade before the works for the National Theatre, another fundamental piece of the overall South Bank scheme, commenced.

The announcement of the imminent extension of the Royal Festival Hall and the construction of the concert halls and the gallery made in spring 1961 was seen by some as a veritable 'rescue operation', just in time before the area completely lost the 'architectural vitality' it had acquired thanks to the Festival and the construction of the Royal Festival Hall.⁷

¹ '£4 million Centre of culture on South Bank', *The Times*, 24 March, 1961.

² Simon Sadler, *Archigram: Architecture without Architecture* (Cambridge, MA: The MIT Press, 2005), 5.

³ Adrian Forty, 'The Sixties: Architects' best years?' in Pekka Korvenmaa & Esa Laaksonen, eds., *Universal versus Individual: The Architecture of the 1960s* (Helsinki: Alvar Aalto Museo, 2002), 21.

⁴ David Hutchinson and Stephanie Williams, 'South Bank Saga', *The Architectural Review* 955, September (1976): 156-162, 156.

⁵ *Ibid.* 161.

⁶ Brandon Taylor, *Art for the nation: exhibitions and the London public, 1747-2001* (Manchester: Manchester University Press, 1999), 213; see also 'Developers picked for South Bank site', *The Times*, 15 December, 1964; and Hutchinson and Williams, op. cit.

⁷ Architectural Correspondent, 'Rescue operation comes just in time', *The Times*, 24 March, 1961, 4.



Hayward Gallery by John Gay. Source: © English Heritage

The wedge-shaped site where the new arts centre was to be built was considered challenging. Squeezed between the river, Waterloo Bridge, the massive Shell tower, and the Festival Hall, the new complex was supposed to 'complement the latter architecturally, not compete with it'.⁸ At the same time, it was hoped that its presence would soften the overpowering profile of the adjacent Shell office building, beautifying the cityscape in this part of the river and the view of it from the other side of the Thames. The new concert halls and art gallery were conceived as an articulated whole. The LCC explained in its documentation that it had made the decision 'to unify the buildings by a simple and consistent use of detailing and materials, and to fragment the components of both buildings in such a way that the overall mass would be reduced'.⁹ Achieving a sense of unity as well as lightness was thus the goal of the teams responsible for the design. These included group leaders Norman Engelback and E.J. Blyth, job architects J.A. Roberts and W.J. Sutherland and, in the early stages of the scheme, architects Ron Herron, Dennis Crompton, Warren Chalk and John Attenborough. Hubert Bennett was, at the time, Chief Architect to the LCC.¹⁰

After going out to tender, Higgs and Hill Ltd. became the main contractor for the proposed works, with Ove Arup & Partners acting as structural engineers. The contract included extensions to the Royal Festival Hall, the construction of the Queen Elizabeth Hall, the Purcell Room, the Hayward Gallery and all

access roads and walkways. Whatlings Ltd. was commissioned for the piling, and 'bored 270 miles in various diameters [...] down to the London clay'.¹¹ Both concert spaces were planned as reinforced concrete boxes resting on a common foundation, supported by large-diameter cylinders. The walls of the hall are themselves structural members, 15in thick and in some areas heavily reinforced. The foyer to both auditoria was designed as two flat slab terraces at different levels, both supported on mushroom-type columns, also in concrete. The Hayward Gallery in turn is made up of five gallery spaces on two levels and three outdoor sculpture courts on the upper level – in total, '20,000 square feet around a vertical service and circulation core with stores, workshops and a loading bay beneath'.¹² The upper galleries are top-lit with glazed pyramids; the walls were plastered and the floor tiled, except for one gallery where maple was used.¹³ A bridge links the gallery to the concert halls' main foyer. The Queen Elizabeth Hall seats 1,106 people on one level. Grouped around the stage area there is extensive artist's accommodation.¹⁴ The Purcell Room, conceived for chamber music, has seating capacity for 372 people.

⁸ 'South Bank Arts Centre', *Concrete Quarterly* 72 (1967): 2-8, 3.

⁹ LCC quoted in 'Two new concert halls', *The Times*, 1 March 1967, 3.

¹⁰ The London County Council became the Greater London Council in 1965.

¹¹ 'Complex structure for South Bank Art Centre', *Construction News*, 18 March, 1965, 25.

¹² 'SBAC', *The Architectural Review* 857, July (1968): 14-26, 16.

¹³ *Ibid.*

¹⁴ 'The Queen Elizabeth Hall South Bank', *The Crown Journal* 148, March-April (1967): 20-8.

SCHEDULE AND COST

Works on the extension of the Royal Festival Hall on the riverside frontage and Belvedere-road frontage started in summer 1962. Those on the new buildings did not commence until summer 1963.¹⁵ It was expected that the new concert halls and art gallery would be ready by 1966, but the Queen Elizabeth Hall and the Purcell Room were not inaugurated until March 1967 and the Hayward Gallery had to wait until October 1968 to open. There was thus a slight delay in the completion of the scheme, but perhaps nothing out of the ordinary in the challenging context of a public work in which several institutions were involved and with the associated bureaucracy this entailed.¹⁶ Technically as well, work on the South Bank posed problems because of the water level and existing underground systems.¹⁷ Higgs and Hill – responsible for excavating down to pile cap level – had experience of digging foundations in a wide variety of materials, including ‘the Festival of Britain foundations, old wharfs and dry docks, refuse, and timber piling’.¹⁸ By 1965 approximately 250 men were working on the site.¹⁹ However, delays to the opening of the Hayward gallery were still attributed to the impossibility of recruiting and maintaining a labour force with the skills necessary for the construction of this complex building during a period of high activity in the building industry in London and the South East.²⁰

The cost of £3.7 million announced in 1961 comprised the extension of the Royal Festival Hall and the new buildings. According to figures in *The Builder* in 1962, Higgs and Hill submitted a tender of approximately £1.6 million for the extension works²¹,

suggesting a cost for the new buildings of c. £2.1 million. A year later, the same journal suggested a total cost of £5 million for the approved scheme, including completing the Royal Festival Hall.²² According to figures published in 1967, the tender price and total cost of the concert halls and the art gallery amounted to almost £2.7 million. Of these, the concert halls, adjacent rooms and walkways, but excluding external works, represented £1,445,000.²³ In 1968, when all the works were completed and the Hayward Gallery had been inaugurated, the Greater London Council (GLC) announced that the total cost of the scheme had been £7 million, of which the art gallery had cost £800,000.²⁴

¹⁵ ‘South Bank Developments’, *The Builder* 13 July (1962): 65;

‘South Bank Final Stage’, *The Builder* 28 June (1963): 1303.

¹⁶ The Arts Council was directly involved in the design of the Hayward Gallery, for example.

¹⁷ Geoffrey Horsfall, ‘South Bank Concert Halls and Art Gallery’, *The Builder* 12 November (1965): 1039.

¹⁸ ‘Complex structure for South Bank Art Centre’, *Construction News*, 18 March, 1965, 25.

¹⁹ *Ibid.*

²⁰ Report by the architect to the LCC Special Developments and Arts Sub-Committee, 22.2.65, LMA GLC/CL/GP/2/134.

²¹ ‘South Bank Final Stage’, *op. cit.*

²² ‘South Bank Developments’, *op. cit.*

²³ See *The Architects Journal* 95 (1967).

²⁴ Michael Levey, ‘Three New Art Galleries’, *Architectural Design* 38 (1968): 483-90.

DESIGN

The notions of the building as a city, or the city as a single building, have appeared on and off throughout the history of architecture.²⁵ The idea became increasingly widespread in the sixties, inspiring both theories and actual projects such as the one on the South Bank.²⁶ The same idea also has currency in the design of another iconic 1960s scheme, the Barbican, conceived as a city within a city. In its sixties version it was partly associated with an egalitarian concept of space, according to which there should be no hierarchical relations among buildings and spaces. In line with this concept, traditional city planning components such as squares, avenues and clearly delimited constructions at ground level were disfavoured. Instead the idea was that buildings ought to be connected to each other at multiple levels through separate bridges, decks and walkways for vehicles and pedestrians, creating a single urban web or system. The buildings themselves, as is the case of the South Bank centre, should not follow any traditional architectural composition rules, in other words, it should not be possible 'to distinguish front from back, top from bottom, inside from outside'.²⁷

The choice of concrete as the dominant construction material suited the design's unifying principle while also reflecting the surfaces of surrounding buildings (including the Old Vic Theatre workshops and the Sainsbury warehouse on Stamford Street).²⁸ It was in many ways an unsurprising choice at the time. Sixties architecture was marked

by the use of concrete – not just the amount of it that was poured 'but the fact that so much explicit attention was drawn to the medium'.²⁹ Celebrated by some and derided by others, there were different ways of forming concrete, each creating distinct aesthetic results. It was mainly pre-cast concrete panels, widely used in housing construction, that stirred criticism, with architects, for example, complaining that their role had been reduced to assembling parts according to a brief, and others disliking their homogenising effect on the built environment.³⁰ In situ concrete was potentially different, providing opportunities for exploitation of the distinctively malleable and sculptural nature of this medium – 'as pliable as Plasticine, it can be rough, smooth, angular, curved, massive and delicate'.³¹

Initially, however, when LCC chief architect Hubert Bennett took over the project in 1961, he replaced the fair-faced concrete proposed by the design teams in previous briefs with 'the officially-sanctioned' pre-cast

²⁵ Y. Cf. Günter Bandmann, *Early medieval architecture as bearer of meaning*, translated by Kendall Wallis (New York: Columbia University Press, 2005 [1951]).

²⁶ Cf. Forty, op. cit.; Jorge Otero-Pailos, 'Bigness in context: Some regressive tendencies in Rem Koolhaas' urban theory', in Doug Kelbaugh & Kit Krankel McCullough, eds., *Writing urbanism: a design reader* (New York: Routledge, 2008).

²⁷ Sadler, op. cit., 31.

²⁸ *Ibid.*, 32.

²⁹ Forty, op. cit., 16.

³⁰ *Ibid.*, 17.

³¹ Rowan Moore, 'Tales of the South Bank', *Concrete Quarterly* Summer (1997): 6-7, 6.

concrete panels.³² The young architects on the design team responded by resigning.³³ Eventually, they were reinstated by Bennett after a compromise was reached by which pre-cast concrete panels would be used for some, but not all, of the facades with all remaining concrete cast on site using boarded formwork. John Ellis and Sons Limited was in charge of producing the pre-cast concrete panels, which were cast with Cornish aggregate and white cement.³⁴ The slabs were not fixed until the end of the works to avoid problems of weatherproofing and staining during construction.³⁵ A member of the LCC Department of Architecture was even sent on a tour of several European countries, prior to the tender, to find out about the kind of board-marked concrete being achieved in countries like Germany, Switzerland and Italy. The Department also consulted the Cement and Concrete Association. When the scheme went out to tender, contractors were invited to inspect a sample panel of concrete which had been set up on the site, and was subsequently 'used as a standard by which all other concrete finishes were judged throughout the building'.³⁶

Queen Elizabeth Hall, site staff



Staff employed on Concert Hall and Art Gallery (CHAG). Source: *Crown Journal*

³² Forty, op. cit., 21.

³³ Sadler, op. cit., 31.

³⁴ 'South Bank Arts Centre', op. cit.

³⁵ 'The Queen Elizabeth Hall South Bank', op.cit.

³⁶ 'South Bank Arts Centre', op. cit. 7.

WORKING FOR HIGGS AND HILL

Higgs and Hill was a well-established London firm with a reputation based on prestigious projects built to a very high quality finish. Founded in 1874, the firm constructed the Tate Gallery and Harvey Nicholls in the late nineteenth century, Dickens and Jones department store in the 1920s, the north and south blocks of County Hall in the 1930s, and the BBC Television Centre in White City in the 1950s among many other smaller projects. The firm was based in Vauxhall at the Crown Works where it ran an extensive timber store, joinery workshop, metalworking shop and stonemason's yard dating back to 1874. The firm remained there until a compulsory purchase order on the premises forced a move to New Malden in 1967 and the workshops moved to Wellingborough. Higgs and Hill was a traditional, family firm, and in the post-war years, under the directorship of Ronald Hill, ran apprenticeships in the main building trades. A former employee remembers that:

Higgs & Hill were known for its apprenticeship scheme, really ...in Croydon they used to have an apprenticeship dinner, once a year. And it was very well patronised, you know, because they used to have carpenters, bricklayers, painters... I don't think they had plasterers, but they had everybody else, and they had a very good reputation actually for apprenticeships. (Ted Newbery)

Career progression up the company hierarchy was encouraged and suitable candidates moved from skilled occupations into management positions. As Glan (also

known as Glyn) Davies, general foreman on the Queen Elizabeth Hall, remembered, this was especially important in providing a team of managers with expert knowledge of the construction process:

And the company took great pride in encouraging apprentices to study and take a building qualification of some sort. Today, anyone that progresses to a higher level in the construction industry, 99% of them are university graduates, which wasn't around in my day. I think the background that the young people wanted, of training from apprenticeship and taking reasonable studies to help them along, is by far the most practical way of achieving success in the industry. (Glan Davies)

The firm, in common with most large building firms holding a directly employed workforce, published a staff magazine called the *Crown Journal*. This contained accounts of current contracts together with photographs and lists of apprentice prizes and staff long service awards and other company news. It also contained photographs of the site managers engaged on the South Bank site, alongside reports on the progress of the scheme, reproduced here.

Both Peter Day and Graham Sargent – two former employees of Higgs and Hill – concurred with Glan's view that the breadth of knowledge they acquired and the length of time they spent on site gave them an advantage over university-educated site managers. Peter Day, Rodney Bond and Ted Newbery were three of the site managers

on the South Bank Arts complex: both Peter and Ted had been skilled carpenters, employed by the firm for a considerable amount of time, and this prior experience was invaluable during the exacting process of construction ahead.

Ted Newbery joined the firm as an improver carpenter in the 1950s and one of the first jobs he worked on was the repair and refurbishment of the House of Lords after wartime bomb damage. Ted remembered this job as:

... a joy to work on ...we had to reinstate the skirtings, doorways, and the timber ceilings, and we did the Law Lords' Corridor, all the way down the sides... was all mahogany doors and shelves for the libraries, all the way through. And my colleague, Lembit Abrahams, he was older than me, and we actually fixed the doors and frame and the clock that was given to the House of Lords by the Parliament of Australia, so I can remember that and the sides between the stonework and the frame, the timber frame was lined with velvet, so that there was no possibility of any light going through. You know, because you actually couldn't...carve that detail in the sides of the timber to match what was in the stonework.

A few years later Ted was asked to become a foreman carpenter and then site agent, supervising 75 carpenters and 25 labourers on the construction of the BBC Television Centre at White City:

There was a main staircase there, a beautiful staircase, and I remember that Ronald Hill, who was the Chairman of Higgs and Hill, he came and said, "Mr Newbery, will you... pick who you want to make sure that that staircase is finished by..." a certain date, because the Queen was going to open it. So we did that, in actual fact, and he actually said, "On completion, you will have a bonus," and in those days my bonus then was £100 for finishing it. The other chaps I think got 50 or something like that. I'm going back yonks now. But that was a cracking building.

After a number of other large contracts Ted was transferred to the South Bank. He remembered that people never knew where they were going to be sent next, the standing joke being that the lorry drivers always knew first and they were invariably right. Ted arrived when the piling had been finished late in 1964. He remembered his arrival on site because it coincided with, early the following year, guardsmen rehearsing Winston Churchill's funeral first thing in the mornings by carrying a weighted coffin over the Bailey Bridge and onto a waiting barge. From the outset it was apparent that the CHAG was going to be a challenging project:

The first part was that you put up these octagonal mushroom columns, and we were let it be known that there would be no making-good of concrete whatsoever, full-stop, that was it.



Mushroom columns. Source: Photograph courtesy of Rod Bond

Rodney Bond, known as Rod, worked as assistant project manager on the South Bank site. He was born in 1938 and entered the building industry through his father who used to be chief buyer for Richard Costain. He started off at 17 in a professional quantity surveyor's office, but gradually realised that surveying was not for him, and joined Higgs and Hill as a planner at the end of 1963. He was soon asked to work on the South Bank development and remembered it as:

... probably one of the most difficult contracts Higgs and Hill have ever taken on, I would have thought, in terms of a difficult build. At peak, there were over 180 shuttering carpenters on-site, all our own men, no subcontractors. The only subcontractors were specialist subcontractors, and you'll see those in the back in the *Architects Journal*.

From the exhaustive list of contractors that appears in the issue that Rod Bond refers to, almost 100 sub-contracted firms were involved in the scheme³⁷ – an unambiguous indicator of the complexity of the works. Samuel Elliott and Sons Limited from Reading supplied and fixed all the hardwood joinery, flooring and Helmholtz resonators with which the interior walls are lined in order to absorb low-frequency sound. 'They used to do all the shop-fitting on ships,' Rod Bond explains. The framing and mechanism for the adjustable canopy, and the system of lifts for the platform at the Queen Elizabeth Hall were designed, manufactured and installed by Hall Stage Equipment Ltd. The textured cast aluminium windows entrance doors and screens were supplied by H.H. Martyn and Co. Ltd, which, according to Rod Bond, used to make the royal trains.³⁸

Peter Day had started out as an apprentice carpenter at a young age in Reading for Barnes and Avis, which used to refurbish pianos. He then joined Higgs and Hill as a carpenter's labourer. When the job ended, and as he was too old even at the age of 17 to train through the apprenticeship route, he became a chainman on Bankside power station. It was here that he had the opportunity to learn setting-out work as he was asked to take on some of the tasks of the site engineer in charge after the latter had a car accident. Eventually the engineer had to quit, and Peter was asked to take over his position.

³⁷ 'Contractors', *The Architectural Review* 857, July (1968): 74.

³⁸ For additional technical details, see *The Architects Journal* 95 (1967).

The fact is that they had to bring somebody else in, and he [the civil engineer in charge] gave me more to do, and showed me how to use the dumpy level and all the rest of it, and started to show me how to do setting-out, and he left the company, and Malcolm McLennan said to me: "Do we need to get another engineer in here? Do you think you'd be able to do it on your own?" And I thought bloody hell... And he said, "Look..." and, I'm now getting my brain into gear for the future to a certain degree, so I said, "Yeah, I'll have a go."

Peter worked on the extension to the Royal Festival Hall before he was transferred to the South Bank arts complex site.

Graham Sargent, his colleague, explained in turn how he joined the building industry:

I started out as a trainee site engineer, and they had begun that process of...bringing that discipline together because they had no engineers to support the construction, at that time, so their idea was to take through individuals from school, through day-release, and engineering training, on-site, shadowing an engineer initially.

His first job was at Regent's Park, building a home for a Jewish elderly organisation. He then worked on pre-fabricated high-rise housing in Clapton, Walthamstow and Hackney; always with Higgs and Hill, which at the time set up a partnership with French construction company Camus. Graham recalls how pre-fabricated housing construction was affected by the gas explosion that took place in the 22-storey Ronan Point tower block in Newham:

And that happened in, let's say, '67, and we'd just started on that, and Ronan Point happened of course, and then there was a sort of hiatus when they did a lot of remedial reinforcement of the structures.

Peter elaborates on the consequences of the Ronan Point incident for the perception of pre-cast slabs and the increased preference for in situ concrete:

Because of that building that had a gas explosion and blew out the sides, everybody I think in the trade or who were buying properties, or getting their properties built, thought that they were all done the same, but in actual fact, ours was done in a different manner, and, if that had happened on one of our buildings like that, it wouldn't have happened, but it all got tarred with the same brush, so nobody now wanted precast unit buildings. They just wanted in-situ concrete buildings or steel buildings.

Glan Davies was general foreman on the CHAG contract and started his working life as an apprentice carpenter in Wales:

I was born in Clydach, Swansea. It's about five miles outside Swansea. I attended the local school there, and then eventually to the Pontardawe Tech, and on completion, at the age of 16, at Pontardawe Tech, I became an apprentice carpenter for a period of five years. On completion of my apprenticeship, I worked in a joiners' shop in Swansea. During my years as an apprentice, I did the usual, City and Guilds, National, Higher

National courses that people attend, and then eventually I came to London and arrived in London on the 7th of May 1951, which was the day they opened the Festival of Britain. I joined a company called Cubitts as a carpenter, at London Airport... building the British European hangers. After about four to six months, they made me up to chargehand and then to a foreman, and I was with Cubitts for a period of about two and a half years. I then left Cubitts and joined Higgs and Hill, as a foreman, working on a building in Piccadilly.

After some years working on a wide range of projects, Glan was working on the extension to the Royal Festival Hall when he was moved.

I was three-quarters of the way through that project when they won the CHAG, South Bank development, so they took me off the South Bank, off the Festival Hall, and put me in charge of looking and constructing the Queen Elizabeth Hall and the Purcell Rooms and the bridges and walkways over Belvedere Road. [Glan Davies]



Site view. Source: *Crown Journal*

BUILDING IN CONCRETE

1. EXCEPTIONAL SPECIFICATIONS

Peter Day had been working on the extensions to the Royal Festival Hall when he was asked by Roy Hunt, the senior engineer for the project, to spend a weekend setting out for the Queen Elizabeth Hall and Hayward Gallery:

[We] were given a job over a weekend. I think we were informed late in the week of a particular week that we'd got the job next door, because it was like a giant site, barren site, and him and I and another chap came in, over the weekend, and set out the Queen Elizabeth Hall and the Art Gallery, setting up the main baselines for both of them, because they had different gridlines on the Queen Elizabeth Hall to the actual Art Gallery... although they're parallel and square to the same. So we spent the weekend doing that, just to purely go back on the Monday morning to the Royal Festival Hall, just to make sure we'd got all the gridlines set up ready for the start. And I think a week (later) they started setting up the offices...

The organisation and management of the CHAG site was split into two sections, one facing the river and the other Waterloo station. Peter's first task was to check the positions of the piling previously undertaken by a subcontractor.

Glan Davies was looking after the back, and a chap called Griffiths was looking after the front. And, when I got back, walked into the office, they said, "Pete, collect all your gear up, you're going over to there", and I immediately was transferred over onto the Queen Elizabeth Hall, and started working on that. Now, when we were doing some work, one of the things we had to do as we

were getting excavations done and all the rest of it, we had to get and check all the piles, the positions of the piles. Roy and I came in one particular weekend to try and crash out, because we were getting behind, checking all these piles, and you'd do them in bunches because we weren't allowed to take drawings out on-site. What you did was get the drawing and you'd draw yourself sketches because drawings cost so much money. If you took it out and damaged it or anything like that...

Building close to the edge of the River Thames had created problems for all the constituent buildings of the South Bank complex and, in the days before GPS, it was difficult to accurately centre the augers of the massive drills used. Inaccuracies in the positions of the piles were discovered, resulting in the placing of a complex series of beams to connect a number of the perimeter piles, which, in turn, caused a delay at the outset of the contract. Glan Davies remembered the unforgettable experience of descending inside one of these piles all the way to bottom.

Now, in excavation for the main building we had big pile-caps, very heavily reinforced, but underneath each pile-cap was a number of six-foot diameter piles that had been borne, drilled into the ground, to a depth of about 100, 120 feet, and they belled out at the base – they were 16 feet wide. And these were, as I say, six foot in diameter. And the engineer for the client, resident engineer, had to go down to the base of these piled areas that they'd drilled out to make sure ... where it had been built, it had opened out to a diameter of 16 feet, that it had all been cleaned out properly. And this engineer said to me, one day, "Davies," he said, "it's alright you doing the work – I'm the one that's taking



Early stages of construction.
Source: Photograph courtesy of Rod Bond



Early stages - curing concrete.
Source: Photograph courtesy of Rod Bond

the risk of going down there to check it all out. It's about time you came with me." So I went down with him in the cage, 120 feet below ground level, to help him with the inspection, and when I looked up, the only thing I could see was a...a white looking dot, which was the skyline and, occasionally, little particles used to flicker off from the side of the bore of the piles and, believe me, I was certainly glad to get out of there! I went down just once and I didn't go down anymore.

Glan Davies also remembers the early days of the contract being difficult but for different reasons, as he recounts:

All the [Festival of Britain] buildings were cleared, and eventually, we took the site over, to clear it and start the excavations, but we found very quickly that the excavations became quite a problem. For the Festival of Britain, they had put in hundreds of heavy-duty electric copper cables, in the ground, and, as it was only a temporary thing, although there were hundreds of them, to supply power to the Festival of Britain, they never kept a record of where they were. Also, there were water mains that had been put in there for temporary water supplies. Some of these were nine inches in diameter. And we had the people starting to excavate to get the foundations and the piling in when they suddenly came across these cables. Although they were dead in themselves, but these cables were quite lengthy ... and a digger, with the chap working one end, would hook them onto a machine and start pulling them. People working at the other end of the site realised what they were doing, and they hooked onto the same cable, and there was a competition between the two of them, because if they could sell these copper cables, that would be money that they would get for themselves, unofficially of course.

However it also became apparent during these very early stages of construction that the standards of accuracy, quality and finish to the concrete were to be extremely high. Ted Newbery, general foreman on the construction of the Hayward Gallery, remembered that for him the first indication of these exacting specifications came unexpectedly early on – at foundation stage:

A lesson was learnt.... The first column we did, and poured concrete, and it was struck down, and right down the bottom, about the size... well, less than the size of a dinner plate, there was a little bit of spoiling in the concrete, and that would have been below ground level at the finish.... but we were made to take it down. Yeah, terrible! So, anyway, we took it down, but a lesson was well learnt, because what one did then was erect the formwork of the column, and the mushroom at the top, and we drew the hole in the bottom and put a bung in there, and we used to fill the whole thing with water and let it [go there] for a couple of days, until the timber had really swollen, and if water couldn't get through, nor could any grout go through, and that's what we used to do, and from then on, it was a success!

While this prevented any spoiling to the columns it was not a method that could be used for the general structure of the gallery which was built throughout to tolerances of 5mm and a quality of finish, according to Ted, that no-one envisaged:

Everything was levelled and done within 5mm, which is a quarter of an inch. ... And that was done by a certain step on Waterloo Bridge, we made a datum, so that it would never be disturbed or whatever, and everything was levelled – the tops of a shutter being poured was levelled to within 5mm. And that is



Mushroom column detail. Source: Photograph courtesy of Rod Bond

exceptional, believe me! And it caused a few problems.

Glan Davies explained how the concrete finish was perfected through trial and error and experimentation in a designated part of the site called the 'graveyard'.

We set up a workshop on the site to make these panels up from the design that the architect and our own draughtsmen has decided on, and, in the beginning, while we were going on with the excavations and the pile caps and things, we had a section of the building that we isolated that we called the graveyard. In the graveyard were sample panels that we had temporarily constructed

and concreted and experimented on the way we were going to place the concrete so that we would have the result that they wanted, and we had several dozen different panels built on a temporary basis that were eventually dismantled and done away with. And we had to find a way of doing these panels so that the concrete was lowered by a crane on a chute into the panels, on a very slow basis, so that we vibrated the concrete slowly to make sure that all the air-pockets were completely out of them, and finished on a perfectly straight line, with a timber screwed onto the shutters, so that we had a perfect line to work off when we started off with the next layer.

2. 'FANTASTIC CONTROL'

Another major and unforeseen hindrance to the contract programme was the realisation that Higgs and Hill was going to have to produce a large number of detailed working drawings for the formwork. As Rod Bond remembered:

It was a contentious point. It was a very difficult interpretation. The architects said they thought this is what we were obliged to do under the contract. All their drawings showed was a piece of paper with lines on it. Higgs and Hill, they were professional contractors and they undertook their duties to produce what was required. We set up a joiners' shop on site, here, just underneath the [Hayward] gallery. The drawings came into the joiners' shop to make the shutters. They were all individual shutters, so without those drawings, the contract would never have been built. The drawing office, of which I was the second member – Tom [Brailsford] was here when I got here. Tom was trying to keep god-knows how many shuttering carpenters going by himself, and it was an impossible task, because...we couldn't produce the drawings quick enough for the progress on-site, which is why we ended up with 12 draughtsmen, in the end, six of whom were Australian. We decided the patterns of the board and the patterns of the shutter.

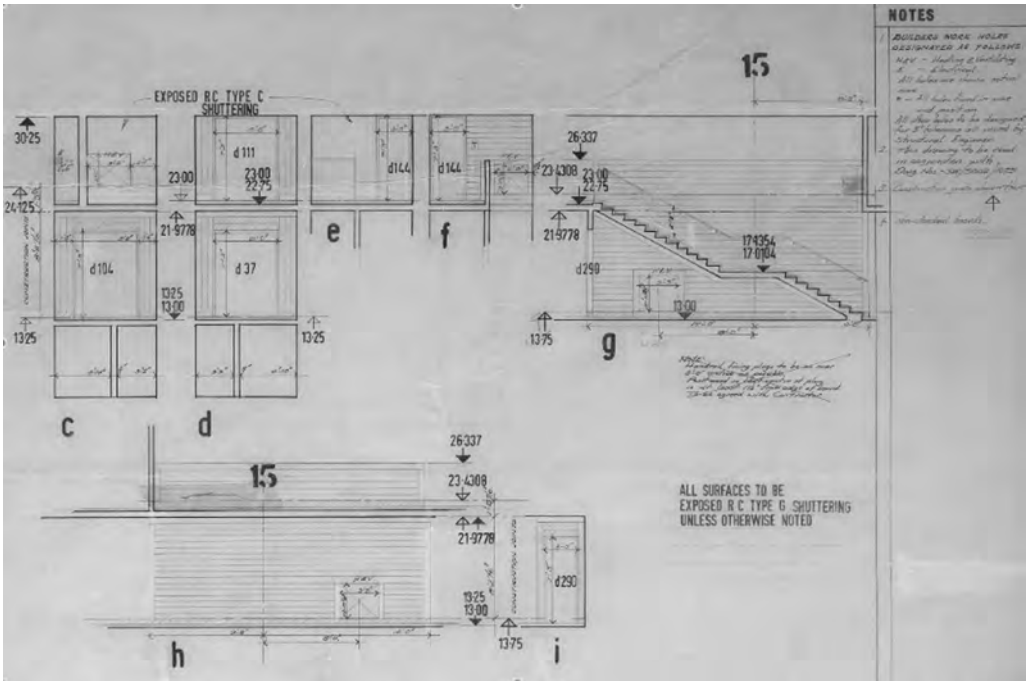
Well, let's take this one, for example. Say this was an external wall, with a staircase behind it, okay? Now, obviously, we couldn't show the rake – you can't build a wall with the rake of the staircase showing on the outside. Are you with me? If this is the inside of the wall, we would build that wall with a recess made in it, with starter bars coming out, to take the staircase up later on, so that it didn't interfere with the pattern on the outside. Now, before you could produce that drawing, you had to look at various other drawings to see what was

behind it, whether there was a staircase. We had to look at where all the ventilation duct work was penetrating, so that we'd left holes – we trimmed holes round to let the ventilating duct come through later on, without having to cut holes. Where there were electrical conduits cast in, we had to show where the conduits were, and so, before we could pour the concrete, the electricians had to come and insert their conduits and their boxes in the right place. So it was really a work of art.

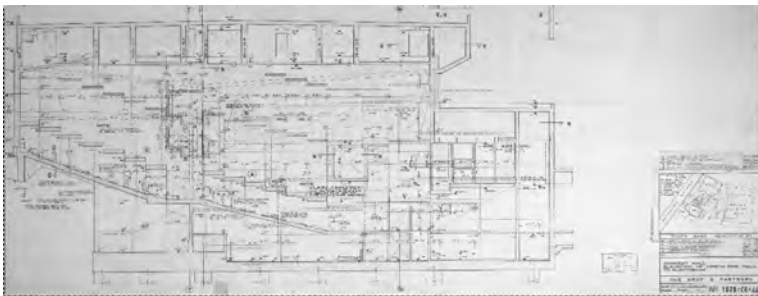
Every drawing was approved by the architects. We used to traipse up to County Hall every day with drawings – this is...done that...this is what you want? Yeah, approved, signed it...They had to approve every drawing. It was fantastic control. We got on really well with the architects in the end. They were all LCC employees. Yes. Well, they were happy to see us interpreting their drawings!

After approval by the architects, the drawings then passed to the joiners' shop where the actual formwork was put together. There were three workshops where more than 1,000 square yards of formwork was put together per week.³⁹ In all, over 1,000 working or 'shop' drawings were produced for the formwork on the CHAG scheme but, unfortunately, none of them have been preserved in the London Metropolitan Archives. The images below show examples of drawings emanating from the LCC special projects' division of the architect's department showing elevations of one of the internal walls of the Queen Elizabeth Hall. It specifies three different types of shuttering, classified by the GLC as 'G' type – sawn board finish, 'C' type – fairfaced plywood finish, and 'D' type a standard plywood finish. But this was

³⁹ 'Complex structure for South Bank Art Centre', op. cit.



Architect's Drawing of internal concrete finish. Source: London Metropolitan Archives



Engineer's Drawing of Queen Elisabeth Hall auditorium. Source: London Metropolitan Archives

still only an indication of the finish required and the Higgs and Hill drawings went into far greater detail and thus became the construction drawings.⁴⁰

⁴⁰ We are indebted to Rodney Bond for clarifying this process.

Some of the shapes required, in particular for the semi-circular staircases which link the external areas, were very complex. In the image below, formwork for these is being constructed in one of the on-site joinery shops

from where it was lifted out by the tower cranes and placed in position, ready for fixing by the shuttering carpenters. The formwork itself was also produced to very specific standards. Rip-sawn Baltic pine (*Pseudotsuga menziesii*) was chosen because of it having 'the most satisfactory grain structure'⁴¹ although Rod Bond mentions the use of Douglas fir (*Pinus sylvestris*). The boards were tongue-and-groove joined, and their thickness varied slightly to achieve the vertical patterning that can be appreciated on the in situ cast concrete surface. In Rod Bond's words:

In order that we didn't get any grout loss at all and spoil the finish, all the boards were tongued and grooved. They were butted up tight, and each board – I can draw you a picture... They were six inch wide boards, okay, sawn-finish, and...like that...and then the next one would be an eighth projection, like that, and that would setback like that, and they were tongued and grooved to avoid any grout loss.

Peter Day recalls this requirement that some timber was one inch and a half, whereas other boards were one inch and five sixteenths thick (or one inch and three eighths, according to an article in *Construction News* at the time) in order to form the distinctive, uneven, textured surface of the concrete⁴². In some cases, such as in the foyer area to the concert hall building, the formwork involved placing cardboard boxes within the beams 'to provide a hollow, weight-saving, form of construction'.⁴³ Concrete was then cast in two pours for each beam. The 17 feet mushroom-shaped columns in the same area, on the other hand, were cast complete in one pour, including the cap.⁴⁴



Formwork for spiral staircase. Source: *Crown Journal*



Painted external staircase in 2012.
Source: Photograph courtesy of Christine Wall

⁴¹ 'South Bank Arts Centre', op. cit., 7.

⁴² See 'Complex structure for South Bank Art Centre', op. cit.

⁴³ 'Concert Hall and Art Gallery'. *The Crown Journal* 142, March-April (1966): 1-6, 3.

⁴⁴ *Ibid.*

3. 'YES, IT'S OKAY TO CONCRETE'

The process leading to a finished concrete wall, or any other concrete element of the building, involved numerous and fairly complex stages. First, a detailed drawing of the size and position of a piece of formwork, including the position of all fixings and tie-bolt positions, was drawn on site in the draughtsman's office. This was then given to the joiner's shop foreman, who instructed the on-site workshop to make the shutter. The position of each shutter was precisely set out on site and checked by the site engineers – this process in turn was dependent on the correct positioning of any supporting scaffold. The shutters were then craned into place and fitted in position by shuttering carpenters, while reinforcement bars were positioned and fixed by steel-fixers. There was an elaborate system of checks before any concrete pour. Peter Day describes part of the process, emphasising the strict control that the engineers exerted during the different stages:

[It] was quite a complicated job, in that respect, and of course, the other thing was, we had to control the concrete manufacture, i.e. the mixing of the thing. And making sure that the cover on the starter bars was correct. He [the engineer] then allowed you to go ahead and concrete the kicker. When the kicker was concreted, you then had to scabble the concrete on the kicker, and then the back shutter got put up. The reinforcement was then fitted in position. Once all the reinforcement was in place, the engineer then came round and checked all the reinforcement – and I don't mean

just looking at it to see if it looked pretty. He actually came out with the reinforcement drawing and checked every reinforcement bar and position, and he would even check the dimensions between the bars.

Once everything was in, he would then check it off and he would agree, and then the front shutters could go up. Once the front shutters was up, the following inspections had to take place before concrete could commence: the clerk of works came out, and the chippies had a plumb-bob down one end, a plumb-bob lay on the bottom end, and why in heaven's name they had to do this, I do not know, but they put a string line along the bottom, hard up against the kicker, and a strong line across the top, offset, so that the clerk of works could go along and check the dimensions and make sure everything was perfect. He would then say, "Yes, it's okay to concrete," provided the engineer signed it off.

Ted Newbery evokes the moments prior to pouring the concrete:

You obviously had to...if you had something ready...to pour, in concrete, you got the clerk of the work's permission actually to concrete it. He would then check it, from this datum on Waterloo Bridge, to within five mil! And then you'd concrete, and say a wee prayer when you shut...the shutters to make sure it was okay.

Glan Davies described how the pour itself was a slow and careful operation.

We did it slowly, we didn't rush it, and we carefully monitored, with torches, looking down inside the shutter as the concrete was placed in and vibrated. What you had to be very careful is, with these heavy vibrators that you use internally in concrete, if it got on the face of the shutter, it would take the markings of the sawn board off, and that is what they didn't want. On an ordinary wall, on ordinary shuttering, that didn't matter so much, but we had to be very, very careful on that. And it was a slow operation.

One of the challenges with this kind of 'rough' form shuttering is sealing the joints between the pours. In this case, Polyurethane gaskets were used successfully and no grout stains are visible on the finishing.⁴⁵

Peter Day recalls how the concrete slabs were sometimes steam-cured⁴⁶:

And then we'd put steam, everything...all the slabs were covered in... In fact, it was one big area of slab, which would be underneath now the Purcell Room area, if I remember rightly. We'd got it all covered over with... and we did it, the concrete, either on the Saturday...Friday or the Saturday, and it had all been covered with tarpaulins, all lifted up above the concrete so it's not touching, with these steam...I can't think what they used to call them...keeps spraying out warm steam, so steam coming out from underneath.

When honeycombing did occur – which was seemingly quite seldom – the concrete had to be redone. However, both Peter Day and Graham Sargent and Rod Bond recall an incident when the clerk of works ordered a wall to be taken down for this reason, and the chief planner, Glan Davies, refused to do so and told the team he was making it good instead:

He said, "I'll make it good, and if you can tell me where it's been made good, afterwards, when I've done it, if you can detect it, I'll take it down." He made – it was right in the middle of the wall. He made a roller out of timber, with the Douglas fir finish on it, and came and did himself, patched it, and rolled it out, and it dried out, and you couldn't see it. (Rod Bond)

Peter Day, who visited the site with a colleague a week later, was unable to tell where exactly the treated patch was located:

He would fake the grain, he's faked the grain so well, I'm trying to tell this bloke, and I knew where it was, and I couldn't even find it to show him it, because I was saying, my God, it's turned out just right.

Nevertheless, when the clerk of works was called to inspect the result, he felt he could not make a decision, and asked Hubert Bennett, the chief architect, to come down and check it too. Bennett was pleased with the result and so the wall was not taken down on this occasion.

⁴⁵ 'Complex structure for South Bank Art Centre', op. cit.

⁴⁶ Steam-curing is a common accelerated curing method for achieving high early age strength in concrete (especially pre-fabricated concrete), enabling the removal of formwork within 24 hours.



Carpenters working on site on formwork. Source: *Crown Journal*

Forms were re-used, sometimes as many as 12 times,⁴⁷ and at least six or seven, according to Rod Bond. However, in order to remove the forms without spoiling the finish, they had to be dismantled board by board. After removal, the boards went back to the workshop for cleaning; all the concrete had to be rubbed off before they could be used again. Approximately 50 per cent of the timber was discarded because of the bolt-hole positions, the column shutters being the exception since they did not contain bolts. The best patterning was apparently achieved after three or four uses of the formwork when

all the whiskering (loose timber fibres) was gone.⁴⁸ In total, more than 250,000 items of concrete hardware were listed in the contract. This included a system, developed by Higgs and Hill and much praised by *Construction News*, consisting of mild steel 'U' channels that were bolted to the ply shutters. The channels 'were held away from the concreted walls with greased mild steel rods that could be blocked to the required gap width, and easily withdrawn to allow striking'.⁴⁹

⁴⁷ 'South Bank Arts Centre', op. cit. 7.

⁴⁸ 'Complex structure for South Bank Art Centre', op. cit.

⁴⁹ *Ibid.*



Concrete finish showing position of bolts. Source: Photograph courtesy of Rod Bond

This system of 'U' channels was devised by Glan Davies on the construction of the Purcell Room and he described it in precise detail many years later when interviewed in 2012.

When it came to the Purcell Rooms, that even gave us a bigger problem, because the Percival Room, the walls are double-sided. There's an external wall that had the sawn board effect. The internal wall was ordinary plywood-faced timber, and in them were these inserts that were put in there to take the bolts. We then had a three-inch gap between the internal wall and the external wall, and, again, the inside face of the wall was of a sawn board nature. The other side, next to the three-inch gap, were

plywood. The problem we had was, when we designed the shutters for the outside and the inside, we had to design the patterns so that they lined up with one another, so that the bolts going through from the inside wall went through the shutters, the thickness of the wall, and the plywood on the other side, and those bolts went into the outside wall that act as a support for the inside wall. Now, the problem I had was: how do you keep a three-inch gap? And I came up with the idea of, on the ply supports, we put little metal channels, where were an inch and a half wide, with a lip on each side of them of about half an inch, and behind them were another two inch timber support to give you the thickness of the plywood, the timber support, and the backing support, that would

give a three inch gap. In these channels, we used ordinary round reinforced bars that we slid down in the channel of the inside shutter and went against the outside wall, and they were greased, and on the top of each channel was a great big hook - we'd bent the reinforcement. And then we'd hook them onto a chain from the tower crane and pulled each individual rod out, independently, and they were at nine-inch centres, so there was a lot of them! And we slid them out, and by releasing those bars, we were then able to hook onto the shutter that was there, which we'd put a plate on the back of them that would take a hook, and then we would pull them out, and we had a perfect three-inch cavity all the way down, and that was to do with the sound acoustics of the Hall.

Glan summed up the role of the contractor's staff:

They [the architects] designed where the walls were, they designed the cavity, they designed the pattern. But not how to do it. We had to find the way of doing it.

After the superstructure was complete, the item of 'drying out' was required.

On completion of the concrete box forming the hall [QEH], we installed a large fan-driven temporary heating system fed from the Royal Festival Hall heating mains for six months to allow the concrete to dry out before the installation of the joinery. GLC Special Works were very demanding!
(Rod Bond)

The architects were demanding and the clerk of works was a stickler for correct procedure, but the staff of Higgs and Hill were themselves committed to getting the scheme built on time and to programme. In one anecdote recounted by Peter Day, this involved solving an on-site problem in a very unusual way. Peter recalled one day when one of the site agents stormed into the office:

Anyway, he comes walking in the office, and it's freezing cold, we're in the middle of winter, and he went, "I can't believe it! I've spent three days getting all that right, we're ready to concrete!" Clerk of works has come up and has got his torch, shone down, says, "Right lads, right, well, that's no good - you've left out all the fixings." So he said, "We'll have to put them in later. We'll have to cut the wall out and put them in afterwards." The clerk of works says, "No, I'm not accepting it, won't, no, you're not! You'll have to take the whole formwork down." So I said... and he's telling Glyn. I'm sitting at my desk ...getting ready for the next job, listening, and he said, "Can't you get down inside the reinforcement?" After all, the wall is one foot six thick. You've got reinforcement, of course, but you might actually be able to get down in the reinforcement...[cage] ... and get somebody to climb down in there and actually fix it. "I've tried!" he said, and he was very skinny. He says, "I've tried," he said, "but I got stuck, up my hips." He said, "The reinforcement comes in too tight at the top." So I jokingly said, "Well, I'll get down there," and of course he says, "You'll never get down there - don't be an idiot!" and I said, "Yes, I will! I'm not as big as you." Glyn said, "Stop arguing. Peter, if you think you can get down there, get up there and get down there!"

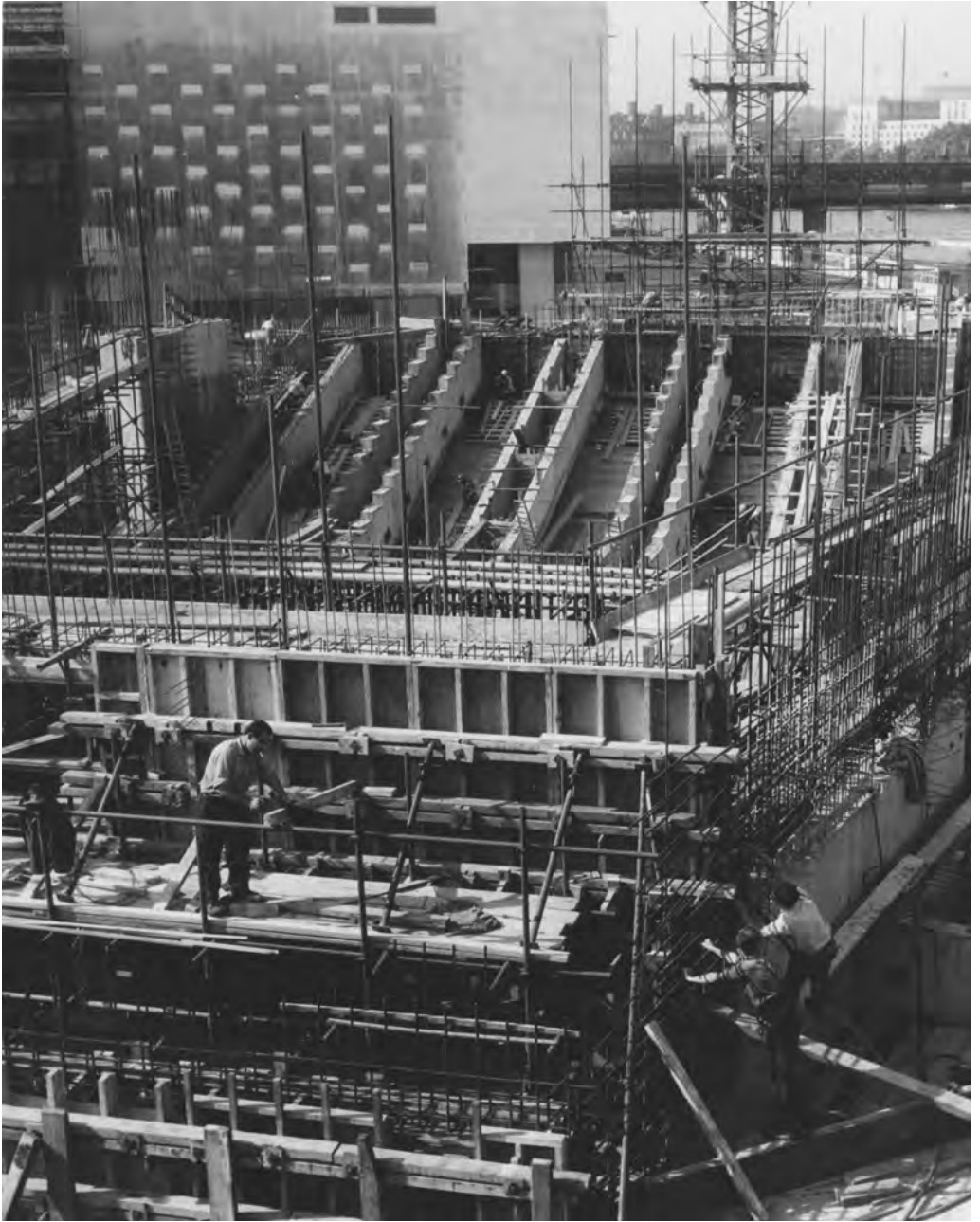
So I got down there, went down and looked, and I thought Jesus Christ, what a challenge...get down there! So, took me bloody donkey coat off, took me jumper off, took me belt off, climbs over the reinforcement and climbs down, clerk of works is standing there, gloating I think – “What are you doing?” I said, “I’m going to try and get down there so that they can lower the timbers down, and I can then hold them on the wall, and then they’ll screw them and can fix them from the other side.

So, I gets down, and I gets stuck, exactly where he said he’d got stuck, at the hips, so I went like that [shaking noise], and the next minute, I go down, and I actually went, froomp, and I actually caught the reinforcement, and then, using my feet, because I’m now trapped, I got all the way down the bottom, and now I’m in trouble. I’ve got a tape, but I can’t go like that, I had to keep going like that...And... struggling, I eventually put four of these things in. Clerk of works is up the top. It had started snowing. I’ve only got my shirt on, freezing cold, and I thought to myself, when I was down there, I thought, how am I going to get back...? My body weight got me in... and then of course, I realised, I can’t bend my knees. I had to lift myself up and then use my feet as sort of a stop-gap, if you understand me. But of course, the reinforcement is fitted from one side, and the one thing we couldn’t do on that job – steel-fixers have this habit of going and cutting the wings off. We used to do our nut when they used to cut the wings off ...and you couldn’t do it on any decking because all the reinforcement... We used to go round with magnets collecting it all up and making sure it’s clean and all the rest

of it, so we used to ban them from cutting these. But the trouble was, of course, all these wings are now sticking in my back, aren’t they, right?!

So I ended up going all the way up, with these bloody things scratching my back, got out. The clerk of works had seen [me] go in and walked away. If he’d have actually stayed there, I’ve got to put up my hands, he’d have condemned it, because there was half my shirt hanging off on the inside, between the reinforcement... Right, eventually, two lads gets hold of me, and they said, “If we can’t get you out, we’re going to concrete you in!” I eventually got out, and I went back to the office, and ... The only thing that was holding my shirt together was my collar. The rest of it had ripped in two pieces in complete half, and I had a string vest on, in them days.

Peter was then summoned to the main site office where he was thanked warmly for saving the firm time and money and told to go and get his injured back seen to at the First Aid station. He was then sent out to buy a new shirt and vest and hand the bill to the firm. On reflection both Graham and Peter thought that this valiant act would never be seen on site today – not just because of health and safety issues but also because no-one would specify timber packing pieces inserted into formwork before a concrete pour solely for the purpose of fixing a hand rail – today it would be drilled and filled after the concrete had set – and the traditional role of the clerk of works enforcing the architect’s specification has also disappeared.



Formwork on the Queen Elizabeth Hall. Source: Photograph courtesy of Rod Bond

SKILL AND INNOVATION

Delays to the construction programme were blamed from the outset on a shortage of skilled workers. Glan Davies was at the time quoted in the industry press: 'the acute shortage is of good carpenters skilled enough to maintain the high standards required'.⁵⁰ Although concrete was the ubiquitous building material of the 1960s, there was no provision for the equivalent of an apprenticeship in all the aspects of working in concrete. Short courses run by the Cement and Concrete Association (CCA) on the 'making and placing' of concrete provided some information for concrete workers, but the CCA aimed much of its educational provision at technician level.⁵¹ There was only one concrete gang working on the Queen Elizabeth Hall as the construction process was so slow and painstaking. They were all classed as labourers and practised on temporary panels set up in the 'graveyard'.

And they had to succeed on placing that concrete before they were used on the main works. So, yes, they were trained, in that sense. I mean the ganger in charge of the concrete was experienced in placing concrete, although he had not done vast amounts of concrete giving sawn board finish. So, he was training himself, and they did it by trial and error originally. (Glan Davies)

It remained for skilled carpenters to take on the precise work of making, fitting and placing the formwork for the entire complex. Ted Newbery remembered that he, and most carpenters at that time, had two sets of tools: one for concrete work and one for second fix work. Their training and experience enabled them to move between outdoor, large-scale

shuttering work and the internal fitting of precision joinery fixtures, although, in the case of the South Bank Arts complex, there was little difference in the tolerances required for these different tasks.

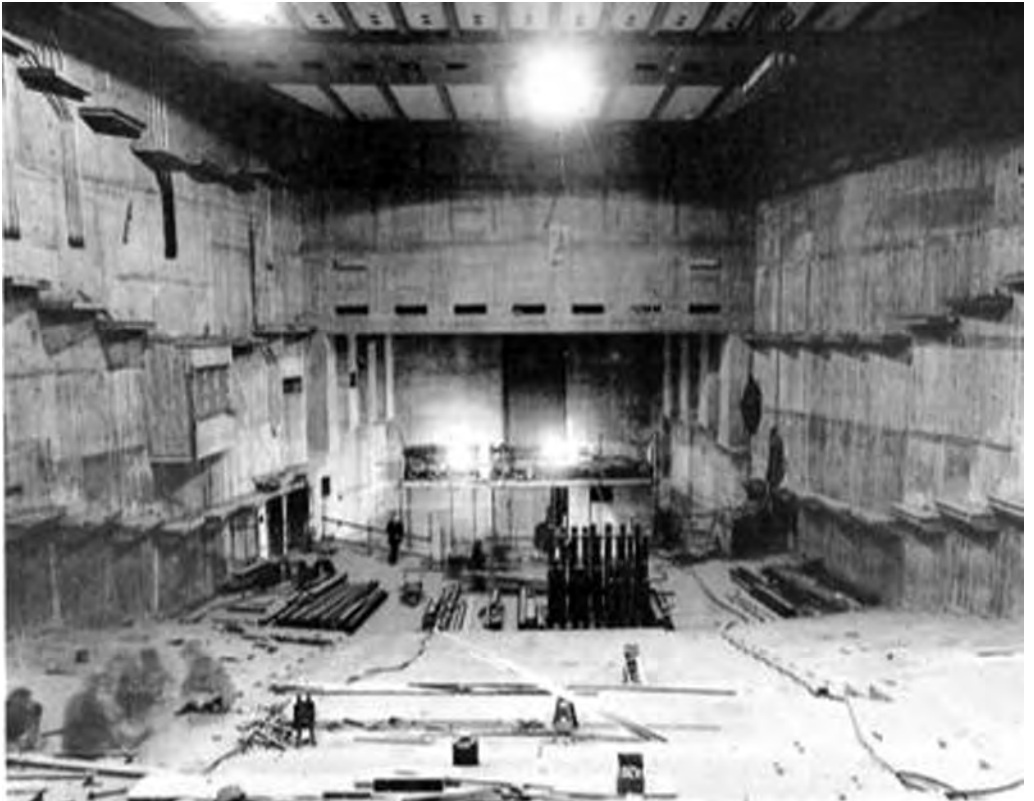
Peter Day remembers the Higgs and Hill carpenters working on second fix to the offices at the rear of the National Film Theatre on the same day as they were concreting:

And the chippies, would be fitting hardwood doors and stuff like that to the back of this building, to the main offices, the main doors, going up the stairs, ... they came in the morning, were erecting [or] dismantling the shutters from the concrete pour the day before... the reinforcement had to go up, so they went over there and started fitting the doors, and then they came over, early afternoon, put the shutters up, and we would then concrete them in the late afternoon. So, they were going from hardwood joinery onto chippie formwork, doing concrete works...

The unorthodox shapes of the arts complex required extremely complex scaffolding to support the formwork into which concrete was subsequently poured. As Glan Davies succinctly described the structure:

⁵⁰ *Ibid.*

⁵¹ ICT (Institute of Concrete Technology), 'Milestones in the History of Concrete Technology: the history of training at the C&CA', *Yearbook 2007-8* (London: ICT, 2008), 13.



Interior of QEH auditorium. Source: Crown Journal

Now the Queen Elizabeth Hall was a vast concrete structure, and the whole of the underside of the Queen Elizabeth Hall was built on a cantilever basis, and it was laid down and supported on some...temporary steel structures, some tubular, some steel-framed, and, first of all, we built the columns up to it, and then we built the auditorium floor,

which, structurally, could not support itself, and then we built the walls up from there, and eventually, we put the roof on, and it's only when the roof tied the auditorium floor, the walls and the roof together, structurally complete, with cube results for the strength of the concrete, that we could then dismantle the supports underneath the auditorium floor.

Irishman Michael Houlihan worked as a scaffolder on the site. Born in County Kildare, Michael was 23 when he arrived in London and had never worked in the building industry before. After some work for Willesden local council in North London, he got a job with Laing and was offered to choose between bricklaying and scaffolding. He went for the latter because he had friends 'on the scaffolding side'. Although no formal scaffolding certificates were issued at the time, he recalls being a scaffolder trainee for 18 months during which time he was expected to learn from the people that he worked with. After this, Michael worked for a number of scaffolding firms and was also active as a trade union member in the Amalgamated Union of Building Trade Workers (AUBTW). When he arrived on the South Bank site, he was working for Acrow and recalls the particularly challenging scaffolding erected to support the 36-ton cantilever on the front of the Queen Elizabeth Hall:

They used to use acros to support the floors and all that, but ...they had, out the front of the Queen's Hall, it was all done with scaffolding. We put the scaffolding up, and we put these, what they called fork-heads, and then they put the timbers in there, the fork-heads, to support ...whatever it was they were doing. I remember that vividly because it was all new, and people, even the carpenters, had never seen that system before. The standards were six inches apart [...] on the line, and every two foot, a line of six inches apart standards, and a ledger every two foot. So that of course made it extremely strong, but the engineer told us, at the time – whether he was joking or not – but he said there was seven ton estimated per standard when the full weight of the building rested on the scaffold.

Steel scaffolding was used, and, according to Houlihan, a lot of it was galvanised:

Very heavy, 21-foot tubes. You had to be quite...strong to...lift them up and... especially when you're up on heights, not only strong, but, you know, confident in yourself that... I've seen very strong blokes didn't have the confidence the knack to [beat] the balance and whatever.

Among the carpenters there were a number of Sikh gangs, who were much admired for being highly skilled. Michael Houlihan recalls:

It must have been around that time that they started coming over...that crowd were on the Southbank there and...at that time, we'd never seen Sikhs before, like with the turbans and their beards and all the rest of it, but by God were they first-class tradesmen!... and they had all their own tools that they'd brought with them from... Amritsar or wherever they had come from. They were first-class carpenters. They were absolutely – you couldn't believe, I mean, the antiquated tools, as they appeared to us, and how well they could manipulate them to provide the finished... It was just incredible, you had to be very precise. It wasn't the normal, you know, crash, bang, wallop kind of shuttering. The Sikhs were first-class craftsmen.... And they were first-class trade unionists as well! ... Yes, the quality of work, well, I suppose that's why those Sikhs were employed there. Because of their skill.

This account reveals the high levels of skill and accuracy demanded of the workforce in order to achieve the structure and finish specified by the architects. It was not only the formwork and concrete work more generally that was highly skilled; the finishing carpentry and joinery work inside the concert halls demanded high levels of skill as well.

Jim McDonald, who worked as a carpenter for Elliott and Sons Limited, remembers working on the stage and tiered seating area of the Purcell Room and Queen Elizabeth Hall. Jim was born in Kilkenny, Ireland, in 1947, son of a carpenter. He spent three years in Kilkenny as an apprentice carpenter, then went to Dublin and continued as an apprentice with McLachlan & Harvey. From there he moved to London, where he resided in West Hampstead and worked on several large construction projects across the city. He was a union member from the age of 15. He recalled that, in the 1960s, only hand tools such as planes, saws, chisels, hammers, and screwdrivers (Yankee screwdrivers had been specifically banned by the unions) were used. Iroko wood (also known as African or Nigerian teak) – notorious for being very durable but less stable than teak – was used for the steps inside the auditorium, and, according to Jim, this was the first time it was employed in the UK. He also recalls spending quite a while working on the Helmholtz resonators, ‘which had little slots in them about 15 inches by 2.5, about 2.5 deep’ – it was an activity that required significant precision:

You had to fit in these little boxes into this bigger case, and they had to fit in exactly. There was no allowance, because they could fall out, because these things had to be moved around. Apparently, they would bring in a man with a shotgun – no live cartridges, I presume – and from that, he would then decide on the arrangements of these things. But I understand that another man actually glued them in, which wasn’t helpful at all [laughing]! These were typical things that happened on building sites.

The Arts Council became involved with the design of the Hayward Gallery at an early stage, in 1961, and stipulated that the upper gallery must be top-lit with daylight, but without direct sunlight: ‘Daylight illumination [was] a prerequisite of the brief’.⁵² This resulted in the characteristic glazed pyramids that were devised and tested by the Building Research Station. A test cell was erected by the direct labour department of the LCC in the rotunda at Crystal Palace to allow Arts Council members to view the new lighting technique and the appearance of the gallery interior.⁵³ Ted Newbery remembered:

And the roof was ...a vast amount of glass pyramids, and it was the original idea, that there would be a constant level of light within the Art Gallery because, if the sun shone, the blinds come across and...vice versa. But then again, Crittalls [had] done the roof...glazing. And right very near the finish...there was a wee drop of water crept in [down] the wall... And I can remember – the architect there was either Austrian or Hungarian. He wasn’t English, and the way he spoke, he said, “We can’t have the Laughing Cavalier on the wall with bloody tears running down his face!” [Laughter]

⁵² Lighting Correspondent, ‘Lighting in the Hayward Gallery’, *Building* 13 September (1968): 155-6, 155.

⁵³ Report by Architect to the General Purposes (Special Developments and Arts) SubCommittee 12-7-62, LMA GLC/CL/GP/2/134.

WAGES AND WORKING CONDITIONS

Wages on site varied depending on the trade. Michael Houlihan explains how scaffolding firms normally operated:

They didn't work on the bonus system. You got so many hours per day. If the job was smallish, you'd get so many hours for the job, and if you did it in half that time...[you could go] home, and we did, we worked right through and finished it. We did a job in Goswell Road there. It was supposed to take a week, and we did it in a couple of days, and then you could stay home for the rest of the week and you had your week's wages earned.

Michael was paid the basic union rate per hour, in this case, AUBTW's. He recalls being paid weekly in cash:

You got the basic union rate, but you got x amount of hours. [...] So, if you'd done a 12-hour job in six, you had double the...rate.

Peter Day and Graham Sargent remember there was a bonus system operating, with bonus clerks or surveyors working out additional hours. Workers arrived on site at eight o'clock in the morning and normally left at half past five; this was already two hours beyond the official finishing time. They had to come in on Saturday mornings as well until one o'clock. Graham explains that, during the summer, civil engineers had to be on site seven days a week. Ted Newbery also remembers how strict the working times were:

Yes, we had a timekeeper. Everybody clocked in, and if you was quarter of an hour late, you lost half an hour. And...meal times and break times were... fairly rigid. You couldn't keep strictly to the times because of the amount of bodies on the site who had to go through the various [canteens].

It was very difficult for workers to live on the basic wages, so everyone needed topping up by working overtime. However, Peter recalls a carpenter who found an alternative way of completing his salary:

... [who] only used to work till half-past three, so he was only getting basic wages. Well, a bloke couldn't live on basic wages, in them days. This is how he used to survive, apparently, he used to do the pools, and apparently, he'd use all his wages and put it on the pools, and he used to win more than he would get if he was working overtime in a month. So, one week, he might not win anything, but... over a four week period, he used to win to compensate for all his losses and make up for he was doing. I thought...can't believe this! But, it was quite funny, because when you were working alongside some people, you were checking the reinforcement or something, and all of a sudden, the chippie alongside you starts putting all his tools in his bag, you think, "Where are you going?! Half-past three in the afternoon!" Well, of course, you don't treat it as being the end of the day.

Peter Day estimates half of the workers received their wages weekly, and always in cash. Jim McDonald, for example, remembers being paid by the hour weekly. His pay was very good comparatively because of

‘the scarcity of carpenters within London’, he explains. Peter Day vividly recalls an incident when £8,500 was robbed from one of the timekeeper’s offices, illustrating the risk to which building site offices were exposed in handling such large amounts of cash.

There was a knock at the door, and [the timekeeper] gets up, and did exactly what he shouldn’t have done – he opened the door, and a bloke came in, grabs hold of him, threw him under the bench, because they were benches in them days – they weren’t proper tables – threw him under this bench. The timekeeper gets whacked over the head, and he falls directly onto the staff tray, with all the staff money laid out, and he lands on the staff tray. They dive in, and they grabbed the money. But one of the women in the canteen saw them go in. She goes out the door and screams like hell. People ran round. They jump in their car, which is on the Embankment, which shouldn’t have been there, and then they drove off and then went straight over Waterloo Bridge. They nicked 8 and a half grand, but they could have nicked a lot more, because him [the timekeeper] landing on all the staff wages, and the wages for this half, so they got away with less than half.

Jim McDonald, as mentioned, was a carpenter with the subcontracted firm Elliott, which was responsible for parts of the interior joinery of the Queen Elizabeth Hall. He had also worked on the Barbican and recalls the strict conditions on site and that supervision was less strict on the South Bank than on other jobs. At the same time, Jim does not evoke this job as a particularly happy one since in his case it involved working indoors for the whole day without any light:

There was no light, and you went [out] at lunchtime and you’d see all the sun you were missing, because it was coming into the summertime as well, you see, and you just knew your day was gone. And then you were working on the likes of a [bulb] which had [no] reflector on it, and you’re trying to get the best under those conditions, because when you’ve been from the light, you’re 20 minutes or half an hour blind.

Jim explains that health and safety was not really an issue for workers like him and at this stage of the building process. Nevertheless, he remembers a fatal accident that took place in the staging area in one of the concert halls:

A group of men came in and I don’t think they were working for Elliot’s.... but they came in to do the staging, and the staging had elevated parts which rose up and went down, and the word went round that we shouldn’t walk on the floor because, whatever value they put in the covering that was on it, obviously they didn’t want to get it damaged. So, underneath the flooring, they laid brown paper, and, as they worked along the floor, they rolled the same paper over the top of the floor to protect it. But when they came to the elevated areas, of course, they weren’t done, and this man came in one day, walked across the floor, straight through the paper, and died.

INDUSTRIAL RELATIONS

The men interviewed who worked on the South Bank agree that it was for the most part a trouble-free site. Although no major disputes took place, on the occasion of the Turriff strike at the Barbican (motivated by non-unionists being employed by labour-only subcontractors), workers on the South Bank and other large construction sites in London such as Euston Station and Paternoster Square downed tools in solidarity on 1 October 1965.⁵⁴ There was also an overtime ban in May 1966, following the sacking of a worker. The overall industrial relations calm on the site was in contrast to the conflict that had occurred during the building of the adjacent Shell Mex tower a few years earlier. On that site, the main contractor, Sir Robert McAlpine, sacked the entire 1250-strong workforce in an attempt to remove trade union activists from the site. Mass picketing followed. The unions refused to declare the action official and several workers were later expelled from the AUBTW with two, one of whom was Brian Behan, brother of the famous Irish playwright, Brendan, eventually being imprisoned.⁵⁵ When on the South Bank Jim McDonald was a member of the old Amalgamated Society of

Woodworkers (ASW). Jim assumes that most if not all of his woodworker colleagues on the South Bank were unionised. He recalls two Irish workers, the Bruce brothers, as the convener steward and shop steward, respectively. There existed the perception at the time that these two brothers essentially embodied and ran the union on this particular job. As a result, he thinks, there was less scope for collective union activity as compared to other large construction sites such as the Barbican.

From the staff side it was considered that Higgs and Hill were fair employers, in Glan Davies' words:

We had very little major problems. There was a few things, but nothing what I call seriously that caused real strikes or anything like that. From that point of view, we were lucky. But the company gave the employees a fair deal and they were paid bonuses on their production.

⁵⁴ "Battle at the Barbican site – police make six arrests," *Daily Worker*, 2 October, 1965.

⁵⁵ For more on the Shell-Mex dispute on the South Bank, see the *Daily Worker*, 4 October 1958; 6 October 1958; 9 October 1958; and 15 October 1958 and the *Times*, 8 November 1958; and 21 November 1958.



Queen Elizabeth Hall and Hayward Gallery on completion, by Eric de Mare.
Source: © English Heritage

OPENING AND APPRAISALS OF THE BUILDING

It was not until 1967 that the Queen Elizabeth Hall and the Purcell Room opened to the public. The Hayward Gallery did not open until the following year. Ted Newbery remembers the day the Queen Elizabeth Hall was inaugurated:

When it all finished, we was all invited, I think it was to meet the Queen, and there was a concert put on in the Queen Elizabeth Hall. [...] She was presented with a...glass plaque of some sort... and the architect who was going to present it was walking up stairs to present this, and he dropped it! And they must have had a replica of some sort, because she did get it [laughing]!

Peter Day recalls there was a meal arranged at the Royal Festival Hall prior to the opening to which the engineers and some of the workers were invited. His account illustrates how company directors were largely detached from what was going on in the actual building site:

We had to be there early. I was sitting on a table with Brian Hill and David Hill and obviously two or three others. Glyn was on that table as well. And when we came away from there, went in, I've got a different coloured ticket to a lot of the people I could speak to, because the tendency is, when we got to the Royal Festival Hall, there's all the directors standing around in a circle, talking, and there's all the workers standing round in a corner talking, you know [laughing]! Anyway, when I went in, it turns out a director had handed over his ticket, and I'd got a director's ticket, so I'm sitting next to a director. I can't remember which one it was now. He said, "Change places!" So Parry had to change places, so that him and I sat together to start with, while we were waiting, and he wanted me to explain how we'd



Reflections. Photograph of Rod Bond at the Queen Elizabeth Hall June 2011.
Source: Courtesy of Christine Wall

done the building, because he was a director who'd never actually been on the job.

Glan Davies also remembers this occasion:

On the completion, in March 1967, it was opened officially by the Queen, which was a big night for me because I got presented to Her Majesty on that night.

Appraisals of the new arts centre by different experts were published in magazines such as *The Architects' Journal* and *The Architect and Building News*. To architect Peter Moro, 'the skilful handling of the whole complex demands nothing but admiration'; he saw the South Bank arts centre as an 'articulated sculpture', where 'the arrangement of shapes and volumes, the impeccable choice of materials and finishes, produce a lively environment', contrary to the 'heavy handed treatment' of many other cultural centres designed at the time.⁵⁶

⁵⁶ Peter Moro, [Appraisal of the Queen Elizabeth Hall and Purcell Room], *The Architects' Journal* 95 (1967): 1000-6, esp. 1000-3.

REFLECTIONS

The men who worked on the site all highlight the rigorousness, precision, discipline and coordination that went into building the concert halls and the art gallery, in particular, as we have seen, towards the preparation for and the actual concrete casting. Ted Newbery reminds us that it is perhaps no coincidence that 'Higgs and Hill were actually known as the Rolls Royce builders' at the time. Furthermore, he does not think that it would have been possible to complete such a demanding concreting scheme today, given the dynamics of the construction industry in which subcontracting predominates:

No, I don't think so because I don't think whoever you employed to do that would have stuck it out. They would have defaulted straightway, no doubt about that at all, no. It was so stringent. That was about it really...

Glan Davies also considered direct employment an asset not just to Higgs and Hill but to the entire construction industry.

In those days the main carpenters employed by Higgs and Hill were all direct employees. The CHAG site developed during the time when most contractors employed their own labour, and it is some years afterwards that subcontractors developed into the industry in the way that is done today. In that respect, I think that's the worst thing that's ever happened to the industry because they don't have apprentices, where the main contractor employed his own labour and had his own apprentices.

In hindsight, while still proud of the quality of the in situ concrete, Ted Newbery believes the material does not age well in the open air:

To me, personally, concrete will never be a finish...doesn't work that way. Internally, where you can't get...the elements attack it, quite likely as good as gold today, but outside, all the efforts that went on to all the indentations on the boards and...It just didn't work now. It's weathered. You might just as well have rendered the thing. But at one stage...architects and engineers were brought in from all over the country to see the concrete that was being produced, and they really couldn't believe the quality of it.

Peter Day and Graham Sargent agree that the building has deteriorated over time:

P: Well, I've passed it many times, obviously, over the years, and...I've noticed numerous things that have deteriorated. Like for instance, where the formwork...the holes, where the bars go through, the bit that you fill in, a lot of them plugs have fell out, if you understand me.

G: Has it stood the test of time?
Discolouration I suppose is one...looks a bit drab.

Peter Day believes ready-mixed concrete would have worked better than the concrete that was mixed on site:

I think that the mix of the concrete... if we'd have used ready-mix, it would have probably been better, because ...batching it in bigger volumes is better all-round, at the end of the day. But...it's one of these buildings, you either hate it or you love it – there's no sort of in between. I like the building...

At another, perhaps more anecdotal level, the two site engineers speculate on the hidden purpose of the building, in other words, the reason why it was made so robust:

And when we were building it, you've got to think of the politics at the time, we thought, and I still don't know whether this is the case, that in actual fact, it was being built in the manner that it was for anti-nuclear blasts. In other words, there's no way a bomb could land on that thing and bring it down. It is so thick. The walls are 18 inches thick. All the walls are thick....

G: See, I mean, it was in the time of the Cold War. When it was designed, because it was designed in the early-'60s.

P: There's no windows in the place. And in fact, if you actually look at the actual hall, and the lead-up to the hall, they could probably close off about half a dozen doors, and they're all bloody doors about this thick, but I mean, if something really did go wrong...

G: It could be blast-proof.

Whether the South Bank arts centre was more or less secretly intended as a nuclear shelter or not, the sheer thickness of its structure might ensure its survival into the future – not necessarily from nuclear bombs, but from redevelopers and conservative preservationists eager to take down brutalist architecture:

I've often said, when it comes to demolishing the place, if they ever decide to do... Well, good job they've got the current equipment, because, if we had the demolition equipment they had in the '60s to take it down, it'd be a job and a half! (Peter Day)

But, in Glan Davies' estimation, it remains a building that should be judged on the quality of its construction material – concrete:

Well, I think it was a remarkable success. The standard of the concrete was superb. But a lot of people think it's dead ugly and don't like it at all. But they look at it from the general trend of finishing buildings, and the CHAG is unique in itself. Concrete finish of the sawn board nature went through a phase, for a period of so many years, and then it died a death. The reason is it's a very expensive way of producing concrete. But I've no regrets on the finish there, and I think, myself, I look at it from a quality point of view of the standard of the concrete.



Disused section of the Belvedere Road walkway, June 2012. Source: Courtesy of Christine Wall

In 1996 Higgs and Hill announced poor results and was bought by the Hollandsche Beton Groep (later HBG). HBG was itself acquired by another Dutch conglomerate, Koninklijke BAM Groep, in 2002. However it was through contacting BAM in London, and the efforts of Graham Sargent in particular, that some of the men who originally worked on the concert hall and art gallery, CHAG as it was known while under construction, were traced. Peter Day, Ted Newbery and Glan Davies remained with the firm in management positions until they retired.

Glan Davies is currently the Secretary of the Higgs and Hill Retirement Club.

Rodney Bond is currently Director of a construction firm.

Graham Sargent is Regional Planner for London with BAM Construction Ltd..

Jim McDonald is currently the executive member for Ireland in the Union of Construction and Allied Technical Trades (UCATT).

Michael Houlihan left the South Bank to work as a scaffolder on the Barbican scheme, where he became site steward for the AUBTW. After his involvement with the industrial disputes on the scheme, he was blacklisted. He spent the last 15 years of his working life employed in local government library services.

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PICTURE SOURCES

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Source: © Henry Grant Collection/Museum of London
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Source: Courtesy of Christine Wall



On 23 March 1961, the plan for a new £4 million arts centre on the South Bank was revealed by the London County Council. The aim was ambitious: to turn the South Bank Festival Hall area into 'the greatest centre of culture in the world'. A monument to 'brutalist' architecture, the unique quality of the in situ concrete of the complex is internationally acknowledged. For the men who worked on the Queen Elizabeth Hall, the Purcell Room and the Hayward Gallery, it involved challenging work and exceptional coordination. This pamphlet tells the stories of some of these men who still recall in detail the rigorousness and precision that went into creating a masterpiece in concrete.