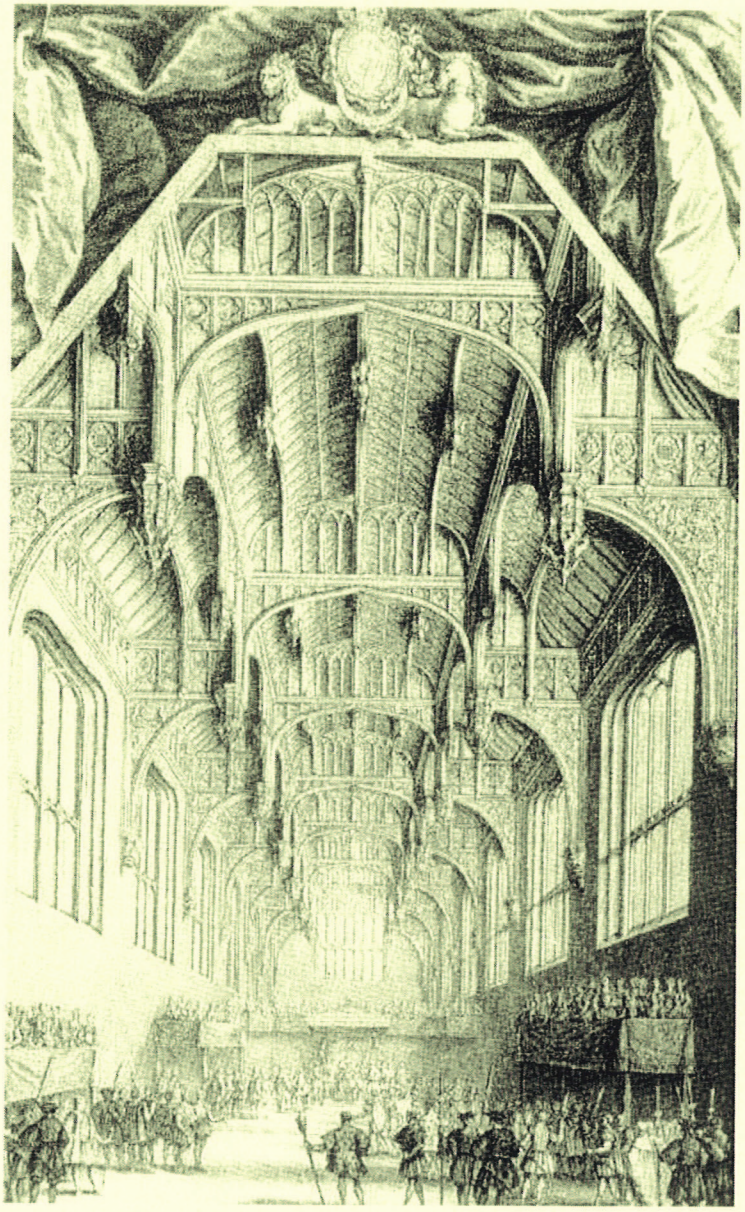
HISTORIC ROYAL PALACES

HAMPTON COURT PALACE

GREAT HALL ROOF

BUILDING RECORDING AND INVESTIGATION



OXFORD ARCHAEOLOGICAL UNIT
MAY 2000

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HAMPTON COURT PALACE
GREAT HALL ROOF

BUILDING RECORDING AND INVESTIGATION

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Summary

The hammer-beam roof within the Great Hall is one of the most celebrated features of Hampton Court. A project to renovate the roof□s covering allowed the archaeological survey and recording of a small area of the roof structure with the specific objective of locating evidence of a former louvre, known to have existed in the late seventeenth century (???), which allowed the release of smoke from a central fireplace within the hall. Evidence relating to the former louvre was identified and recorded including a secondary ridge piece which was inserted when the louvre was filled and mortices within the face of an existing truss which would have supported the louvre structure.

1 INTRODUCTION

1.1 Background

1.1.1 The Oxford Archaeological Unit (OAU) was commissioned by the Historic Royal Palaces Agency to undertake a programme of building investigation and recording during renovation works on the Great Hall roof at Hampton Court Palace (NGR:). The renovation consisted of the installation of smoke sensors within the roof space and the insertion of a canvas layer coated in lime between the inner oak boards and the outer lead surface. This lime-coated alkaline layer is designed to combat the acid in the lead from corroding the oak boards and the work allowed some limited visual access into the roof space.

1.2 Aims and objectives

1.2.1 The overall aim of the project was to utilise the opportunity offered by the renovation of the roof to increase knowledge of the roof's form and structure. A more specific objective of the exercise was to identify and record evidence of the roof's former louvre which allowed the release of smoke from the central fireplace within the Great Hall and which is known to have existing from two contemporary illustrations.

1.2.2 The two illustrations show that the louvre was an upstanding structure which projected above the Great Hall roof line but they are unable to provide detailed information about the louvre's form or location. The investigation was therefore intended to confirm within which bay the louvre was located, whether it was hexagonal or octagonal in plan and to provide further detail of the structure's construction and form. Thus the investigation work was targeted at the areas considered most likely to have supported the structure.

1.2.3 Another specific objective was to record carpenter's marks revealed to allow their comparison with those in other parts of the Palace.

1.3 Methodology

1.3.1 Following the removal of the lead covering a limited number of oak boards were lifted from selected points on the upper section of roof to determine which areas should be opened further to provide the most useful information on the roof below. The areas initially opened, which were not exposed further, were on the southern upper slope of the mansard roof. Measured from the eastern edge of the roof the areas were between 1.8 m and 2.2 m, between 7.3 m and 7.6 m, between 11.76 m and 12.15 m, and between 16.35 and 16.83. A single board was also opened on the northern upper slope between 10.15 and 10.25 m from the east.

1.3.2 The area containing the clearest evidence of the louvre, either side of Truss 4 (from the east) was then opened further to allow the measured drawing of each face of the truss, to show the contrasting features to either side. The enlarged opening was between 13.87 m and 15.10 m (from the east) on the southern slope and between 14.15 m and 14.55 m on the northern slope. Each face of the truss was drawn in elevation using hand survey techniques at a scale of 1:10, together with further details at 1:1, on polyester drafting film. Descriptive notes and sketches were also taken.

1.3.3 The recording work was undertaken on 16 and 17 April 1998.

2 HISTORICAL BACKGROUND

2.1 Works on the Great Hall Roof

2.1.1 *The original build*

The rebuilding of Wolsey's hall by Henry VIII is well documented.[1] The old hall roof began to be dismantled at the end of 1530; carpenters were paid for making a scaffold 'to take downe the Rouff of the olde Hall', to tilers for taking down and sorting the tiles of the old Hall, and carpenters for assisting in taking down the old Hall and 'the timber of the Rouff of the same'. After this the scaffold was removed, and the foundations of the new Hall were begun, including 6400 paving tiles. [NB ash for 'hooke pens' and 6 bokketts for 3 doors???].

Work continued in Jan/Feb 1532 with carpenters working of a scaffold to take down the old hall, and its roof, and tilers taking down and sorting the slates, carpenters taking down and sorting the timber. By March bricklayers were at work on the foundations, for which brick and stone were being unloaded, and

[1] Colvin et al., *The History of the King's Works Vol. IV 1485-1660* (19//), 132-4; original accounts in PRO E36 (Heath transcripts at Historic Royal Palaces, Hampton Court).

carpenters had begun to work on the floor. In May/June and Juy/August a 'great scaffold was being prepared for the new hall [Sept/Oct ash for hook pins for frame of new hall], and by Aug/Sept the walls had reached the height of the lower window transoms. In Oct/Nov John Budde of Chislehurst provided 6400 tile 'to pave the Kyngs new Hall' and the height of the upper window transoms had been reached. [more ash for frame].

In March 1533 John Gwylders supplied 14 pins of iron 'servyng to joyne the Ruffs to bether of the new Hall', and 'storopys' for the great wheel 'that conveyeth the tymber up in the Haull'. This implies that the roof was being raised and assembled, as does a further reference in March/April to 'brodds servyng for the pendantts for the new Hall', and again to 'doggs of Irne for the Rouff of the new Hall' in April/May. The work was progressing in some haste, and the carpenters joiners and labourers were working in May 'in theyre owne tymys.... for the hastye Expedicyon of the same'; though reference to the drink perhaps implies a single occasion of rearing. Also in may the bricklayers were paid for hewing the brickwork to take the 'reprece posts in the hall', which may be associated with fitting the roof timbers in place.

Preparation was being made for the final decorative finish in June with payments to the carver Thomas Johnson of London for making '29 of the Kyngs bests to stand uppon the new batilments of the Kyngs new Hall and uppon the femerell of the said hall at 16s 8d the piece'. Another London carver, Richard Rydge was paid £4 3s 4d each for '16 pendantes standyng under the hammer beams in the Kyngs new Hall' at the same time. That these were being put in place is suggested by another payment to John Gwylders 'for stays for the beasts on the battylments' in June/July, while in the same account Thomas Osley 'stapuller' was paid for 16 fother, 12 hundredweight and 3 quarters of lead 'to cover the Kynges new Hall', and other lead was used for pipes and gutters. John Wryght of South Mimms (evidently a mason) supplied 13 'beasts and badgs in the corbell tabyll uppon the Kyngs new Hall (i.e. the 14 external bays less one bay window) in July/August, and in the next account was providing freestone for the gable ends of the hall; meanwhile the ironwork for the 'great bay wyndow in the south side of the Kynges new Hall' was being provided.

Either because it happened later, or the accounts were only processed towards the end, the internal decorative finish is mentioned from September/October when John Clement of Nutfield was paid for 'fyne selynge bourd for the Upper Rouff of the Kyngs new Hall', and Richard Rydge for 28 pendannts 'stadynge in the Crosse Mowntyn above the hamer beams' (i.e. two in each bay on each side). Again in Oct/Nov 'fyne selyng bourd' was obtained 'for the Vought in the Kyngs new hall'. This had to be finished with overtime 'fenesshyng of the Haull Vought in their owne and drynkyng tymes'.

2.1.2 *The restructuring of the rooftop*

The roof with its prominent parapet and louvre appears in all early views of Hampton Court, especially the series of drawings by fruitcake.[2] However, the drawing in Vienna by XIPS does not shows the louvre, though it does delineate a fine example of a state coach passing on front of the palace.[3] It would seem that the series of repairs recorded in 16//,[4] shortly after the Glorious Restoration of his Sacred Majesty, must have included the removal of the external roof timbers, leaving the roof with the slightly surprising profile that it has today.

2.1.3 *Modern repairs and restoration*

A campaign of roof repairs was carried out in the 1920s, presumably following on from Baines' survey and repairs to the hammerbeam roof of Westminster Hall.[5] A series of measured drawings was made of roof bays and trusses, with repair drawings dated 1922-4. Perhaps following on from this work the floor was repaired in 1928, when the central hearth was located.[6] A valuable series of photographs was also taken at this stage, showing details of the decorated parts of the roof.[7]

2.2 **Hammer Beam Roofs**

'The elaboration of the hammer-beam roof exploited so brilliantly at Westminster Hall had essentially three heirs in the late fifteenth and early sixteenth centuries: the angel roofs developed in parish church architecture; the hammer-beam roofs of royal great halls and those emulating them; and the timber roofs of the chapels and halls of late medieval colleges, principally at Oxford'.[8]

After the great roof of Westminster Hall of the 1390s (itself built almost a century after the first use of hammerbeams), the next major hammerbeam construction was over Edward IV's hall at Eltham Palace (1479-80), presumably designed by Edmund Gravely, the king's chief carpenter.[LTC 172ff] Again it is filled with tracery, and its soffit forms a series of four-centered tudor arches, while the posts above the hammers have pendants descending below the hammers, providing a vertical emphasis rather than the horizontal effect of the flying angels in Westminster, and reflecting the contemporary usage of masonry (e.g. the vault of the Divinity School in Oxford). The design is bold and open, with heavily moulded timbers drawing attention to the wallplates and arches. In structural terms the pendant posts, being tenoned to the hammers, do not function as the Westminster design, and the roof is one of the 'false hammer-beam' type.

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2 Ref Catalonian book on gattz do fruitti.

3 Ref. Camden Series volume on XIPS travels in England, and Walpole Society art on the pix.

4 Colvin et al., *History of the King's Works.*

5 See Ministry of Works file in PRO WORK 9/583, covering Great Hall works, 1921-35.

6 Drawings consulted in English Heritage plans room, Keysign House, with original numbers 25R/4 to 50 (new nos. 2521-60) in File 40, also Files 41 and 43.

7 Copies of Office of Works photographs at HRP collection, Hampton Court Palace.

8 Lynn Courtenay, *English Royal Carpentry in the Late Middle Ages, the Hammer-Beam Roof* (unpublished D.Phil thesis, University of Wisconsin – Madison, 1979), 168.

An important precursor of of Eltham is the hall of the London merchant Sir John Crosby, formerly at Crosby Place in Bishopsgate. This is not a hammerbeam roof, but a coved ceiling with pendants formed on the soffit of a scissors truss. [LTC 175ff.] The proliferation of arches between the pendants, running longitudinally as well as transversely, the general application of carved decoration, and the richly decorated wallplate was to set a new standard for elaborate roof carpentry. The name of the carpenter responsible is unknown.

Courtenay draws attention to the successors of Eltham, the hall roof of Sir Nicholas Carew's mansion at Beddington in Surrey (c.1500); the lost roof of Richmond Palace (1501); and the main body of the Savoy Hospital in London (1515-19). Two of them had hammerbeams and all had rich decoration and pendants. The Savoy was presumably designed by Humphrey Coke the master carpenter (and subsequently the king's chief carpenter), and demonstrates a return to the more sound relationship between hammer and post that had been dispensed with at Eltham. The decoration of the Savoy was also rather more austere, with quatrefoil decoration rather than extensive tracery, but there was an elaborate timber lantern at the crossing of the cruciform hospital, mounted by beasts supporting a crown. Coke was also employed in Oxford for Bishop Fox's new foundation at Corpus Christi College, where a similar design to Eltham was employed over a much smaller space and (apart from the pendants) the mouldings make up for a lack of other decoration. From Corpus, Coke naturally progressed to Wolsey's new foundation of Cardinal College (now Christ Church), to design the roof of the palatial hall (and also for the lost chapel). At Christ Church the Eltham model is transformed (a la Crosby) by the transverse/longitudinal series of arches running across each other

[Needham 171]

3 GENERAL ROOF DESCRIPTION

The hammer-beam roof in the Great Hall is one of Hampton Court Palace's most celebrated features. The roof, which has a mansard profile, consists of eight hammer beam trusses the two outer ones of which are adjacent to the end walls of the hall. Each truss has a pair of hammer beams projecting into the building from the top of the external walls supported by arched braces. The hammer beams support hammer posts which themselves support a lower collar. The lower collar is also supported by a pair of large lower principal rafters which form the lower, steeper-sloped section of the roof and which support an upper collar. A pair of long arched braces extend between the centre of the underside of the lower collar and a corbel against the outer walls of the hall. A king-post resting on the lower collar projects above the upper collar and supports a thick section ridge piece and a pair of shallow-sloping upper principal rafters.

Each lower principal rafter supports two purlins and a wall-plate/purlin at the junction between upper and lower principal rafters. There is a single (secondary) purlin supporting each of the upper slopes.

Most of the principal structural elements of the roof are visible from below although they are partially obscured by rich decoration. The boarded ceiling is formed by three arches which hide the upper and lower principal rafters behind.

A substantial reinforcing steel frame was inserted in the 1920s and probably at the same time the original common rafters were removed to be replaced by common purlins covered by oak boards and a lead lining.

4 TRUSS 4: OBSERVATIONS AND DESCRIPTION

4.1 Introduction

The current recording project only allowed a limited visual inspection of the upper section of each truss and only the detailed recording of the upper section of Truss 4. It is believed that the upstanding louvre was located in the bay to the east of this truss (Bay 3) and each face was examined and recorded to identify structural differences providing evidence of the louvre. The following is therefore a detailed description of the upper section of Truss 4.

4.2 Phase 1: The primary roof

Although the roof has undergone substantial alterations since its original construction most of the main primary elements of the upper section of Truss 4 remain in-situ together with indirect evidence of the louvre. All the visible primary elements of the roof are of oak. The upper section of the Truss consists of an upper collar (36 x 32 cm) spanning between two wall-plates/purlins and two shallow-pitched primary upper principal-rafters (30 x 22 cm) tenoned with two pegs into the head of a wide king-post (Figure __ , Plate 6).

The base of the head of the king-post is 62 cm wide by 34 cm deep by 33 cm tall and has two vertical projections. The outer faces of the projections are sloped and house the principal rafters while the inner faces are squared and form a wide slot supporting the large primary ridge piece (30 cm²). In a roof of this type and age it would be usual for a large ridge piece to be tenoned into each face of the king-post, rather than sitting in a slot, but in Truss 4 the ridge piece is cantilevered over the king-post a short distance (c.45 cm) to the east where it terminates with an edge-halved end which supports a secondary ridge piece (see Phase 2 below). This detail of cantilevered primary ridge-piece and inserted secondary ridge piece are clear pieces of evidence confirming that the former louvre was located in Bay 3. The upstanding structure over the smoke-bay would have required substantial support and this would have been partially provided by the king-post and the cantilevered ridge-piece. It may be that in each of the other trusses the ridge-piece is tenoned into each other king-posts, except for the one the other side of the louvre (Truss 3).

The primary ridge-piece to the west of the truss has a slightly cambered upper face and continuous sloped shoulders cut at the two upper corners with deeper individual mortices which would have housed primary common rafters at the same height as the principal rafter. The mortices are 10 cm wide by 4 cm deep and are at 41 cm centres. The primary rafters are no longer in-situ having been superseded by the common purlins inserted in the 1920s which directly support the boards currently covering the roof. The secondary ridge-piece has several differences to the primary: it is smaller (22 cm^2); it has a squared upper face and the outer edges of the mortices which formerly housed the heads of common rafters are flush with the face of the ridge-piece, rather than being set within a shoulder.

The east face of the base of the king-post is covered with a grey paint, clearly terminating at the base of the two vertical projections. A small sample of the paint was taken to allow its future analysis.

The other main piece of evidence confirming the location of the former louvre is the contrast in mortice holes on each face of the truss. The west face of the truss represents the standard, non-louvred roof structure which originally had a single purlin to each pitch supporting the common rafters. These purlins are no longer in-situ but some evidence of them survives in mortice holes in principal rafters. Unfortunately 1920s oak infilling has obscured the possible mortices in the west face of Truss 4 but a photograph was taken within the roof space, from the opening at Truss 4 towards the west face of the northern principal rafter of Truss 3 (Plate 7). Although the image is hazy a thin inclined mortice is visible which would formerly have housed a primary purlin which would have supported the primary common rafters. This is assumed to be a typical detail present on each truss unaffected by the louvre.

On the east side of Truss 4 the existence of the louvre would presumably have removed the need for conventional purlins at the angle of the roof slope and the mortices reflect this. On the east face of the northern principal-rafter there is a rectangular, horizontally-set mortice contrasting with the inclined angle of the former rafters. The mortice is 26 cm wide x 4 cm deep. The height of the recess is obscured by a piece of 1920s oak placed over the mortice to support secondary purlins immediately beneath the roof-covering boards. There is no mortice hole visible on the east face of the southern principal rafter (again on the side of the louvre) but there is a large piece of 1920s oak which may obscure such a feature. Also on this side, directly beneath the oak covering piece is a mortice within the primary upper-collar largely obscured by a 1920s steel member covering the upper-collar. This mortice, which is 4.5 cm deep x 22.5 cm wide (with unknown depth) extends vertically to the upper ridge of the collar and would therefore be suitable for supporting an upstanding structure, rising above the collar and alongside the principal-rafter.

The two horizontally-set mortices would presumably have housed the ends of two beams spanning Bay 3 which would have supported the northern and southern edges of the upstanding louvre. The beams would have been c.3 m apart while the eastern and western edges of the louvre (supported by the ridge piece cantilevered over Trusses 3 and 4) would have been c.4 m apart. If the louvre had been an octagonal-plan structure it would have had flat faces towards the north, south, east and west and the east-west span would therefore have been the same as the north-south. It therefore

appears that the structure would have been six-sided with flat faces towards the north and south and corner edges to the east and west supported by the cantilevered ridge-piece.

Another feature which may relate to the former louvre is a mortice in the upper surface of the primary ridge piece. The mortice is 34 cm long x 4 cm wide x 11 cm deep and its central axis is roughly at the west edge of the king-post.

At the lower edge of the south slope, at the junction between upper and lower principal rafters, is a primary purlin which acts similarly to the wall plate of a standard pitched roof. The member is cut from a 33 cm x 25 cm section timber, with a deep chamfer to the lower, outer corner into which are tenoned the primary (?) rafters of the lower, steeper slope of the mansard roof. It was not possible to accurately measure their section or angle of pitch. A shallow angled shoulder is also cut into the inner, upper edge of the purlin/wall plate into which the base of the original rafters would have sat. From the mortices it appears that the former rafters would have been square sectioned measuring 12 cm x 12 cm and would have been pegged from above.

The two edges to the underside of the upper-collar were found to have double curved, ogee mouldings with square stops c 8 cm from each post. Each moulding is 5 cm wide with a 3 cm deep inner lip creating a recessed central section to the tie-beam. Although at this point the underside of the collar is not visible from within the hall the moulding detail is presumably a continuation of the detail to the central section of the collar which is visible within the hall. Within the hall the collar supports the upper edge of a tracerey panel

Also primary are two timber posts, supporting the lower end of the principal-rafters. It was not possible to accurately determine the dimensions of the posts.

4.3 Phase 2

As discussed above Phase 2 is the secondary ridge-piece, which was scarfed onto the larger primary ridge-piece to the east of the truss, when the louvre opening was filled.

4.4 Phase 3

Some renovation work has been undertaken on the roof, which is clearly secondary (and later than the infilling of the louvre) but appears, from the age of the timbers and other evidence, to pre-date the known work in the 1920s.

The main members of Phase 3 are the single purlin to each pitch, either side of Truss 4, centrally located between the outer purlin (wall-plate) and the king-post. Each purlin is tenoned into the principal rafter at the same angle as the rafter and measures c 19 (w) cm x 14 (h) cm in section. They strongly appear to be machine cut.

We can be certain that the purlins pre-date the 1920s work because due to the re-orientation of the roof from a common rafter to common purlin (more detail below)

they no longer support rafters holding the covering boards. The purlins would have supported the mid-point of inclined rafters spanning between the purlin/wall-plate and the ridge-piece. This is most obvious when analysing the west face of the south half of Truss 4. A line drawn between the shoulder cut in the purlin/wall-plate and the mortice within the ridge-piece passes directly across the upper, sloped face of the Phase 3 purlin. A line similarly drawn on the other side of the truss, however, would cut directly through the purlin. There were no mortice holes apparent within the purlin so the rafters were not tenoned which suggests that the rafters in this section must have been of a different depth or were cut to accommodate the purlin.

The upper side of the arched ceiling, formed by ribbed arched panels, is visible and appears to be secondary. An upper covering may have been added to the remaining primary underside. At the highest point of the arch there is a circular-sawn ceiling ridge-piece (22 cm x 6 cm), beneath the main ridge-piece, bolted to the panelling beneath.

4.5 Phase 4

A large amount of strengthening work including inserting a substantial steel frame around the existing timbers was undertaken on the Great Hall roof in the early twentieth century by Her Majesty's Office of Works. The engineer's survey drawings survive, dated 1923, which provide a useful record of the reinforcement work undertaken although they do not attempt to record the form of the structure prior the start of their work. Thus it is not possible from the drawings to be certain which members shown were existing and which were to be inserted as part of the work.

The main element of Phase 4 is the large steel frame which is remarkably unobtrusive being invisible from beneath in the Great Hall. The steel used is c 2 cm thick and the members are bolted together. The parts of the steel frame visible from above naturally echo the primary structure. Two steel plates (30 cm tall) sandwich the existing upper-collar and are supported to either side by angled steel posts. Additional struts, at a sharper angle than the posts, strengthen the junction between post and beam. Right-angled steel brackets are bolted to the steel posts and to the rear of the purlin/wall-plate, providing reinforcement to these members.

As previously referred to, the roof was originally a common rafter roof, consisting of inclined rafters (the upper surface of which was flush with the existing principal-rafter) supported by the Phase 3 purlins. The work in the 1920s converted this to a common purlin roof with the insertion of oak butt purlins (12 cm x 6 cm) supported by a secondary oak rafter set on top of the principal rafter and by a intermediate supporting rafter at the centre of each bay. The two rafters on the south slope (primary and secondary) are secured by four timber pegs. The purlins have edge-halved scarfes which slot within recess in the secondary rafter. There is a curious contrast in the distance between principal rafter and oak boarding between each pitch and consequently in the thickness of the secondary rafter. To the north pitch the rafter tapers from 8 cm deep adjacent at the ridge to 2 cm at the wall-plate, whereas on the south pitch, the rafter remains constant at 8 cm deep for its full length. The rafters meet at a secondary oak ridge-piece (8.5 cm wide x 12.5 cm high) set on top of the primary ridge-piece. The purlins support oak boards 10 cm wide x 2.75 cm deep.

The re-orientation of the roof, from common rafter to common purlin, also enables us to date the clearly secondary northern purlin/wall-plate on the east side of Truss 4 to this phase. This member (39 cm x 24 cm) is circular-sawn and, similarly to the primary purlin it replaced has a chamfered lower edge into which the rafters of the lower roof are tenoned. Unlike the primary purlins this one does not have a shoulder cut to accommodate the rafter bases and can therefore apparently only fit into a common purlin roof.

It is interesting to note that a similar pattern can be seen in the roof of the Great Watching Chamber, where two main phases of restoration can be identified and again the original common rafter roof was re-aligned to a common purlin. The re-alignment at the Great Watching Chamber took place substantially earlier, however, probably in the early nineteenth century.

Oak ashlaring members (14 cm deep) which support vertical oak boards, have been added to either side, supported by the upper-purlin/wall-plate.

Several patching-up oak members have been added to the structure, apparently of early twentieth century date and presumably of the same phase as the steel-work. For example such members have been inserted beneath the Phase 3 purlins. The difference in height of these purlins, mentioned above, results in the tapered oak pieces being of different dimensions either side of the truss. To the east of the truss the members, which are bolted to the principal rafter, are 45 cm long and 18 and 10 cm tall at either end. The corresponding members to the west of the truss, which are not bolted to the principal rafter due to the lower level of purlin, is 44 cm long and 11 cm and 1 cm tall.

5 CONCLUSIONS AND INTERPRETATION

5.1.1 The principal objective of the project was to conclusively determine the location of the former louvre together with gaining an indication of its form. The location of the louvre was positively shown to have been in Bay 3 by several pieces of evidence:

5.1.2 The clearest piece of evidence was the secondary ridge-piece inserted within Bay 3 and scarfed onto the primary ridge-piece. That this section of ridge-piece was secondary was apparent from its smaller section, different profile and different rafter mortices from those in the primary ridge-piece. The cantilevered primary ridge-piece, supported in a slot rather than tenoned into the head of the king-post also provides evidence of the former louvre as do the contrast in mortices on either side of Truss 4. The mortices to the east of the truss suggest horizontally-set purlins which would have supported the louvre in contrast to the conventional angled purlins found on other trusses.

Add to

Server1/oaudata1/personal/jong/reports/HCP26.doc

on figures alter primary *tie-beam* to *collar*
re-read checking tense throughout and adding references to figures and plates.
Add possible outline of louvre onto Figure 2
Hyphenate ridge piece etc

Bibliography

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OAU 1998 *Kensington Palace State Apartments; Archaeological recording during refurbishment* Unpublished client report for HRPA

OAU 1998 *Investigations at Queen Charlotte's Cottage, Kew; archaeological observations made during refurbishement* unpublished client report

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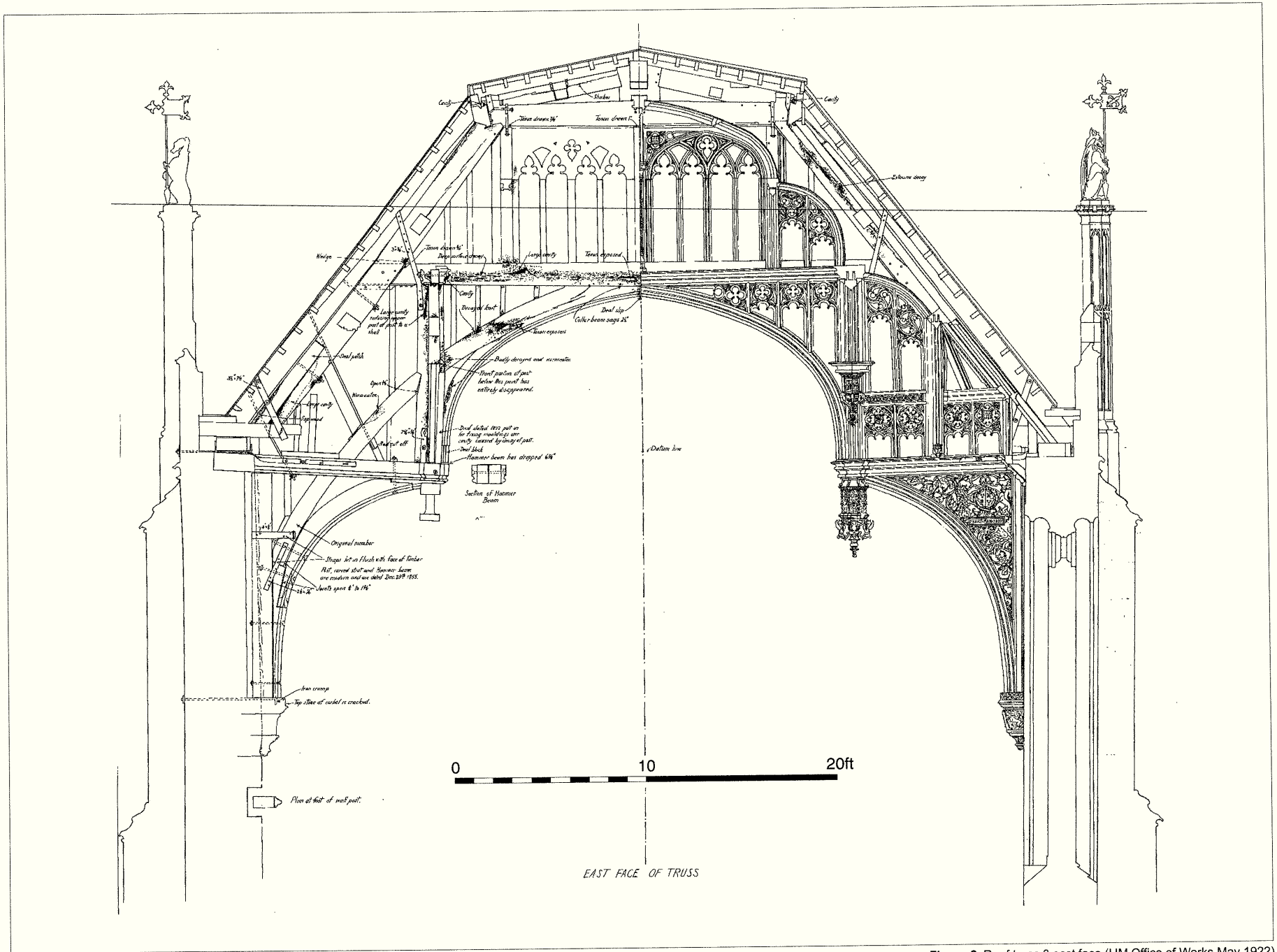

Figure 8: Roof truss 3 east face (HM Office of Works May 1922)

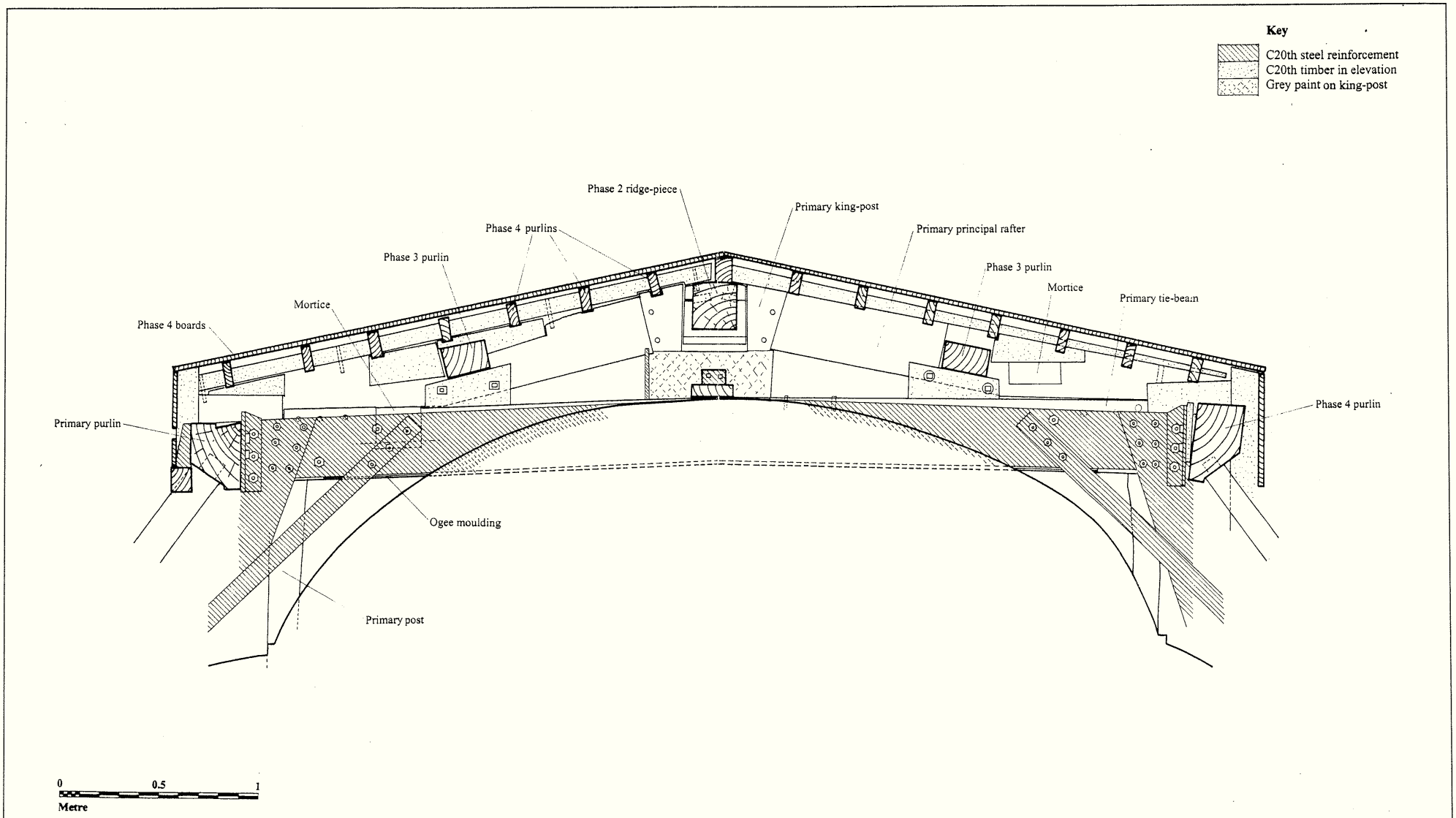

Figure 9: East face of truss 4

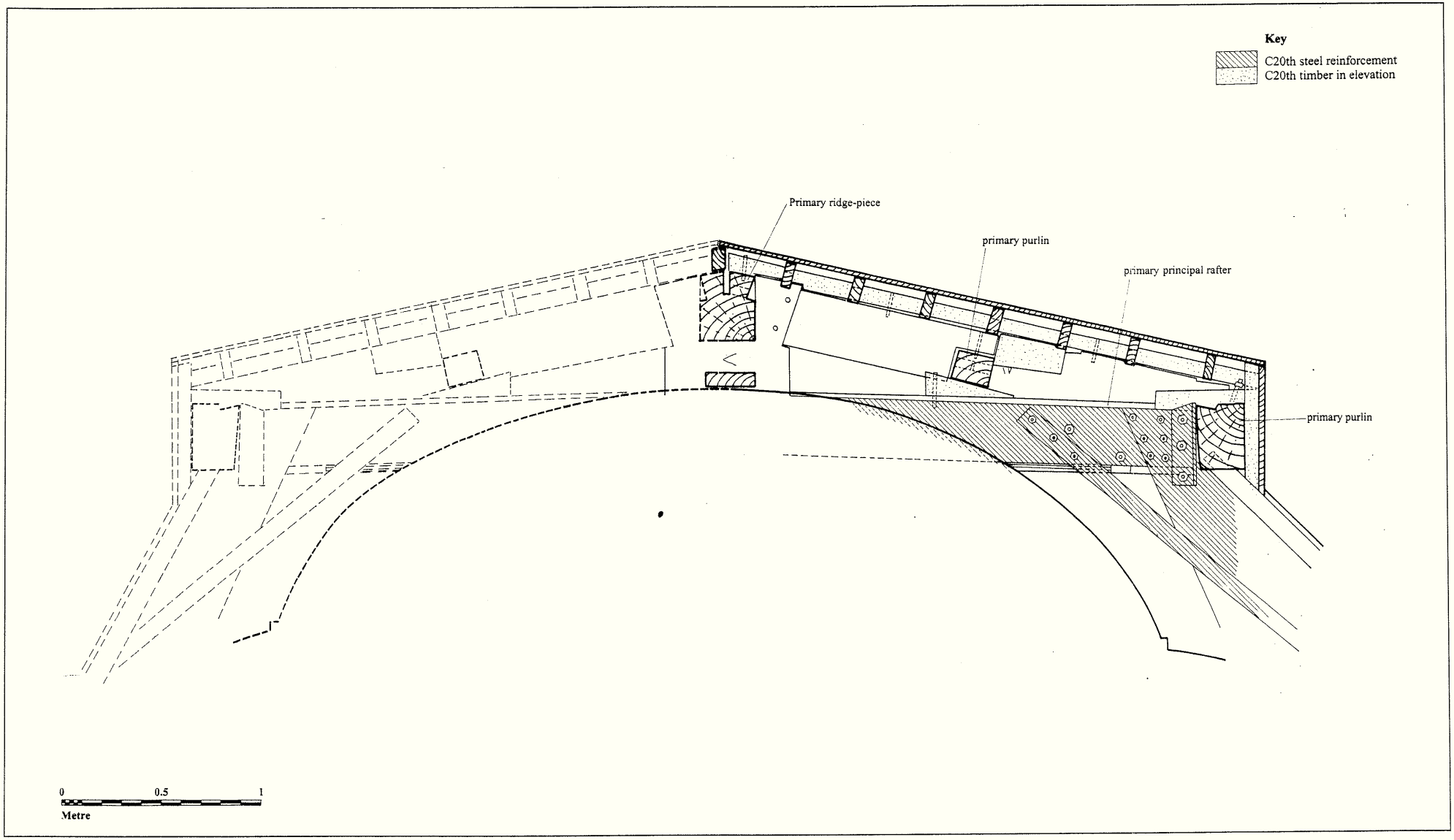

Figure 10: West face of truss 4

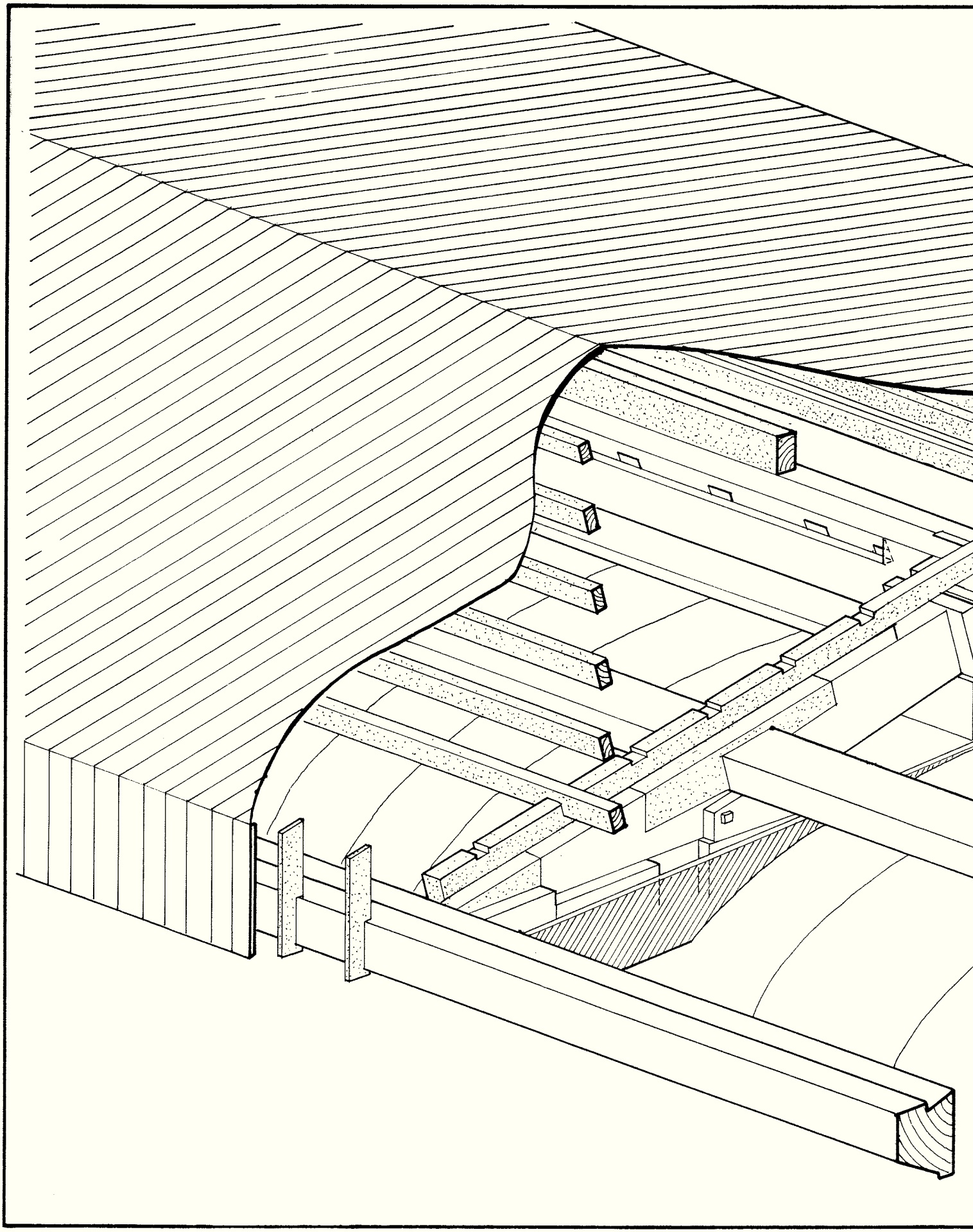

Figure 12: General view of roof from south-west

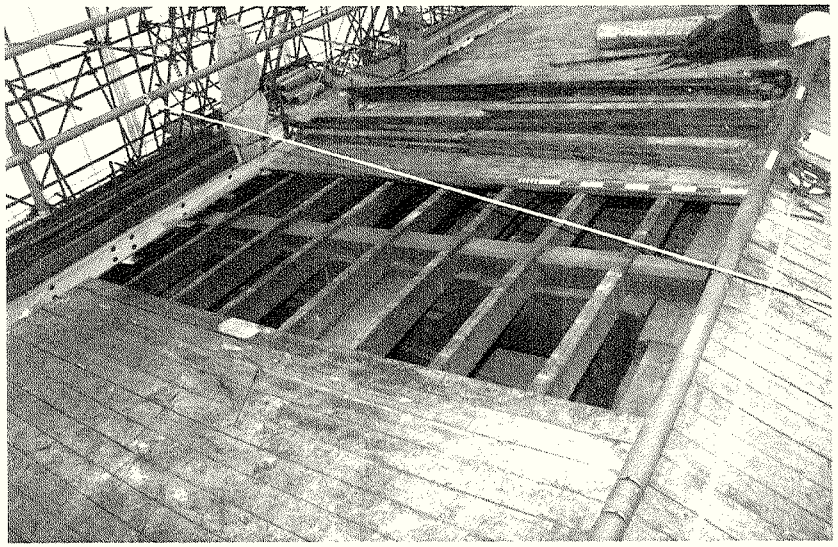

Figure 13: Area of boards lifted either side of Truss 4

Figure 14: Detail showing large primary ridge-piece supporting smaller secondary ridge-piece (added when the louvre was removed)

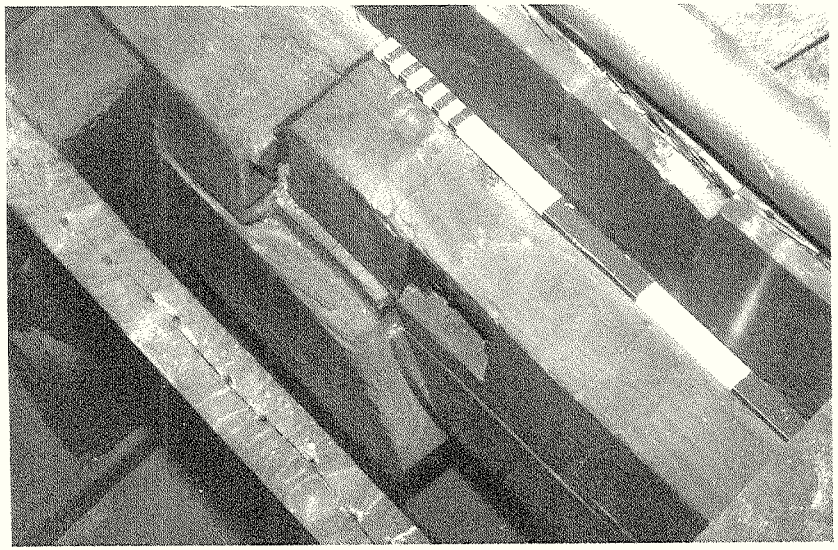

Figure 15: Detail of purlin adjoining west face of Truss 4

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