Recent Archaeological Work and Research at St Paul's Cathedral

John Schofield

This article is a summary of archaeological work at St Paul's Cathedral, that is the present building of 1675–1711 by Christopher Wren. The cathedral is now 300 years old and has gone through several periods of change to its fabric and surroundings. During the 18th and 19th centuries St Paul's assumed more and more of the role of the nation's church, which had been enjoyed by its medieval predecessor. The most important 19th-century change, during the long Surveyorship of Francis Penrose, was an opening up of the access and surroundings so that St Paul's is now the iconic architectural centre of the City of London. From day to day, the cathedral poses management questions just like any other.

Around St Paul's in the City of London, there is now professional archaeological coverage of a high standard, but the amount of evidence left to record has declined in post-War years, since London must be one of the most excavated cities in the world (Fig 1). At the cathedral the years 1990–2011 saw a comprehensive reappraisal of the cathedral as whole, leading to a thorough repair and refurbishment programme by the Surveyor to the Fabric, Martin Stancliffe. Longstanding structural issues have been resolved, the external stonework repaired and cleaned, the interior comprehensively cleaned, various alterations made for the conduct of worship both on the main church floor and in the crypt, extensive facilities for visitors and staff provided in the crypt, and the churchyard rearranged on the south side. The facilities for management of the cathedral's archive were improved with the creation of permanent staff posts and newly-designed storage areas.

These required modifications to the fabric of the building and the ground of its surroundings; recording and subsequent reporting were financed by the Dean and Chapter. At the level of publication, this resolved into two volumes. A comprehensive report on the archaeology of the site from Roman times and the cathedral from its founding in AD 604 up to the Great Fire of London in 1666 was published in 2011 (Schofield 2011). The second volume, in preparation, will deal with the archaeology and main historical developments of the Wren building and its churchyard from 1675 to the present. From this latter work, three aspects of the archaeology of the Wren cathedral are reported on here: examples of archaeological recording of the present building; consideration of the work of 1852–97 by Francis Penrose, one of the most important Surveyors after Wren in terms of what he did to the building and its surroundings; and an archaeological commentary on some aspects of post-War planning of the area around St Paul's. But this short report also shows how recording at the cathedral must take account of the interweaving of the work of all the main Surveyors to the Fabric, from Wren to the present, on the fabric of the building.

Construction of the Wren building 1675–1711

Two recording exercises have concerned the upper part of the building in its original phase; an investigation of the roof space above the nave, and recording of the cleaning of decorative elements on the exterior.

Fig 1
St Paul's Cathedral from the east in 2007. The Wren building of 1675–1711 now sits on a large pedestal of Roman and later strata; most of the evidence for the Roman and later City, including the wider setting of the first cathedral in AD 604, has been removed. (Photo: John Chase)

The roofs

The main vaults of the four arms of the cathedral are of brick, arranged in saucer domes. A bricklayer's inscribed name and date – G Reeve May 13 1705 – in the nave roof space provides a date for the whole building, to match the copious documentary evidence (Fig 2). According to the building accounts, 'Geo. Reeve' (presumably George) was a bricklayer who worked on the adjacent nave saucer domes in 1704–5 (for this and the following see the accounts published by the Wren Society, specially created for documenting Wren's architectural works, 20 volumes issued in 1924–43 conventionally abbreviated 'WS'; references to Reeve are in WS XV, 113, 115).

The roofs of the cathedral were constructed as the work progressed. The choir was roofed in 1689–93, the transepts in stages in 1690–7, the aisles of the nave up to the library and Trophy Room in 1695, the west end, library and Trophy Room in 1701–6 and the nave in 1698–1706. Towards the end of the construction years, the amount of carpentry undertaken would naturally have increased as the roofs were built: in 1702 there were over 170 carpenters on site.

The trusses of the nave roof, probably one of the longest and largest surviving from Stuart Britain, were examined by a team from Museum of London Archaeology led by Damian Goodburn in 2013 (Figs 3–4) (Goodburn and Karim 2013). The nave roof, apart from an extension over the west portico, comprises 24 trusses in two groups. The eastern is of 13 trusses, where each truss has a tie beam averaging 14.08m (46ft 2½ in) long. West of this, the roof space is wider, over the larger western saucer dome of the nave. Here it was impossible to provide a larger tie beam, so the 11 further trusses are scarfed to produce a length of about 17.3m (56ft 7in).

Fig 2
Signature of G[eorge] Reeve, bricklayer, in a passage above and next to the saucer-domes of the nave, on which he was engaged; dated May 13, 1705. From the building accounts it appears that Reeve had been employed since the previous October, and continued to be until May 1706, so the significance of the date eludes us. (Photo: A Chopping, MOLA)

The tie beams in the eastern half appear to be the largest currently known oak timbers recorded in any historic English roof, demonstrating the prestige of the project. The longest are over 6ft longer than, and of a similar scantling to, the 14th-century Ely Cathedral octagon timbers which previously held this position. Bearing in mind the great length and comparative lack of taper of the longest tie beams it is surprising that Wren did not chose to use a coniferous wood alternative for these timbers from either northern Europe or North America.

Wren asked John Holles, 3rd Duke of Newcastle, for 50 large trees from his Welbeck estate in Lincolnshire. A '*1st parcell of shorter lengths timber*' was sent in 1695. In 1696 ten trees from the estate were brought from Stockwith (presumably West Stockwith, on the banks of the Trent) to Hull, and shipped to London, with ten more pieces from York. The first ten, presumably some of the '*Great Beames*', totalled just over 20 tons in weight, so would have averaged two tons each; the ten from York were evidently half the size, as they totalled 10 tons. In 1696 the carpenter John Longland was sent again to supervise the preparation of the timber; in 1698 he was paid for not only for working on the first ten long trees, but for getting this exceptionally large load to the Trent. This involved land carriage requiring a double team of cattle for 20 days to Bawtry (including payment for taking the load through a yard to avoid a corner in the road between Welbeck and Bawtry), and water carriage from Bawtry to Stockwith, presumably on the small river Idle.

Various forms of numbering, most commonly in versions of Roman numerals, were used to label particular joints in a timber frame. We were able to find two different ways the master carpenters distinguished these to avoid attempts at erroneous trial fitting on site. One type involved versions of Roman numerals cut with 2 inch chisels including a small additional cut or 'tag' on one side of the truss. The other form found involved the use of a 2in chisel mark on one side of the truss and a 1in or 1¼in on the other side. This patterning appears to reflect the supervision of the two different master carpenters working on the roof, John Longland and Richard Jenings. Longland was paid for erecting 11 of the roof trusses of the nave roof in 1704 and as there are 11 trusses marked using the 2in chisel and tag system, it seems likely that those were made under his supervision. These trusses are largely those forming the eastern half of the nave; the accounts confirm that the roof was constructed, like the brick sauce-domes beneath it, from east to west. The other trusses using a different marking system are therefore likely to have been constructed and assembled under the supervision of Jenings.

The trusses were reinforced with wrought iron straps and screw-threaded bolts. The use of the new screw bolts, in comparison to the previous technology of forelock bolts, would have made adjustment and tightening of the bolts easier following any shrinkage in the timbers once assembled. The first screw-threaded bolts at St Paul's are seen in the roofs of the side aisles of the nave, from the middle of the 1690s.

The king-post truss, assisted by metal straps and bolts, was a feature of 16th-century Italian buildings, and Wren owned an Italian book in which the truss was described from a mechanical point of view, *In Mechanica Problematica Exercitationes* by Bernadino Baldi (1621). This form of truss was used by Inigo Jones in roofs at the Banqueting House, Whitehall (1619–22), Queen's Chapel, St James's Palace (1623–5), Stoke Bruerne (Northants) (*c*1630) and St Paul's Covent Garden (1633–42) (Yeomans 1992, 30–43). Wren used it on buildings from the start of his career, such as at a residential block at Trinity College Oxford, in a drawing of 1665 (Geraghty 2007, 25, fig 12). His intentions for the nave at St Paul's in the same year included straps in the roof trusses, though not perceptibly bolts.

Fig 3
The roof over the nave, looking east. The nearest truss is one of the longer ones over the larger western saucer dome, so the tiebeam had to be scarfed, with two bolts through the scarf (left). This form of king-post truss came from Italy via Jones, and was widely used in the 18th century in colonial America. (Photo: A Chopping, MOLA)

The introduction and early use of screw-threaded bolts in Britain therefore remain to be elucidated, though their occurrence in large number at St Paul's, where they survive, can be dated to the 1690s. Screw-threaded bolts did not immediately take over from forelock bolts but were an alternative. Forelock bolts were used in other roofs over major churches, such as at Winchester in 1699 and at Ely in 1768 (Hewett 1985, 71, 76; his assertion (1985, 66) that a roof at Lichfield Cathedral with forelock bolts is from a reroofing of 1661–6 is doubted by Yeomans (1992, 6) on the grounds that existing records fail to support this and the structure looks later). They were also the preferred method of bolting timbers together in the roofs at Blenheim Palace in the second decade of the 18th century. Screw-threaded bolts were used in the high roof of the choir at Durham Cathedral in a restoration attributed (though perhaps not securely) to the architect James Clement who died in 1690, and in large church roofs throughout the 19th century (Hewett 1985, 70, 80–1).

External decorative elements

A programme of external works at St Paul's began in 1996 with repairs to the peristyle of the dome. Cleaning of the exterior of the cathedral walls and associated repairs took place in stages between 2003 and 2011. Archaeological recording by photography, by Andy Chopping of Museum of London Archaeology,

Fig 4
The north side of the nave roof, looking west. Below, one of the brick saucer domes of the nave. Each kingpost was strapped to the tiebeam, bolted three times with screw-threaded bolts. (Photo: A Chopping, MOLA)

included swags and cherubs' heads above the windows on the south nave and north choir bays; most of the panels below the windows of the north transept and the north nave, which are carved by Grinling Gibbons; and the arms of William III in the pediment of the north transept, also by Gibbons.

Only one feature is reported here, a question for which the author would appreciate answers. Several of the cherubim above the main windows have square stone inserts in their heads (Fig 5). This was evident when the sculptures were dirty but is far less visible now after cleaning, especially as it is in the top of the head and therefore not visible from ground level below. The purpose of this cut in the cherubs' heads is not clear, but there is a late reference (of 1710) in the accounts to readjustment of carving above the windows (WS XV, 188–90), and it may be that there had been difficulty with their original fitting. It is a feature of several of the cherubim, especially on the north side of the choir.

Reputation and repair in the 18th century

St Paul's quickly became the most talked about and illustrated English ecclesiastical building in the 18th century. From the moment it was finished, the building also assumed or was given new roles, religious and secular. Because of its size and centrality, the cathedral was a convenient and suitable place for large gatherings of clergy from all over England. From about 1720, maps were produced which had St Paul's at the centre

Fig 5
A cherub carving above one of the windows of the choir, before cleaning. In several cases the head has this odd feature, as though part of the stone has been replaced. Or is this to do with the method of attachment of the heavy piece to the wall? (Photo: Author)

of London, with circles centred on it to indicate distances on the map. From 1676 to the 1790s, it was taken to mark the meridian, until this status was given to Greenwich. As a landmark in a predominantly flat city, St Paul's was the tallest building in London for generations, indeed until the Post Office Tower of 1964. The bell of its clock could be heard, on occasion, up to 20 miles away. In 1848 soldiers constructed a crow's nest of timber on top of the ball and cross on the dome, from which they took bearings in connection with the triangulation of the area for the first Ordnance Survey maps of London.

A recurring theme in the maintenance of the building during the 18th century was concern about settlement. Robert Mylne became Surveyor in 1766, and in 1781–2 carried out measures to stabilise the dome and south transept, by inserting iron rods or ties

Fig 6
Graffiti of 1776 incised in the marble jamb of the great west door, recorded in 2003 (Photo: A Chopping, MOLA)

at triforium level across the latter. Two iron discs or paterae were thereafter visible in the face of the south transept, for instance in the 1890s (see Fig 9), but were removed around 2004.

As well as the signature of George Reeve, there are many initials and occasionally names carved, with various degrees of care, in the fabric at all levels. During the cleaning of the west front in 2003–4, photography recorded a representative selection of the historic graffiti to be seen around the west doors. Naturally these were at a height where they could have been incised by people either standing or perhaps on small temporary supports such as boxes; they were nowhere higher than 2.3m from the floor. One group is shown here (Fig 6). The graffiti were inscribed (and some of them must have taken hours) between 1759 and the 1790s, from their dates. Besides those shown here, there are many more which are less legible. They were presumably left by visitors to the lower portico around the great west door. None of the legible surnames has so far been traced in contemporary wills.

During the late 18th century, St Paul's was sometimes used for state occasions; a turning-point may have been the service of thanksgiving for the restoration to health of George III in 1789 (which figures at the end of the 1994 film *The madness of King George*). The cathedral held out against being used as a mausoleum of national heroes for most of the 18th century. The

introduction of commemorative tablets and effigies onto the church floor began in 1791–6 with two secular monuments to John Howard, prison reformer and philanthropist, and to Samuel Johnson, writer and lexicographer, to be followed by two others by 1813. The many other monuments which adorn the crossing and the transepts, both statuary and wall panels, were largely introduced in the years that followed. They were mostly of heroes who fell in the war with France from 1793, and have been called the Peninsular School of monuments (Bowdler and Saunders 2004). Thus, by the time of Nelson, St Paul's was an appropriate place for his burial.

Early photographs of these monuments a few decades later are useful in that they show the extremely dirty nature of the internal walls by the end of the 19th century. The dirt and soot on the fabric, both internal and external, had been a source of comment for decades. One pamphleteer of 1868 spoke of the filth on monuments:

> *'converting classic groups into piebald monstrosities… black angels are conveying Ethiopian heroes to their long rest. Smutty-faced Britannias vie with much-besoiled Glories and Fames in doing honour to English worthies to whom soap and a scrubbing-brush are a first necessity'* (Sinclair 1909, 308).

In this grimy, obscurely lit and often freezing cold pantheon, two state funerals took place at the cathedral in the 19th century, of Admiral Horatio Nelson in 1806 and the Duke of Wellington in 1852. Their obsequies shared several characteristics. Both took place beneath the dome, with an attempt at spectacular funebrial lighting; and both services included the slow disappearance of the bier and coffin into the crypt beneath. Mylne cut a hole in the middle of the dome pavement for this purpose for Nelson's funeral.

The work of Francis Penrose

From 1852 to 1897, the Surveyor to the Fabric was Francis Penrose. In terms of changes to the cathedral building and its surroundings, he is the most important Surveyor to follow Wren. Inside the building, he removed the choir screen and divided the organ; moved the choir stalls; stripped the interior of its dirtied paintwork; inserted heating and lighting; and changed the central and eastern parts of the crypt into monumental and worship spaces. Outside, he radically changed the Wren railings by lowering them and removing the section of railings round the west end; landscaped all the churchyard around the building, by bringing many gravestones from the north-east churchyard into the crypt, afterwards installing a fountain in that part of the churchyard; and inserted a new gate to Cheapside. Hardly any part of the cathedral or its immediate setting was left untouched by Penrose; only the roof spaces and the western part of the crypt remained in their 18th-century form. Here, only some of his main projects will be mentioned in any detail.

Fig 7
The west end about 1890. The Wren railings have been removed from the atrium and have been pulled back to the sides of the building. The effect of opening the western approach to the cathedral must have been startling. On the left, a cabstand, which survives, moved slightly, today. (Photo: Guildhall Library)

In the 1870s, Penrose rebuilt or altered all three entrance ways to the cathedral: the steps outside the west end and the north and the south porticos at the transepts. At the transepts, he attempted to preserve or imitate the original Wren work as much as possible. But at the west end, it was different. By 1880, the west end of St Paul's had been opened to view and access from Ludgate Hill (Fig 7). St Paul's was always accessible

from Ludgate Hill, but with the removal of the railings, a larger open space at the top of Ludgate Hill (the present one) was created.

The railings at the west end were removed, to be replaced by the present Shap stone bollards which were set back behind the former line. Penrose also designed the form of the bollards, and a removable iron fence in sections to hang between them. On 8 January 1874 the removed railings were sold by public auction. One section of railings was bought by JG Harper, a Canadian, and set up in front of the prominent tomb of himself and his wife in High Park, Toronto (his house, now a public park), where it still stands, straightened out.

The present design of the west steps with 'squared' lower side flights by Penrose reproduces what he thought to have been Wren's original design. As built by Wren, the lower flight had flared, curving sides. In 1872 Penrose rebuilt and relaid the steps, changing the design of the lower flight to the present squared form. By the 1990s the west steps were in need of relaying, and handrails suitable for better access were required. The steps were taken up and relaid, with occasional repairs. At both ends, the base of the original flared sides could be seen outside the line of the Penrose rebuilding (Fig 8).

The many periods of construction and repair since 1675 are shown by recent work at the south portico. In September 1677 Joshua Marshall, mason, was paid for making the foundation of the south portico. The portico itself was built in 1682–3. It was paved in 1697–8 with 'Red Denmk polished', 'Swede stone' and 'Irish Black Marble step.' Also specified was a special mortar called 'tarris' or 'trass'. This was made with ground tufa from Liège, which was durable in water, and thus water-proof. Wren experimented with it, but why he should think it necessary here, in bedding steps on an underlying brick and stone structure, is not clear.

In 1875–6 Penrose replaced the curving steps of both north and south porticos with black Irish marble (not yet provenanced), including the best he could retrieve from the original steps of both (Fig 9). At the south portico, all the marble steps were replaced in 2007, and a small archaeological investigation was made of the underlying layers of mortar. Three layers were identified as probably being from the Wren construction, and they were sampled by Alan Vince, especially with regard to the geological origins of inclusions in them. In particular, he was asked if the mortar samples provided any evidence of use of volcanic ash, that is 'trass'.

Fig 8
The north end of the steps at the west end, during relaying in 2003–4. The line of the original flared side of the lower section of the stair (left) survived beneath the rebuilding by Penrose. (Photo: A Chopping, MOLA)

Vince concluded that the lowest of the three layers was made from lime mortar mixed with a local, Thames valley, quartz sand and that the sample has been contaminated after burial both with calcium phosphate and local sediment. The intermediate mortar was another lime mortar, containing a higher proportion of quartz sand than the raft. The sand is, however, probably of local origin. Sparse chips of Irish Black Marble were present, indicating that the steps were on site and being prepared when this layer was laid down. The mortar nearest the step was not a lime mortar but a hydraulic cement. The resulting compound would set under water and was resistant to sulphate corrosion. The materials used in this case were volcanic tuff, crushed flint and a small admixture of Thames valley sand.

The exact nature of the volcanic ash used is not clear. Several of the ash fragments are rounded, and the lack of well-rounded grains is partly due to the crystalline structure of most of the fragments, which are

more likely to fragment than erode. There are also no very sharp angled fragments which would be present if the material had been milled. Most likely, the material came from a detrital deposit. The lack of alteration to the volcanic glass indicates a Tertiary or recent date. These characteristics limit the potential sources in the old world to the Rhineland, Iceland, southern Italy and Greece. A source in the Rhineland is likely (Vince 2007). Thus the inclusion of trass in the mortar bedding of the south portico steps can be confirmed.

From the finishing of the cathedral in 1711 up to the late 19th century, the churchyard around the east end of the building was a closed, reserved space for burial by the two parishes which between them occupy the cathedral close, that is St Faith (to the north) and St Gregory (to the south). The opening up of this space at the east end, into something approaching its present modern form, is Penrose's second legacy concerning the exterior.

In 1879 the Cathedral agreed with the Corporation of London that the latter should take over management of the churchyard. Some of the 18th-century table tombs have been retained up to the present, but the majority of the ledgers were moved. About 40 were relocated in the north aisle of the choir crypt, which was always part of the parish of St Faith's. The Goad Fire Insurance map of 1886 (Fig 10) shows the landscape of paths. In the cleared area of churchyard a fountain designed by Penrose and Sir Horace Jones was placed in 1880 (whose other work as City Architect included Tower Bridge and the three markets of the City at Billingsgate, Smithfield and Leadenhall); this was on the site of the present column erected only 30 years later, in 1910. Penrose inserted a new gate to Cheapside to the north-east, that is, the present one, and thus opened a large new recreational space to the secular City and its workers. At both ends of its site, the cathedral had been made more accessible.

The 20th century

There is also an archaeology of St Paul's of the first half of the 20th century, and its changing surroundings since World War II are relevant to how it is perceived today. During World War I, searchlights were placed around the cathedral, and in 1915 young soldiers practised signalling from the Golden Gallery. The cathedral was not hit by enemy action although, on 30 September 1917, it was struck *'by one of our own shells, which landed on the cornice of the south-east corner of the Cathedral'* (Matthews and Atkins 1957, 288–9). Mervyn Macartney, who had been instrumental in establishing the first St Paul's Watch of firewatchers in 1915, had inserted water tanks in the upper part of the building before the War, and an undated plan (in the cathedral archive) at triforium level, later annotated but apparently of about 1916, details hoses and tanks in the triforium. Several of the numbered places for hoses are still present. There is also one large tank surviving, in the Plumber's Aisle (the north choir aisle triforium), where there has been no development since that time. This is shown on the plan in outline, and therefore must date from just before or during World War I.

Fig 9
The south portico about 1890. This shows some features no longer surviving. The circular paterae forming part of Mylne's bracing repairs have been removed. All the Victorian glass hinted at here was blown out by bombs in World War II. Deterioration of the statues was causing concern by 1911, and the standing ones were patched up. The seated ones at the corners were replaced, not without controversy, in 1923 by the sculptor Henry Poole. The incense pots at the gateways were replaced by replicas in the 1970s. The portico steps, shown here after relaying by Penrose in 1875, were replaced in 2007. (Photo from Birch 1896)

Fig 10
The Goad Fire Insurance Map of 1886 of the cathedral and its surroundings. This shows the short-lived public fountain of 1880 in the newly-landscaped north-east churchyard, approached from the new gate to Cheapside (top right). The fountain would be replaced by the present Doric column celebrating St Paul, by Sir Reginald Blomfield, in 1910. (Guildhall Library)

Since the opening years of the 20th century, there had been concern about the building's structural stability (described in Stancliffe 2004). In 1925–9 there was much concern and major repairs to correct perceived subsidence, especially in the piers below the dome. In addition to grouting on a large scale, the measures included a radial arrangement of steel braces within the upper fabric, which are still partly to be encountered as obstructions to personal movement in the passages today, though not in the public areas (Fig 11).

In 1940–1, large areas of the City north and east of the cathedral were destroyed by aerial bombing. Several large bombs fell nearby, including one immediately outside the south-west tower which, unexploded, had to be dug out of the ground. Two bombs hit the roof of the cathedral and caused serious damage. The first, on 10 October 1940, hit the choir roof and exploded against the top of the choir vault. It unsettled the entire choir roof and showered masonry down on to the altar and its baldacchino; the lead covering of the roof *'billowed like the waves of the sea'* (Briggs 1957, 358). The second, on 17 April 1941, hit the north transept roof, went through and blew a large hole in the floor of the transept, including the crypt vault beneath. It destroyed the inner porch of the north transept, and Mylne's inscription commemorating Wren (after the War, the Dean and Chapter replaced it with the current inscription let into a circle of stone below the dome). The east wall of the transept was blown up to 8in out of the vertical, and some of the external ashlar dislodged. Apart from these two bombs, the cathedral survived the War with only scratches from shrapnel (from bombs near the cathedral; still showing on the apse and the south transept) and having the majority of its windows blown out, mostly by the explosion of 1941.

Standing remarkably intact in the middle of a large devastated area, St Paul's became a symbol of national survival through the War, to add to its already

Fig 11
Extract from drawing showing the reinforcement scheme between the inner and outer drums by means of ties and bars, 13 February 1928. The inside of the drum is to the left; the Whispering Gallery (minus its railing) is the ledge above the letter D. The line of one of the ties is shown passing diagonally through the fabric behind the Gallery. (SPFA SPCAA/D/14/11/2)

considerable stock of symbolic roles. Attitudes to the surrounding townscape were far less sympathetic. In the immediate post-War years people looked ahead, not back. The buildings destroyed in the area east of St Paul's were almost all less than a hundred years old, and the Blitz, like the Great Fire, was regarded in some quarters as a cleansing mechanism which would enable up-to-date office accommodation to be constructed in quantity. During and after the War there were several schemes for rebuilding the City of London after war damage. The one most relevant to the cathedral was a report called *The precincts of St Paul's*, by William Holford, presented to the Corporation of London in March 1956. The main objective was to improve the setting of the cathedral, ensure its practical future and contribute to an improved flow of traffic. Overall, Holford's scheme had more freedom in its planning than Wren had after the Great Fire; indeed, one has to go back to the expansion of the precinct under the bishops of the early 12th century to find a parallel in magnitude of scope. Though some aspects were changed during the lengthy discussions, we can see parts which did come to fruition: the Paternoster development on the north side and the concomitant movement of the south end of Ave Maria Lane to join Ludgate Hill a little to the east of its medieval junction. Similar new buildings, a new alignment for Creed Lane and a south-east garden including a large jet of water (Fig 12) were proposed; every stretch of the original line of Wren railings would have been removed. South of the cathedral, the Blitz had cleared blocks of buildings and opened up the south aspect of the building, which was widely welcomed. These areas became managed open space.

Holford proposed that Temple Bar was to be brought back and rebuilt, not in Fleet Street where it had been historically, but adjacent to the north side of the cathedral, in line with the west front. Holford's scheme, presented in 1956, was given its final form in 1961. This is the date of construction of the Paternoster Square development, which Pevsner hailed as an *'outstandingly well conceived precinct, the architecture of the buildings … sensible and unobtrusive, ie not competing with the cathedral.'* Although the Paternoster development has now been demolished, Temple Bar was brought back and erected on the west side of the Chapter House in 2004, to the north of Holford's proposed site.

This brief review passes over the years from 1950 to 2000 as regards the cathedral's surroundings; they are described in the cathedral history of 2004 (Bradley 2004). We conclude with mention of landscaping of the south-west churchyard by Martin Stanclife in 2004–7. Access for disabled people was provided at the door in the corner of the south transept and the nave, by replacing a lift placed within the core of the Wren stair which gives access to the Whispering Gallery and other higher levels. The ground outside was graded to the approved gradient. Next to this approach, the site of the medieval chapter house and most of its surrounding cloister, where it had not been clipped by the foundations of the Wren nave, were laid out in new stone, with correct facsimile mouldings (Fig 13). This works very well as an addition to the small number of open spaces with grass in the City of London.

Fig 12
One of the proposals for the cathedral and its setting by William Holford in 1956. At A, north of the cathedral, the genesis of the 1961 Paternoster Square blocks can be seen. South-east of the cathedral there would have been a spouting jet of water. All the Wren railings have vanished. The only traces of the medieval precinct here are the line of Carter Lane, its southern boundary, to the south; and the stub of a Saxon and medieval street next to St Augustine Watling Street on the right.

Conclusions

By a combination of archaeological recording and study of the rich documentary evidence, especially the building accounts, it is possible to begin a detailed study firstly of the disappearance of the medieval cathedral and its surrounding buildings, and secondly of the appearance in the brief space of 35 years of Wren's masterpiece in its own surroundings. This short survey has only been of some aspects of the archaeology of Wren's cathedral. There is also much to report on the character of the foundations and walls, the use of stone, brick and tile, the attitude taken to the remains of the pre-Fire cathedral both above and below ground, and details of the innovative constructions such as the Geometric Stair in the south-west tower.

Though the work of several of the Surveyors who succeeded Wren was important for keeping the cathedral standing up and in good condition, the work of Francis Penrose from 1852 to 1897 was one of transformation for the cathedral. When he started in the 1850s, the cathedral was surrounded by a high fence on all sides, with no gate to Cheapside, at the north-east corner, and the only use of the space within the railings was for burials, which were stopped in 1861. By the end of his time, the west front had been made far more accessible by removal of the railings there; the access to north and south porticoes had been improved by repairs; a gate inserted at the corner with Cheapside; and most importantly, the north-east churchyard turned into a public space with a fountain jointly designed by the City Architect, Horace Jones. All the churchyard spaces around the building had been landscaped by Penrose. Inside the cathedral, his most important work was removing the choir screen and the organ. This was part of an opening-up of the interior, driven by liturgical requirements (the nave did not have a pulpit until Penrose designed and inserted one in the 1860s). Outside, he made the cathedral more accessible so it could play more of a part in secular life

John Schofield is Cathedral Archaeologist for St Paul's. In 2011 he published St Paul's Cathedral before Wren, *an account of the cathedral and its churchyard from Roman times up to the Great Fire of London in 1666. A subsequent volume,* on The Archaeology of St Paul's Cathedral, *about the Wren building, is in preparation.*

Fig 13
The landscaping of the south-west churchyard by Martin Stancliffe, 2003–7. This was prompted by a need for proper disabled access to the cathedral, which is now supplied by an enlarged lift approached by a ramp along the side of the south transept. The adjacent site of the medieval chapter house and its cloister, which became Wren's site office from 1672 to about 1710, was laid out in facsimile stone, with replica mouldings, just above the surviving and reburied medieval remains. In the foreground, a plan in stone by Richard Kindersley shows the plans of the two superimposed cathedrals. (A Chopping, MOLA)

at the local and national level. During the 20th century the miraculous survival of St Paul's in World War II further enhanced its reputation as the nation's church. In comparison to most other English cathedrals, St Paul's is an open part of the urban fabric of the City of London, and its most important monument.

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