Walsall Art Gallery

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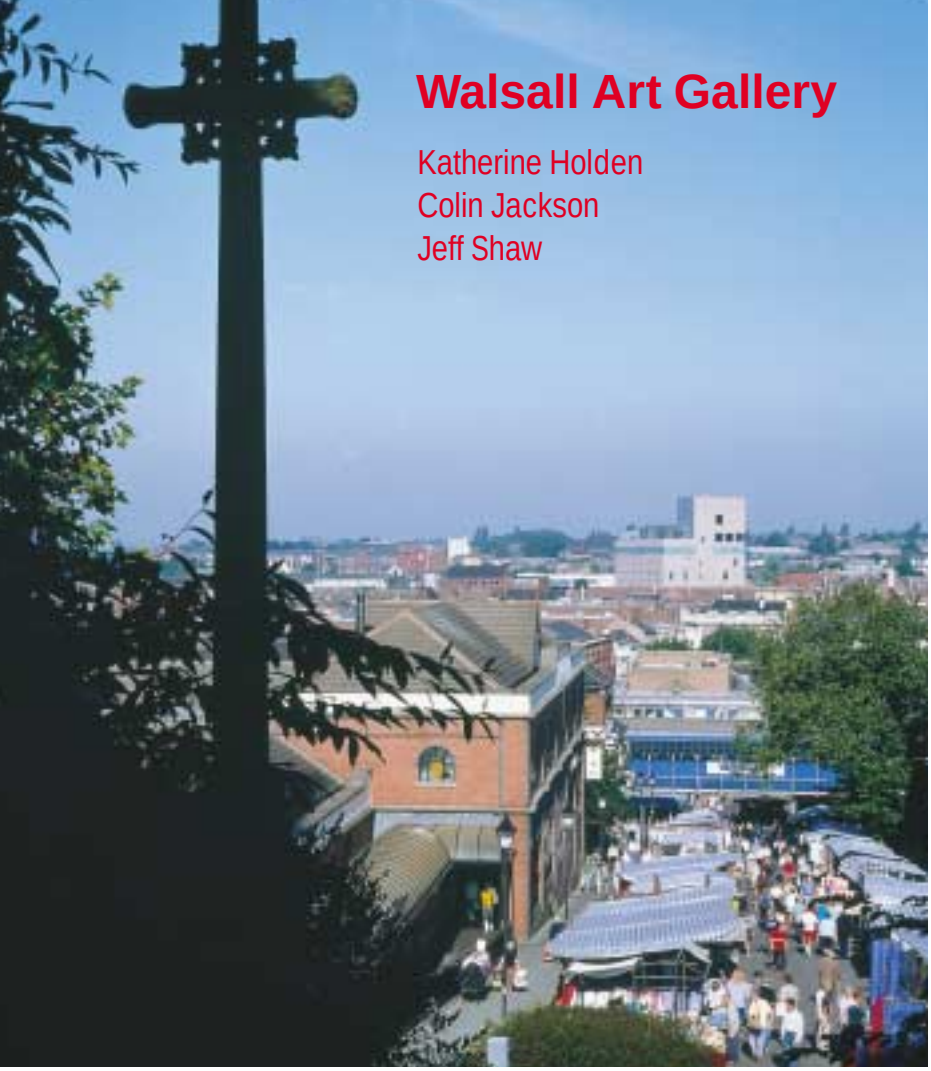


1.
The Gallery in its urban setting.

Introduction

The new Art Gallery at Walsall - north of Birmingham in the UK West Midlands - not only houses an existing historic collection, but also has world-class facilities for contemporary exhibitions, and interpretation and education spaces.

At the Gallery's core is the Garman Ryan Collection of 350 works by 153 artists, including 43 by the sculptor Sir Jacob Epstein. Kathleen Garman (Lady Epstein), who came from nearby Wednesbury, and American sculptor Sally Ryan - a life-long friend of the Epsteins - created the Garman Ryan Collection between 1959 and 1973 and donated it to the gallery later in the 1970s. As well as those by Epstein himself, particularly bronze statues and busts, the collection contains works by his family, including his son-in-law Lucien Freud, and several by major artists like Picasso, Van Gogh, Matisse, Monet, Manet, Modigliani, Delacroix, Gauguin, Constable, and Turner.

The client, Walsall Metropolitan Borough Council (WMBC), made several attempts to replace the existing Museum and Art Gallery before succeeding with this building. The project was launched by the New Art Gallery Project Director Peter Jenkinson, whose vision and enthusiasm made it succeed, and was based on all-party support from the council and intensive public consultation and marketing. The policy of the new Art Gallery is to exploit both the Garman Ryan Collection and the contemporary exhibitions for their educational potential, and also to explore how contemporary artists can help to interpret the Collection.

The project's total cost was £21M. WMBC had no capital funds itself, so applied for Arts Council National Lottery funding as the best and most ambitious opportunity to provide the new building. £15.75M was forthcoming - covering most of the construction cost - and partnership funding of £4.5M came from the European Regional Development Fund (ERDF), plus £4.426M from Walsall City Challenge for urban regeneration. To secure the ERDF funding, the contract was let in two parts. The main contract had to be let by the end of December 1996, with provisional sums for the services and other contracts. Construction began in January 1997.

The architects were Caruso St John Architects, a small practice based in London. Their concept was of a 'big house' with irregular window layouts, and clad in terracotta. Located near the top of a pedestrian shopping street, by a canal, it is five large storeys tall, mirroring in height a church at the other end of the town (Fig 1).

2.
Timber cladding with boardmarking above.

The Garman Ryan galleries are small in scale, to suit the size of the works in the Collection, but the exhibition galleries are large and are lit with clerestorey windows. The 'Children's House' contains a discovery gallery, education rooms, and an artist's studio; adjacent is the art library, and there is also a public research room. On the top floor a conference room, restaurant, and winter garden all have splendid views over the town and surrounding area. The back-of-house has staff offices, art storage, and a workshop.

Structure

The building has a gross area of about 5200m^2. The structure is entirely of reinforced concrete - a mixture of in situ and precast. Ribbed floors are supported by internal and perimeter walls at lower levels (first-third) and by beam / column frames and perimeter walls above (fourth level and roof). The ground floor is entirely column-free. There is a single-level, externally tanked basement for art storage and plantrooms. Shallow foundations bear directly on Silurian limestone.

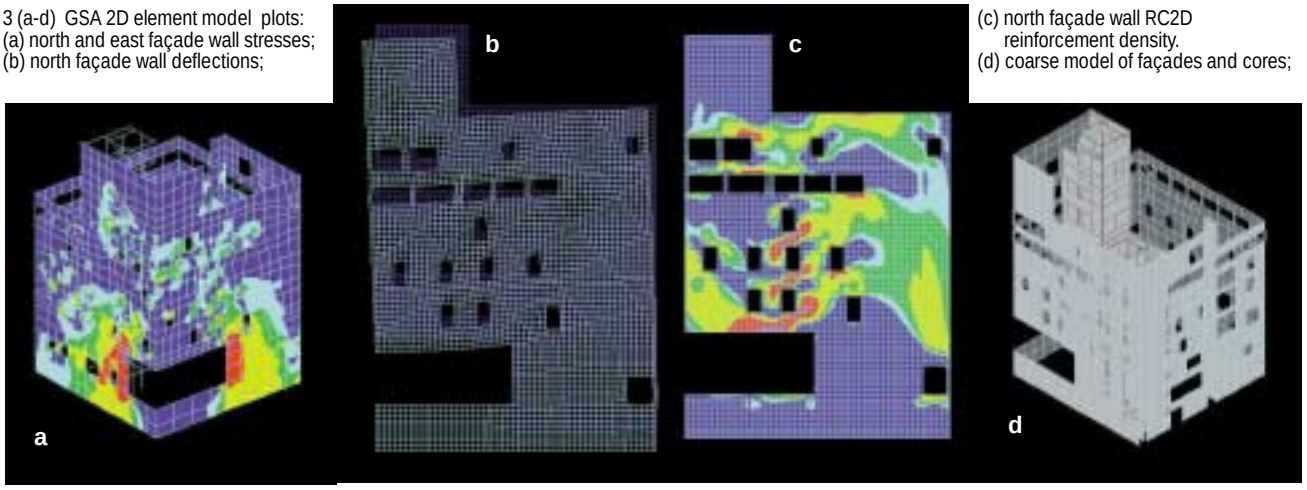
Gallery floor loadings are generally at the statutory minimum of 4kN/m^2. This is adequate for most purposes, but it restricts the siting of heavy sculptures, and greater loading capacity was required for the third floor temporary exhibition space and some circulation areas. The study of loading levels required to provide this flexibility was one example of the co-operation between the clients and design teams for Walsall Art Gallery and the Tate Modern at Bankside. The Tate provided details of the weight and footprint of several heavy sculptures that the Walsall Art Gallery wished to be able to accommodate. These included Epstein's *'Jacob and the Angel'* (2.5 tonnes on a 1m^2 base) and Hirst's *'Mother and Child, Divided'* (14 tonnes on an 8m^2 base). A loading allowance of 10kN/m^2 for display areas and art movement routes to them provided the desired flexibility for siting the sculptures identified.

The exterior is fully clad, for the most part in terracotta tiles, but with stainless steel between ground and first floors and on the inward-facing walls of the tower which projects above roof level on the north east corner. Inside the building, wall linings are typically stopped short at high level to reveal a boardmarked concrete finish (Fig 2). The wall linings are 75mm wide Douglas fir boards - the same timber and width used for the board-marked concrete wall formwork, giving the illusion that the in situ walls were poured into the linings which were then peeled back to reveal the board marks. Pre-tender samples of the boardmarked concrete finish were made to define the quality required and to test the prescriptive specification which was based on a survey of experience from the 1960s and 1970s when similar finishes were popular.

The form of the structure was largely determined by several features of the building:

• The large rectangular gallery spaces with exposed concrete ceilings suggested the precast ribbed floor. The timber joist analogy precluded the use of tapered sides for the ribs, so they were precast individually in sprung steel forms which, when released, enabled the rib to be withdrawn upwards. This analogy also dictated the aspect ratio of the ribs, which led to the narrow, 120mm, width. An interesting, if structurally illogical, feature of the ribbed floors is that the depth of the ribs relate not to the loading and span of the floor, but to the floor-to-ceiling height of the space below. Thus the temporary exhibition floor supporting the heaviest loadings over spans up to 10m has the shallowest ribs, due to the fact that the second floor houses part of the Garman Ryan Collection and is therefore a modest (for this building) 4.5m floor to floor. The slenderness of the ribs led to several precast concrete contractors declining to tender due to perceived difficulties in transporting them to site undamaged.

3 (a-d) GSA 2D element model plots:
(a) north and east façade wall stresses;
(b) north façade wall deflections;
(c) north façade wall RC2D reinforcement density.
(d) coarse model of façades and cores;



This did not prove a problem for the successful tenderer who transported the ribs to site upright on bearers and separated from its neighbours by padding. Precast soffit panels, incorporating holes for lighting and other services, span between the ribs. These provide permanent formwork to the in situ slab forming the table of the T-section and the horizontal diaphragm which transfers lateral forces to the perimeter walls.

• The column-free ground floor is realised by transferring all loads from above to the perimeter walls. This is achieved by using the internal walls of the Garman Ryan galleries as transfer beams.

The Garman Ryan floor plan is similar on the two levels occupied. The walls, which span up to 18m, are therefore 9m deep (2 x 4.5m). Door openings are accommodated, at similar locations on the two levels. A consequence of the transfer of load to the perimeter is that little downward load remains on the basement slab away from the edges to counteract the upward water pressure on the underside of the basement. Although the permanent water table is close to basement level, the proximity of the canal basin means that should a breach occur in the puddle clay lining to the basin, water may possibly rise to close to ground level around the building.

To hold the basement slab down in this event, ground anchors grouted into the limestone below have been installed on a 3m grid.

• The architects introduced the concept of a landscaped 'Gallery Square' flowing into the building. However, this could only be realised if a significant length of façade wall was omitted between ground and first floors at the main entrance in the north-east corner of the building. On the north façade these walls are omitted for 13m - half the length of the building - and for 6.5m on the east façade. The façade walls above first floor cantilever over this opening to transfer forces to the walls that continue to the foundations. The design of the walls to perform this function was complicated by the irregular pattern of window openings and the need to support the double-storey height transfer beams which span over the ground floor.

To analyse and design the reinforced concrete internal and façade walls, 2D finite element models were analysed using Arup's in-house structural analysis package GSA (Fig 3). The results of these analyses were then post-processed to produce arrangements of reinforcement.

The post-processor, RC2D, was written by Arup Research & Development and has since been incorporated into GSA as a standard feature. The program uses a procedure based on the Wood-Armer method devised for bending elements and widely used for floor slabs and raft foundations.

Lighting

The lighting was a major focus of the design from the outset. It was decided early on that a significant component of the gallery lighting would be natural daylight, and that it would be from the sides. The decision to side-light was partly sheer necessity, due to the large gallery area stacked up on the small site which eliminated the possibility of using skylights. However, this approach also suited the 'domestic' quality desired of some of the gallery spaces housing the Garman Ryan Collection (Fig 4). The challenge was to make side-lighting work for both this and the Temporary Exhibition galleries, which required quite different lighting conditions.

4.
Garman Ryan Collection gallery space.

5.
Temporary Exhibition.

6.
Computer-generated graphic
of Temporary Exhibition gallery

An important consideration in side-lit spaces is that light from the horizon is only a third as bright as light from the zenith - the sky directly overhead. Additionally, side-lit spaces are prone to producing asymmetric lighting conditions, and can cause reflections on artworks hung opposite that hinder their viewing.

The Garman Ryan Collection is arranged by theme rather than by artist or period, and so each room contains works in various media, each requiring different lighting levels for conservation reasons. By placing windows off-centre in these rooms, the asymmetric characteristics of side-lighting are emphasised, allowing works in oils which can be hung on brightly lit walls to be in the same space as paper-based works which must be exposed to considerably less light.

To arrive at the most suitable balance of light and dark in these galleries, the design team studied the curators' requirements in depth, and determined that a window reveal depth of 600mm, together with metal sputtering on the window glass, would give suitable light distribution and diffusion. The quantity of available daylight varies considerably over the course of a day, and through the year. White material blinds with a light transmission value of 10% provide additional control of the amount of daylight entering the space, and are lowered when the daylight levels exceed a set limit or when direct sunlight shines on the windows.

In the Garman Ryan galleries, the lighting levels were designed using a kilolux-hour per year approach for the exposure of the artwork to light. This takes into account the cumulative exposure throughout the year, rather than targeting a specific constant lighting level to be maintained at all times. This permits short-term variation in the levels of light, enabling the design approach to accommodate some natural variations in light levels.

The artificial lighting in these spaces is also located off-centre, and its design was influenced by the natural lighting strategy. Large suspended diffuse-glass boxes called 'laylights', containing fluorescent luminaires and conceived as sculptural ceiling furniture by the architects, provide ambient lighting when daylight is insufficient. The light levels can be dimmed or raised automatically to respond to daylight levels, and connections for spotlights are provided from tracks concealed within each light box to highlight specific works.

The main Temporary Exhibition room is the largest in the UK after the Tate Modern at Bankside, and is naturally lit from three sides. The lighting levels throughout the Temporary Exhibition rooms are strictly controlled to meet the requirements of international art lending institutions by using a layered clerestory window system (Figs 5-6). Electric lighting and motorised blinds, together with heating and ventilation services, are located in the cavity between light-diffusing layers of glass. The blinds adjust constantly yet discreetly to ensure that the permitted light levels are not exceeded, and the electric lighting is automatically dimmed to supplement daylight when required and to illuminate the spaces at night.

Whereas asymmetric lighting was desirable for the permanent collection, the Temporary Exhibition rooms require even levels of light. The diffusing window glass and height of the rooms allows for intra-reflections within each room, ensuring largely uniform light levels on the walls. As the windows are located above eyebrow level the risk of reflections is also eliminated.

Mechanical services

The mechanical services brief for the galleries was that the internal air conditions should be of international standard, so that works of art could be borrowed from all over the world. This meant that they had to be air-conditioned, with close temperature and humidity control, and a study was made of existing galleries and conditions recommended by art experts to determine what was appropriate. Pollution data for the area were gathered, as levels of acidic gases like sulphur dioxide had to be kept very low - typically 20-50 times less than outside. Activated carbon filters were used to remove almost all the acidic gases.

The design noise level is NR30 for the galleries and conference room, which also is air-conditioned, with comfort cooling. The remainder of the building, however, is naturally ventilated where possible, both to save energy and to achieve relative simplicity. In some of the public areas, high-level motorised vents are used instead of windows, both from architectural preference and because of concerns about people falling out of windows. The basement, toilets, and kitchen are all mechanically ventilated.

The services had to be carefully integrated with the architecture and the structure, because the building is very irregular and does not have many accessible false ceilings or floors. There are two main risers, but they are blocked off from the main floors in some areas by double-height spaces or stairs, making it necessary sometimes to take the services through tortuous routes which during the design had to be visualised in 3D.

Architectural acoustics

Richard Cowell

The substantial building envelope construction, with sound insulating glazing, protects the interior from a moderately noisy external exposure (in the range 60-70dB LAeq).

When combined with building services noise controls, this achieves sufficient restraint over noise to avoid significant aural distraction.

The Gallery acoustic design balances the necessary control of reverberation - to limit activity noise and help public address intelligibility - with the creation of an aural sense of the space.

Visits were made to the existing Walsall gallery and others, including the Tate Millbank and Lisson Galleries in London. Reference was made to a wide range of previous gallery studies to refine the targets for reverberation control. Auralisation of the effects of reverberation on speech intelligibility was also arranged.

Mid-frequency reverberation time maximum targets in the range 1.2 - 1.8 seconds were set. The openings between galleries and the design preference to avoid unnecessary 'soft' finishes challenged the scope to restrain reverberation. Materials selected for visual hardness with effective sound absorption were integrated into the finishes at high level.

9.
Entrance foyer.

Where there are exposed concrete ribbed ceilings, air is distributed within thick walls, from below or from risers at the sides (Fig 7).

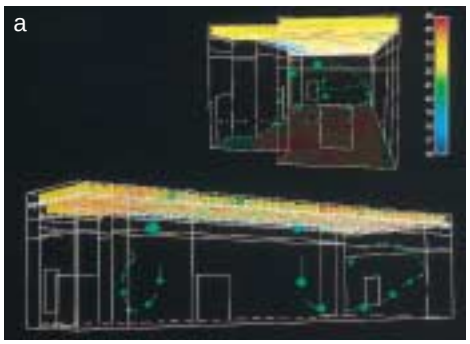
The architects wanted to have virtually invisible services. In the Garman Ryan galleries, the air is supplied at the top of the laylights suspended just below the wooden ceiling. The return air is extracted through slots in this ceiling. In the Temporary Exhibition galleries, air is supplied from long slots at the tops of the walls and extracted through the clerestorey windows.

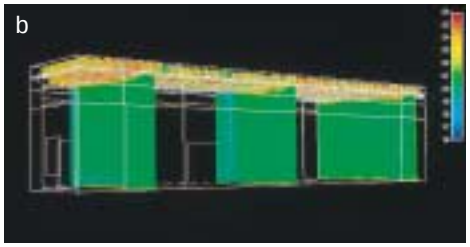
7.
Air-conditioning ductwork
being concealed behind thick walls.

8.
CFD models of Temporary Exhibition gallery:

(a) Summer air movements with temperatures in °C.

(b) Vertical sections showing
summer air temperature distribution in °C.





This both helps to remove some of the heat that builds up in these windows and reduces solar gain to the rooms. Computational fluid dynamics (CFD) was used to model air distribution in a key gallery, to check that it would mix properly (Fig 8). In the Children's House rooms and the conference room, air is supplied and extracted through long slots at the tops of the walls.

The air systems for the galleries are all-air, mixed ventilation, with high-level supply and extract. The air-handling units (AHUs) are constant volume with zonal reheat and rehumidification. They have minimum outside air - between 20% for one unit and 45% for another - as the client wanted to keep the carbon filters as small as possible. These have to be replaced every two to five years, depending on outside pollution and extent of use, and they are quite expensive. All the AHUs have heat recovery. Most of the air plant is in the basement. There are air-cooled chillers, two AHUs, a generator on the roof tower, and boilers within the tower.

A stair pressurisation system was required because one set of stairs was not located on the outside of the building and there was not a spare escape stair, which could be discounted. It was difficult to integrate this system into the building, as it requires a lot of plant and riser space, and available vents from the floors were limited.

There is a sophisticated building management system to operate the services systems efficiently and monitor conditions.
The predicted annual energy use is approximately 170kWh/m^2 in total: 35kWh/m^2 of gas and 135kWh/m^2 of electricity.
The main uses of energy are for the lights and the fans. Since the air-conditioning system has been running, once a few hitches had been sorted out, the measured temperature and humidities have been within tolerance and very stable. The systems are also very quiet.

Conclusion

The new Gallery was completed within budget in February 2000, and officially opened by HM The Queen on 5 May. The client's aims were achieved: an outstanding building worthy of visiting for its own sake, and the best and most accessible accommodation for the Collection, the temporary exhibitions, and the education programme. Structure and services were carefully integrated to satisfy the challenging demands of the brief and the architecture. The building has since been acclaimed in many national and local newspapers and in the architectural press.

Credits

Client:
Walsall Metropolitan Borough Council

Architect:
Caruso St John Architects

Engineers:
Arup Peter Bailey, Tony Campbell, Ed Clark, Stuart Cowan, Richard Cowell, David Gilpin, David Glover, Simon Hancock, John Heath, Judith Henson, Katherine Holden, Colin Jackson, Adam Jaworski, Barry Jefcoate, Lidia Johnson, Jon McCarthy, Alan Reading, Sharon Rose, Andy Sedgwick, Jeff Shaw, Ned Stork, Malcolm Turpin, Paula Walsh, Colin Whewell

Quantity surveyor:
Hanscomb

Project managers:
The London Group (pre-contract)
Bucknall Austin [now Citex Project Delivery] (post-contract)

Main contractor:
Sir Robert McAlpine

Concrete subcontractor:
Code

Services subcontractor:
Drake & Scull

Illustrations:
1, 2: Hélène Binet
3: Ed Clark
4, 5, 9, 10: Paul McMullin
6, 8: Darren Woolf
7: Peter Mackinven

10 right:
Gallery exterior.