The Monument in the City of London: Repair and Discoveries

by

JUDY ALLEN

The Monument to the Great Fire of London, constructed between 1671 and 1677, is located near Pudding Lane in the City of London where the Great Fire started in 1666. A contract to conserve and enhance the Monument was undertaken between 2007 and 2009 at a cost of £4,500,000, funded by the legal custodians, the City of London Corporation. This paper discusses why such a sum should be spent on the Monument and the philosophical questions raised during the conservation design process. An account of the preparation works prior to the contract is given together with the attitude taken to repair work and new interventions. The new design initiatives are described together with discoveries made during the works.

The Monument represents an event in London's history which has captured the imagination of generations. The Great Fire of London began in a baker's house in Pudding Lane on Sunday, 2nd September, 1666, and was finally extinguished on Wednesday, 5th September, after burning thousands of buildings and destroying hundreds of streets in the City of London. King Charles II ordered the building of a monument to commemorate the Great Fire and to celebrate the rebuilding of the City[1]. An Act of Parliament in 1667 for the rebuilding decreed, 'To preserve the memory of this dreadful visitation…, a columne or pillar or Brase of stone be erected on or as neare unto the place where the said Fire soe unhappily began as conveniently as may be …'.

Over 150,000 visitors a year now climb the continuous flight of 311 spiral steps within the shaft of the great column of the Monument and admire the continually changing views over London (Fig. 1). The Monument is intriguing to visitors – a massive historic stone column amongst the high-rise buildings in the heart of the city. This is in contrast to the late 17th century when the newly constructed Monument towered above the surrounding streets of terraces, adjacent to the primary route of Fish Hill Street leading to the old London Bridge (Fig. 2).

The Monument itself is largely unchanged since its construction over 300 years ago. It remains the tallest isolated stone column in the world and has limited visitor facilities: no interactive interpretation, toilets, shop or lift. Its historic and architectural importance is nationally recognised by its grade I listing and registration as a scheduled ancient monument.

The City of London Corporation, who own and manage the Monument as a visitor attraction, receive a regular source of income from the paying visitors. This funds the management and staff, regular cleaning, maintenance and major repairs, which occur approximately every 80 years when the column is fully scaffolded.

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Fig. 1
View of the top of the Monument against the City skyline, following completion of the repair contract.
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Fig. 2
18th-century view looking south down Fish Hill Street towards the old London Bridge. The Monument rises high above the surrounding buildings; a simple balustrade encloses the viewing platform.

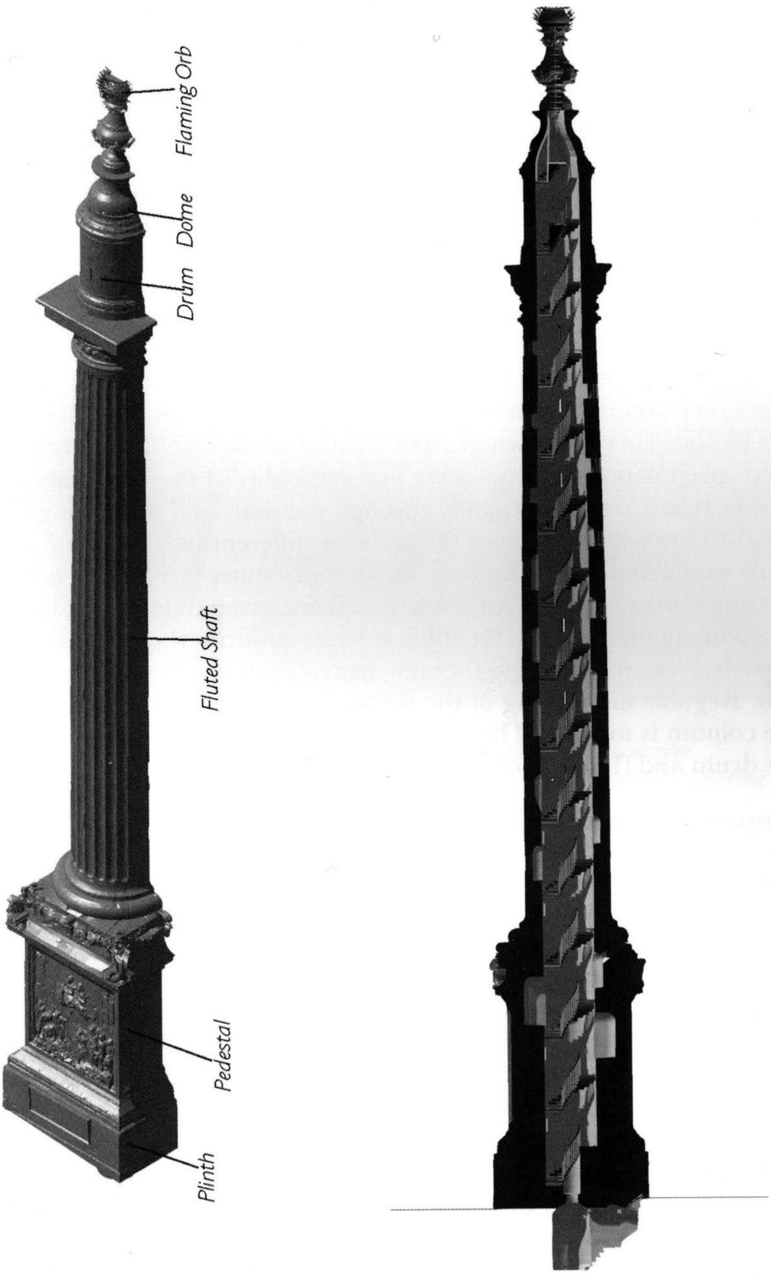

Fig. 3
Cut-away sections of the 3D computer model of the Monument showing the external west side of the Monument and the interior of the building.
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PREPARATION FOR THE MAJOR REPAIR CONTRACT

Julian Harrap Architects were appointed in 1991 by competitive interview and financial bid as architects for the Monument, the first commission being a quinquennial inspection of the condition of the fabric. Over the next decade the practice worked for the City of London to understand the history and construction of the building and how it has responded over the years to changes in its environment. The Docklands Light Railway line has been built beneath it; tall buildings have arisen around it, drastically altering the local wind conditions; air pollution has greatly increased over its lifetime and the thousands of visitors have affected the structure, finishes and environmental conditions.

Measured survey and measuring verticality

A measured survey of the entire monument was commissioned from the Downland Partnership, who recorded the exterior from a crane. Their survey drawings are of such detail that every stone block and each step of the spiral staircase is individually measured (Fig. 3,A-B). The survey drawings were used as a basis for the contract drawings and quantified specification for the works. The verticality of the Monument was measured using a laser beam arising vertically through the shaft and measuring offsets from the laser beam to brass studs set into the walls at different heights. Four 10mm diameter brass studs were fixed with resin into the masonry inner face of the shaft, on the north, east, west and south points, at four levels: basement, ground floor, mid-height up the shaft and at viewing platform level. At 2005, it was seen from these measurements that the Monument leans from ground to the viewing platform level by 270mm (10⅝ in.) towards the south. Regular monitoring of the verticality is recommended using this system to see if the column is moving. The alignment of the Monument above viewing platform level (the drum and flaming orb) was not recorded.

Environmental monitoring

Ridout Associates were commissioned to monitor the internal and external environmental conditions over a whole year (April 2004-2005), allowing a full cycle of relative humidity (RH) levels and temperatures to be analysed. Interior RH was higher than external RH and the temperature inside the building was lower than that externally. RH increased the further up the building. Within the column shaft, below the viewing platform level, where the slot window openings had no glazing, the high interior RH resulted in surface condensation running down the gloss-painted massive stone walls, ponding on the steps. Above viewing platform level, where the slot windows were glazed, the condensation did not occur.

Recommendations were made to stabilise the internal environmental conditions in order to secure the long-term future of the fabric. The proposed strategy included background heating, to be activated during critical humidity conditions, removal of the gloss paint to restore the breathable, absorbent stone wall surfaces, fitting the slot window openings with glazed opening lights and reinstating a door at the top of the stairwell to control the internal environment. These recommendations formed part of the brief for the major repairs contract.

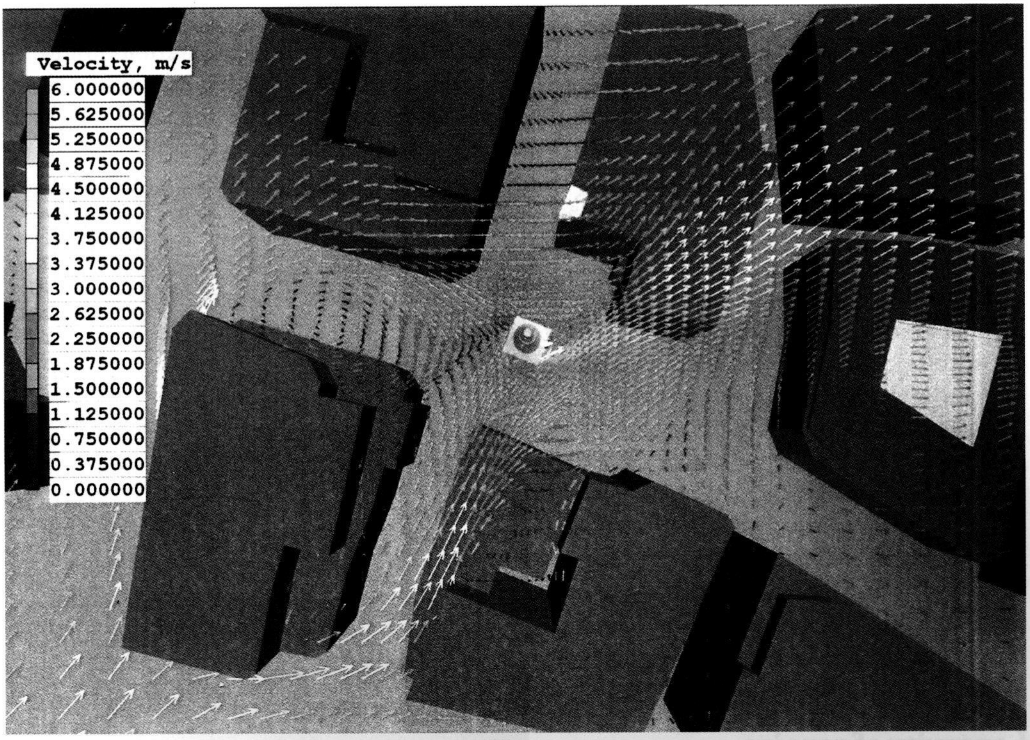

Fig. 4
Virtual wind tunnel model of the Monument and surrounding streets.
The figures are the wind speeds from the south-west at 2m intervals up the Monument, starting at velocity 0.0m/s at 1m from ground level.
© *Fulcrum Consulting Building Physics Group*

Local wind analysis

A local wind analysis was commissioned from Fulcrum Consulting to provide information for the design of the scaffolding and any objects to be fixed to the Monument. This allowed temporary and permanent additions to the structure to be designed with minimal intervention into the historic fabric. A three-dimensional computer model was generated of the Monument, together with the forms of the surrounding buildings, to which wind speed and direction data was applied and the local wind conditions calculated. Results revealed that the tall surrounding buildings caused turbulent local wind conditions and that hurricane force winds could be expected during a 1-in-50 years storm, as illustrated in Figure 4. Throughout the contract regular readings were taken from a site anemometer at the top of the scaffolding, with gusts of up to 101mph recorded.

Scaffolding

Scaffolding was at first designed as a structure independent of the Monument to avoid fixing to or stressing the historic column. The resulting scaffold design was like a pyramid, needing to be so wide at the base to resist the wind load that there was insufficient space around the Monument to accommodate it. For the redesign, the mass of the column was used to restrain the scaffold so that the latter abutted the column without fixing to it. To keep wind resistance to acceptable levels, only the lowest third of the scaffold could be sheeted, and of the scaffold lifts, only every third lift could be boarded at any one time. The boards were moved as stonework accessible from each lift was cleaned and repaired.

ATTITUDE TO CONSERVATION

The conservation philosophy has been based on the internationally accepted standards laid down in the Venice and Burra Charters. This is within the context of the national conservation policies of the Department for Culture, Media and Sport for scheduled ancient monuments, and English Heritage for listed buildings. Some philosophical conflicts arose between the established conservation aim of minimal intervention and the need to design repairs for a very long lifespan, and some new interventions were required to continue use of the building as a public viewing gallery.

Longevity of repairs

The difficulty and expense of scaffolding the column, 202ft (61.5m) high, governed the approach to designing the longevity of repairs. Historically scaffolded approximately every 80-100 years, external repairs to the Monument must be designed for a very long lifespan. Friable stone blocks at high level were repaired with well-secured natural stone repairs, and a larger proportion of a damaged stone was cut out and replaced at high level than at the relatively accessible base. No mortar repairs were specified above the plinth of the column due to their short lifespan in relation to natural stone repairs. The gilded copper flaming orb at the very top of the Monument, with its riveted flames, was repaired and regilded with two layers of 23.5 carat gold leaf, the highest quality available for the longest lifespan, applied over the thoroughly prepared existing finishes (Fig. 5).

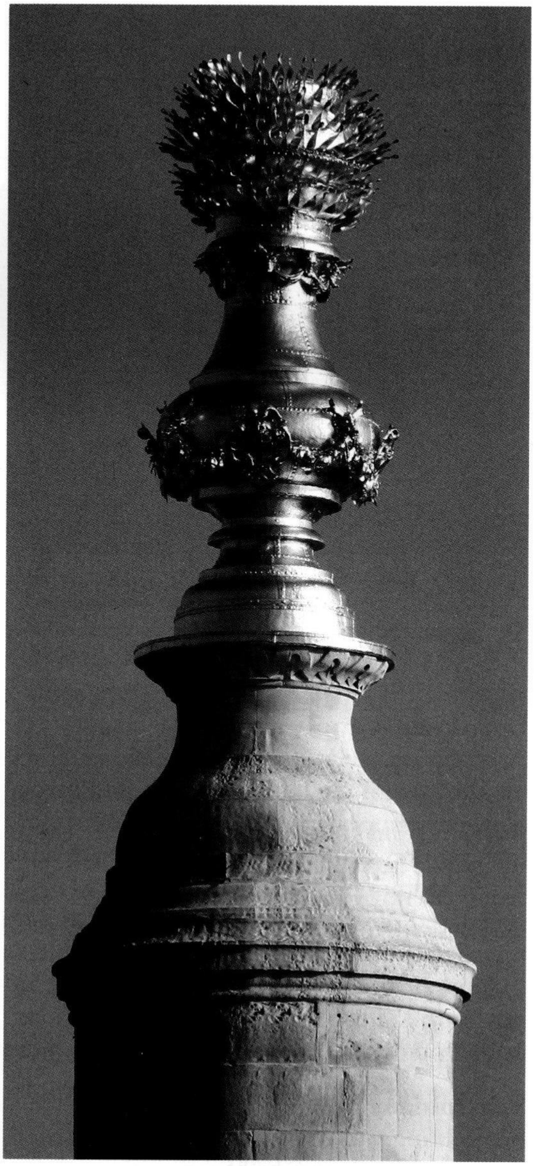

Fig. 5
The re-gilded copper flaming orb at the top of the Monument, with riveted flames representing the Great Fire of London.
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Retention of original fabric and wear patterns

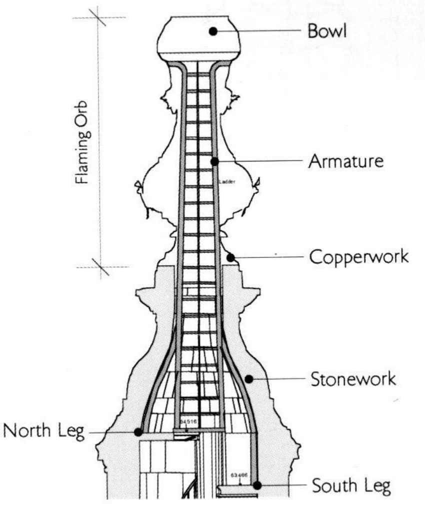
All original material of cultural significance has been retained, with particular attention given to surviving masons tooling patterns on the stonework and sculptural expressions of the very finest work in the relief carving of the Caius Cibber panel. A cleaning regime was devised for the Portland stone to achieve an 85% level of clean yet avoid over-cleaning and damaging fragile original stone surfaces. Ancient incised graffiti have been preserved while modern felt-pen scrawling has been removed. The corroded surfaces of metalwork have been respected together with the wear patterns of thousands of visitors over hundreds of years. Old paintwork has been preserved and encapsulated in modern protective finishes, while old gilding has been overlaid with new protective gold leaf layers to resist the weathering of the future.

Reinforcing rather than rebuilding the structure

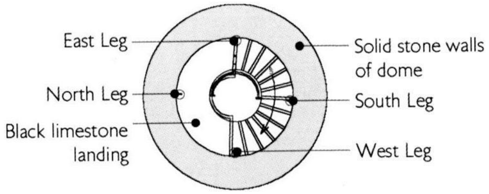
The flaming orb at the top of the Monument is a massive urn constructed from deep bands of sheet copper riveted together to form an urn, with a bowl at the top. The urn is decorated externally with copper garlands and the bowl with many twisted strips of copper, all fixed with rivets. The urn sits on a circular stone cornice above the neck of the stone dome on the circular drum. The Portland stone 'drum' above the viewing platform is a continuation of the stairwell shaft below, with solid walls containing a doorway out to the viewing platform (Fig. 6).

The copper flaming orb is fastened down to the stone mass of the dome and drum below by a structural wrought iron armature, the form of which is a circular ladder. The ladder gives access from the black limestone landing at the top of the drum, up into the copper bowl at the very top of the flaming orb. The circular iron rungs are bolted to four iron vertical legs, with bolted flanges riveted to the copperwork. When viewed from the high level scaffolding it could be seen that the structure above the drum, together with the flaming orb, was leaning over.

The four legs of the circular ladder continue down to the stone dome below, where they each curve outwards following the profile of the inside of the dome, to which they are fixed with bolted iron



Section through the Stone Dome and Flaming Orb, looking east



Plan at 64.55

Fig. 6
Section through the top of the Monument and plan at the top of the spiral staircase, showing the four legs of the structural iron armature.
© *Julian Harrap Architects*

flanges let into the stonework. The foot of each ladder leg rests on a step of the spiral staircase, therefore the legs are of uneven length and the longest leg had buckled under the load, pulling the whole armature to the south, as illustrated in Figure 7.

Two options were considered to prevent the armature continuing to lean over. The first, quickly discounted, was to disengage the armature and flaming orb from the stonework and lift off the whole orb by crane. The crushed stonework on the south side of the dome would then be repaired and rusting iron cramps cut out and replaced with stainless steel. The armature and flaming orb would then be craned back into position and the armature securely fixed to the stonework. This option was ruled out due to extensive disturbance to the historic fabric and the excessive cost. Aesthetically there was no good reason to straighten the flaming orb. The second option was to restrain the leaning flaming orb in its current position, making no attempt to remove or reduce the distortion that had developed during the life of the structure. The proposed solution was to stiffen the bottom portion of the armature by tying it to the masonry. The restraint design consists of four circular iron bands fixed at equal intervals to the interior of the stone dome, each bolted into the stonework and welded to the 17th-century wrought iron armature legs. A welded connection was proposed to fix the new pure iron bands to the original wrought iron, in order to avoid drilling into the historic ironwork and to produce a good looking, clean connection.

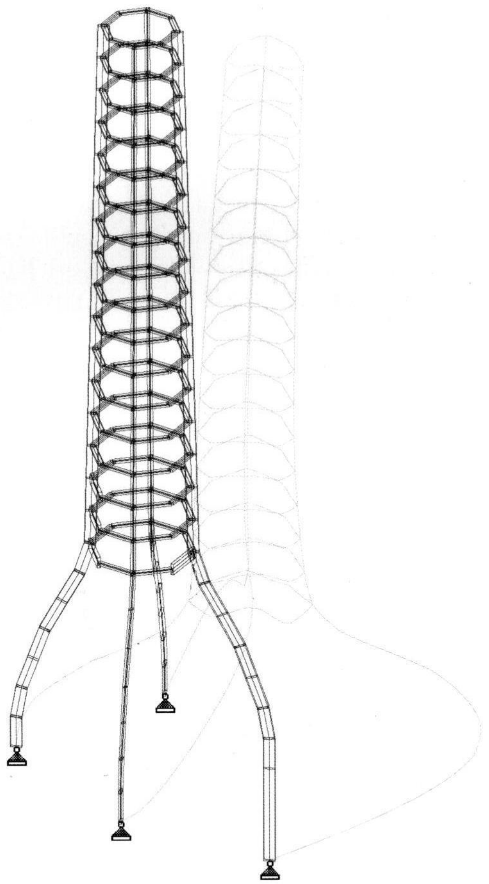


Fig. 7
Computer model of the iron armature of the Monument, illustrating distortion of the structure under load.
© *Hockley & Dawson Structural Engineers*

An architectural approach

In designing the repairs an architectural approach was taken rather than an archaeological one. A purely archaeological approach would give each change to a building an equal status: all colours, finishes, additions and neglect are retained as a record of change over time. Little account is taken of the appearance of the addition or how it affects the architectural composition. Modern felt pen graffitti would be retained alongside historic incised graffitti, new materials would be retained where they replaced the original, regardless of their appropriateness.

Fig. 8
The newly revealed black limestone floor of the viewing platform of the Monument, with the new curved stainless steel balustrade and lightweight cage above.
© *Sue Salton Photography February 2009*

The architectural approach assesses the original building in terms of fabric, construction, composition and historic interest. The significance of each alteration to the building is considered and a decision made as to whether to retain or edit the addition, or to restore the original fabric or method of construction. The architectural approach is generally compatible with the widely accepted conservation policy of selecting materials and construction methods to repair the historic fabric which are as close to the original as possible.

The viewing platform had been covered with asphalt for many years, concealing the original black limestone slabs beneath, which had been partially revealed during pre-contract opening up works. The asphalt was judged to be unsightly and an inappropriate material for the repair of a 17th-century building, so it was removed. Six huge slabs of black limestone were revealed, with local cracks and damage that had previously allowed rainwater to soak into the structure below. Truncated sections of former iron and bronze balustrade fixings remained in the limestone together with the original drainage channel, drain pipe and spitter.

Overlaying the defective paving with new black limestone slabs was considered, to ensure a waterproof finish, but rejected. Slabs of the original size were unlikely to be available, to lift them into position would be very difficult, and they would alter the profile of the viewing platform and conceal the archaeology. So repairing the historic slabs was the preferred option. The bedded metal remains were retained and polished to indicate changes to the balustrade, whilst cracks in the slabs were injected with epoxy resin and colour-matched to the black limestone (Fig. 8). The poorly serving drainage channels and outlet were cut deeper and wider into the stonework, to discharge by way of a replacement lead spitter pipe.

Another opportunity to replace inappropriate former repairs to the building revealed some alarming structural damage to the spiral staircase. The stone treads, worn down by centuries of use, had been pieced in with Belgian black marble inserts (Fig. 9,A). The opportunity was taken to replace these with inserts of black limestone, matching the original material, and to improve on the appearance of the previous angular-shaped

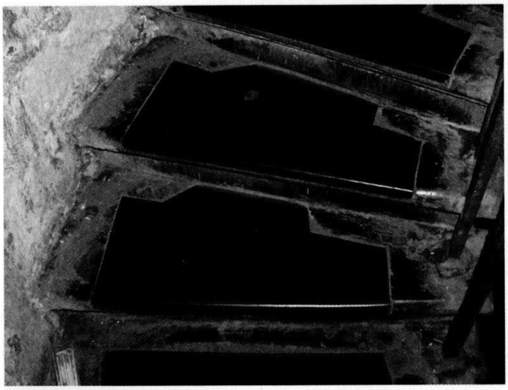


Fig. 9 A-B
The Monument.
A. Previous repairs to the black limestone steps used angular-shaped insets in Belgian black marble.
B. The previous deep excavation of the stair treads was revealed beneath the Belgian black inserts. Fischer epoxy resin was poured over reinforcing rods before new black limestone inserts were laid.
Photographs, Julian Harrap Architects

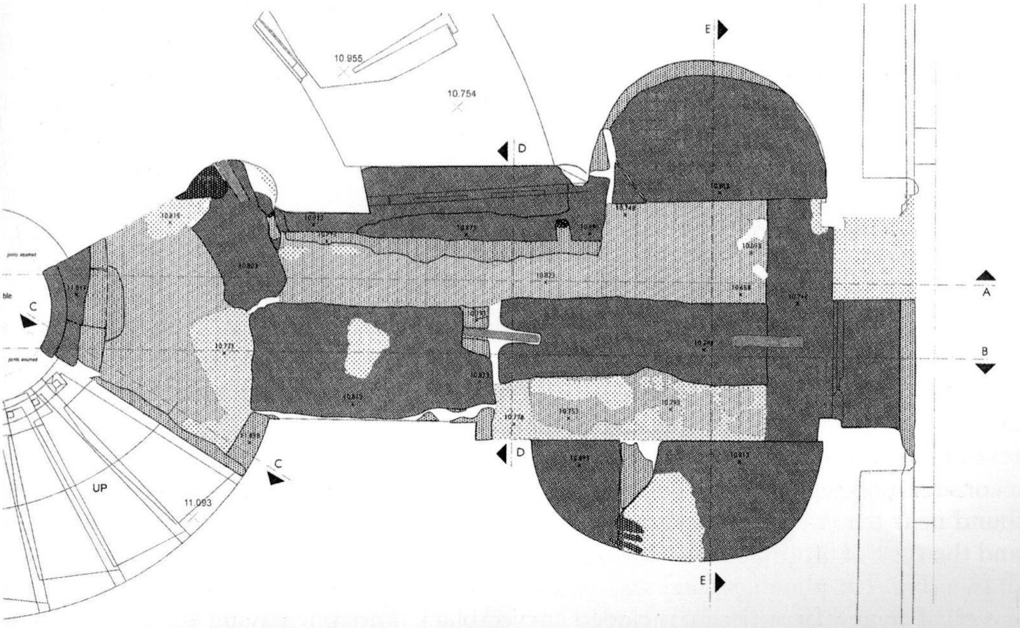


Fig. 10
Plan of the ground-floor entrance to the Monument recording the archaeology revealed following the lifting of the concrete floor slab. The dark grey represents stone slabs; the light grey represents sand and soil mixed with pebbles.
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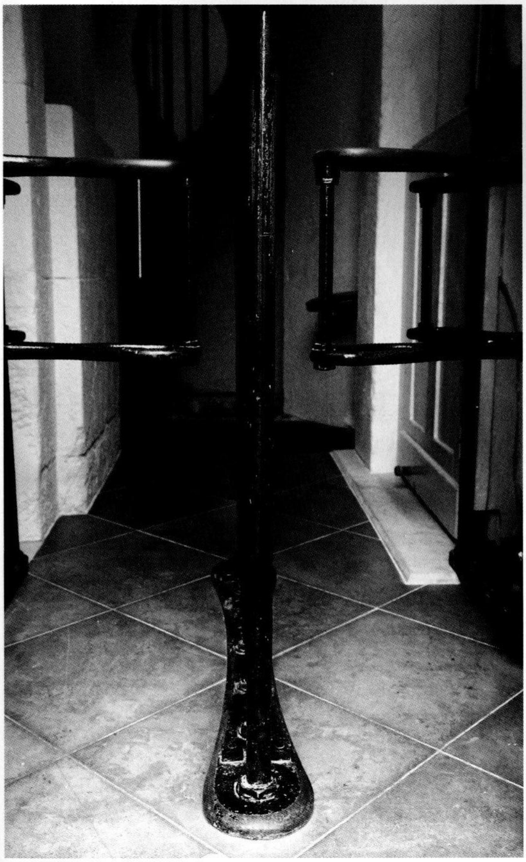

Fig. 11
View into the entrance of the Monument, showing the Victorian turnstiles on the new Purbeck freestone diamond patterned floor finish.
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insets with gently curved inserts reflecting the wear pattern on the treads. When lifting the Belgian black inserts, bedded on mortar dabs, the extent of former wear of the historic treads below was apparent. Hockley & Dawson, structural engineers, designed reinforcement for the treads using stainless steel rods, bedded in Fischer epoxy resin well bonded to the keyed surface (Figs 9,B). Black limestone inserts from the Pooil Vaaish quarry on the Isle of Man, believed to be the original source, were laid on top of the reinforced substrate. The new inserts were hand dressed to a lightly dished surface to soften their impact in the historic interior, an approach contrary to the philosophy of the Society for the Preservation of Ancient Buildings of ensuring that new repairs look new.

For the ground floor of the entrance lobby, the decision was again taken to restore (together with a little new design, where historic evidence was unclear), rather than retain the functional but inappropriate carpeted concrete floor slab. A thick concrete slab had been laid over the original stone floor raising the floor level, reducing the height of the first spiral step and increasing the height of the entrance step. Lifting the concrete revealed the archaeology of floor finishes beneath, the remains of which were beyond a conservation repair robust enough to receive thousands of visitors. Purbeck stone was found near the entrance door, but damage was extensive at the base of the spiral step and the type of original stone finish unclear. The archaeology revealed was measured, drawn (Fig. 10), photographed and overlaid with a thinner finish of stone slab on lime screed. The new floor design included curved black limestone paving at the base of the

Fig. 12
The Monument: The site agent holds in position a template of a missing part of a sculpted dragon's wing.
Photograph, Julian Harrap Architects

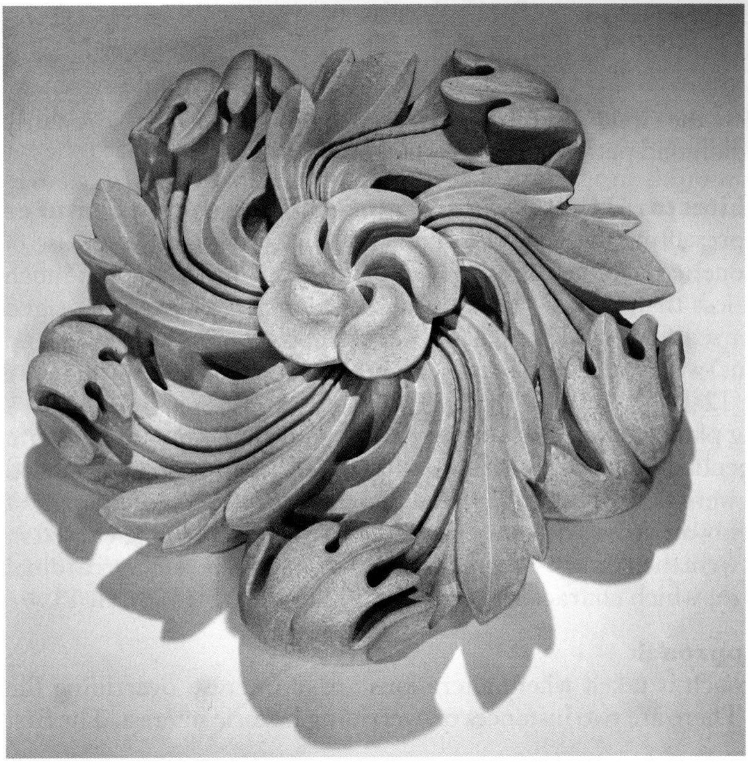

Fig. 13
The Monument: A sculptor completes the carving of one of the four new Portland stone paterae; the carvings are deeply undercut in order to be effectively viewed from a great distance.
© Sue Salton Photography, 2008

Fig. 14
The new carved stone patera with a swirling design for the south-west corner of the Monument, where the winds are strongest; the centre is removable to allow fixing.
© Sue Salton Photography 2008

Fig. 15
The Monument: One of the new stone paterae fixed in the original location on the underside of a corner of the viewing platform.
© *Sue Salton Photography, 2008*

black staircase to complete the circle and Purbeck freestone, now only available in fairly small slabs, set out in a diamond patterned in the entrance hall (Fig. 11).

Re-establishing Architectural Profiles and Principal Decorative Features

Four carved dragons representing the City of London sit at each corner of the base of the column, clearly silhouetted against the sky. Their profiles are dramatic but much damaged, as stonework less than 1 inch (25mm) thick had eroded or been damaged by the erection of timber scaffolding in the past. A decision was taken to re-carve and reinstate missing dragons' wings, ears, tails and tongues to re-establish the silhouette originally intended (Fig. 12).

Beneath the viewing platform are four new, re-carved stone paterae some 900mm (36 in.) in diameter suspended by stainless steel bolts. Wren's carved paterae detached themselves in 1882 and were never replaced, so the architect researched the design of similar decorative elements on Wren's St Paul's Cathedral, which were being carved in the late 1660s. Proposals were then drawn up for individual designs related to the cardinal winds expected in a storm, which characterise the English weather (Figs 13, 14, 15).

An Archaeological Approach

An archaeological approach is taken where alterations are of interest, overriding the architectural approach. There are two instances of overriding historic interest. The first relates to war damage. Wren's Monument and St Paul's Cathedral both survived the war, St Paul's becoming a symbol of Blitz survival. The Monument suffered slightly as bomb damage scarred the base and shrapnel pierced the copper urn notching several copper flames. The damage has not led to further deterioration and is therefore retained, unrepaired. The second example relates to the north inscription panel on the base of the column. It describes the destruction of the Great Fire and in the last line, added in 1681, blames Catholics for starting the fire: 'But Popish frenzy, which wrought such horrors, is not yet quenched'. The incised words were deleted in 1830 by crudely cutting out the incised lettering, leaving a damaged strip all along the bottom of the panel, which has been kept.

There are many other examples where later alterations have been retained and repaired, where they are of significant vintage, value or use. The cast iron railings and gate to the east side of the Monument were added in the 19th century. Previously black, these have been repainted a Portland stone colour to diminish their impact against the stone column. The Victorian cast iron turnstiles, added at the entrance to count and control visitors, now have an attractive patinated paint finish and are of interest (and use) in themselves (Fig. 11). The small arched recess where the attendant sits is enclosed with some historic joinery with a surface build-up of paint finishes, which has been carefully retained. The discovery of a stone piscina, presumably for blessing oneself after the safe ascent and descent of the shaft, has been but one of several interesting archaeological discoveries.

Reducing the Rate of Deterioration

Two interventions were designed to reduce the rate of deterioration of the historic fabric. New bespoke bronze casements were fixed into the existing rebates of the slot window openings to control the humidity levels within the column shaft. Also the flat stone top of the base of the column was not adequately shedding water, which led to saturation of the stonework. During the contract the stonework, enclosed in scaffolding, dried out and was painted with a stone-coloured, breathable polymer membrane, Belzona, for protection.

NEW DESIGN INITIATIVES

Some modern facilities are required at the Monument, principally for the safety of the visitors. The philosophy for new interventions is that they should be reversible and can be readily replaced, as their lifespan is likely to be shorter than the stonework of the column. New interventions should not damage the fabric of the building nor detract from the enjoyment of the heritage. They are to be of high quality design, workmanship and materials. The ambition is for visitors to enjoy the necessary interventions, together with the historic fabric.

Fig. 16
Historic sketch illustrating a former cage over the viewing platform at the Monument. Punch, *January-June 1850, cartoon no. 64*

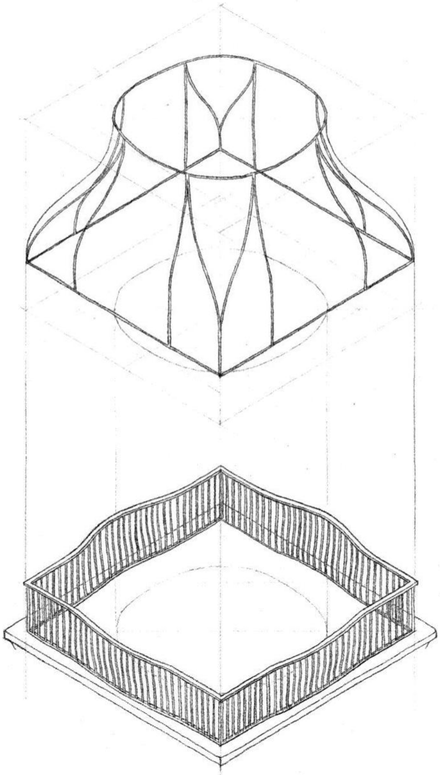

Fig. 17
The Monument: Initial hand-drawn design for the new balustrade and cage for the viewing platform.
© *Julian Harrap Architects*

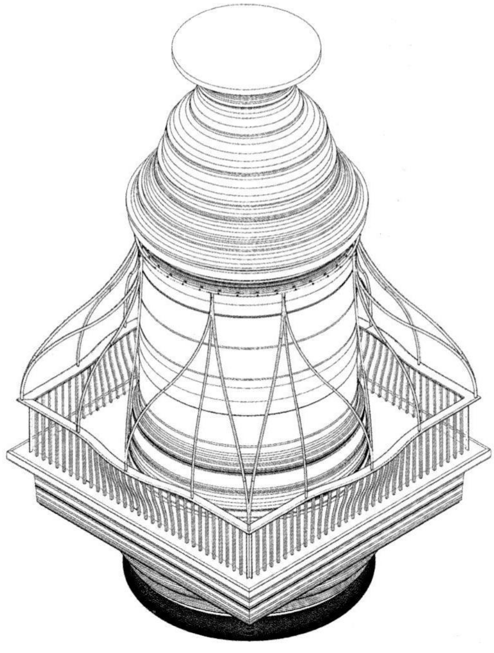

Fig. 18
Computer model of the top of the Monument and the new balustrade and cage, for fabrication purposes.
© *Littlehampton Welding Ltd*

Viewing Platform Cage and Balustrade

Early images of the Monument show an iron balustrade around the perimeter of the viewing gallery to reassure and restrain the visitors. Archives record six people having committed suicide by throwing themselves from the gallery between 1788 and 1842; in the latter year the building was temporarily shut and, to prevent further precipitations, the gallery was enclosed in an iron cage (Fig. 16).

The balustrade and cage were replaced in the 1950s with a basic steel bar enclosure, and the opportunity was presented to replace both in the 2007-2009 contract. Early design drawings and Roman precedents have informed the new balustrade design, of widely spaced square balusters, each appearing to be lead caulked into the stone platform. Only alternate balusters are actually structurally embedded to avoid inducing a crack along the edge of the black limestone. The intention for the cage above the heavy and reassuring balustrade was to create a lightweight birdcage hanging from the stone dome beneath the flaming orb (Fig. 17). The curved profiles of the slim structural members are cloaked

Fig. 19
The Monument: The new balustrade to the viewing platform with the lightweight cage above, made of curved stainless steel tubes and expanding mesh.
© Sue Salton Photography, February 2009

in fine stainless steel cable mesh, its diamond pattern distorting as it stretches over the bulbous lower frame and contracting at the slim neck beneath the dome. The curved form of the cage avoids reflecting blocks of light, whilst the mesh is almost invisible from afar and less obtrusive to the high level viewer than the former prison-like bars. The throwing of potentially lethal large objects, such as drink cans, has been prevented. To replace the former inelegant freestanding telescopes, new telescopes have been designed, integrated with the stainless steel handrail which is widened at the corners to receive them. The stainless steel tubes of the cage contain electric cables to the telescopes, lighting and discreet CCTV cameras surveying the viewing platform (Figs 18, 19).

INNOVATIONS, ART AND EXPERIMENTS

Panoramic Camera System

The client's brief called both for improvements to public access and for some interpretation of Robert Hooke's use of the Monument for scientific experiments, reputed to include a zenith telescope for observing the passage of one star.[2] In response to these requirements, and the desire for artistic input, Julian Harrap Architects commissioned Professor Christopher Meigh-Andrews, media artist, to design a panoramic camera system. A stills camera is mounted in a bespoke weatherproof housing beneath a conical lens, supported high above the urn of the flaming orb. The camera is programmed to take many frames per minute; the result appears as a 360° moving image of the breathtaking views from the top of the Monument, including sky and the tips of the gilded flames (Figs 20, 21). The artist has used data from a weather station above the camera, recording temperature, wind-speed and rainfall, to manipulate the camera images displayed on a dedicated website www.themonumentview.net. The images will in due course be displayed on a large screen in Monument Yard. Access to the views and the weather from the top of the Monument is thereby provided for the many who are unwilling or unable to climb the continuous flight of 311 spiral steps to experience both from the viewing platform.

Fireworks and Lasers

One purpose for which the Monument was originally designed was to serve as an elevated base from which fireworks were to be discharged. A written report given by Wren to the City Lands Committee on 27 July 1675 discusses the design for the proposed terminal of the column, describing the flaming orb as being of 'good appearance at distance, and because one may go up into it, and upon occasion use it for fireworks'.

The architects worked with fireworks company, The World Famous, to prepare designs to enable a pyrotechnics and flame display from the Monument on the occasion of celebration and commemoration. A fireworks and flame show has been designed to animate the architecture of the Monument, fired from twelve positions around the outside of the balustrade and from the twenty-two opening windows below the viewing platform. It starts with white and silver effects which illuminate the architecture, then moves into orange, yellow and red suggesting the Great Fire, and climaxes in gold sequences which create an image of a giant flame 61m high. Bespoke equipment has been designed to allow for safe rigging of the pyrotechnics and flames outside the Monument and balustrade structure.

A less expensive alternative is a laser display. The architects worked with LM Productions on its feasibility, whereby a horizontal laser beam display is projected centrally from all sides of the viewing platform. Four 16 amp exterior grade power points have been provided for laser projectors to be hired and brought to site for each display.

OVERVIEW

The approach of Julian Harrap Architects is to undertake works in the best long term interest of the building and to avoid detrimental works to the building in the short term interest of a particular client. A long term approach involves really understanding the

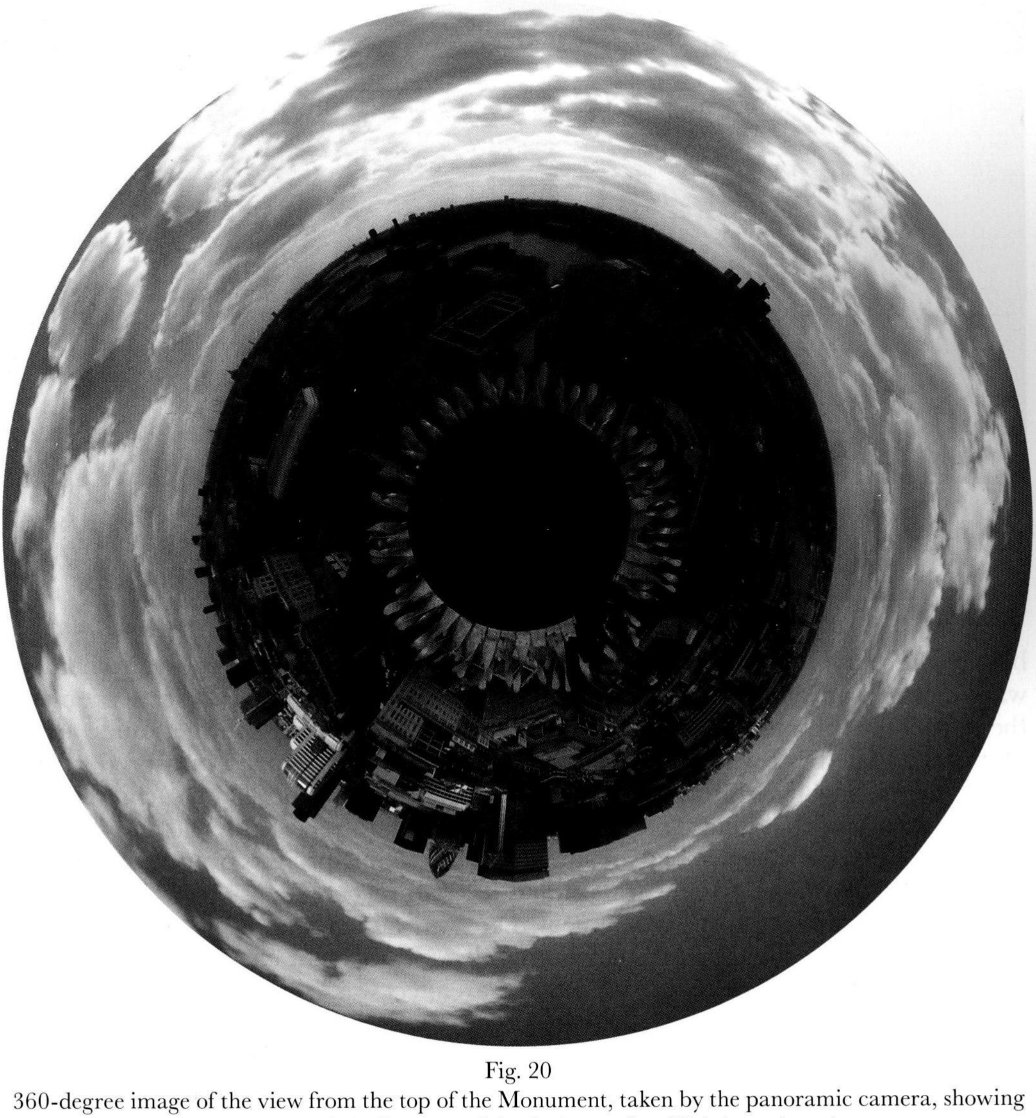

Fig. 20
360-degree image of the view from the top of the Monument, taken by the panoramic camera, showing the gilded flames of the flaming orb in the inner ring. This is a mirror image.
© *Professor Christopher Meigh-Andrews*

Fig. 21
The 360-degree image is 'unwrapped' to create a linear image of the view from the top of the Monument; the gilded flames are along the bottom. This is a true image.
© *Professor Christopher Meigh-Andrews*

building through research, surveys, site trials and tests. In this respect, the Monument was an exemplary project as we had seventeen years between our first inspection and the start of the contract to work methodically through all the pre-contract issues, access permitting. The brief was based on sound research and a detailed measured survey, which gave as much certainty on the scope of works and costs as can be achieved on a largely inaccessible building. The project was without the layers of bureaucracy which, in our experience, have been added to many historic building projects over the last twenty years, leading to more administration and a less direct relationship between client, architect and builder. At the Monument there was no external project management company involved: the City of London provided a competent client representative to manage the project on the client's behalf. The architect was lead consultant and worked closely with the principal contractor, who undertook works on site rather than having a purely management role. This resulted in a good and productive working relationship.

The practice remains involved with the Monument and has just been instructed by the City to prepare a conservation management plan for the future safeguarding and maintenance of the building.

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The principal contractor for the Monument Major Repair Contract was Cathedral Works Organisation who undertook the stonework cleaning, carving and repairs, and managed all the specialist sub-contractors. Gary Collings, site agent for CWO, managed the works with expertise and good humour. Littlehampton Welding Ltd made the ambitious design for the new balustrade and cage a reality.

NOTES

1 For more detail on the history of the Monument, see J. Allen 'The Monument to the Great Fire of London: an Investigation of the Verticality of the Monument and the Resecuring of the Flaming Orb', *Journal of Architectural Conservation*, Nov. 2009, 27-40.

2 See further L. Jardine, *On a Grander Scale: the Outstanding Career of Sir Christopher Wren*, (London, 2002).