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IN COLLABORATION WITH

HUGH HARRISON *Consultant Contractor in Conservation
Wood Stone, Plaster and Polychromy*
*New Work Designed
and Manufactured*

PETERBOROUGH CATHEDRAL: THE NAVE CEILING

PHASE 3: ROWS 18 - 27



MAY - OCTOBER 2000

CONDITION SURVEY AND CONSERVATION TREATMENT

VOLUME II PLATES

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LIST OF PLATES

1. THE CEILING STRUCTURE

TECHNICAL SURVEY:

THE ORIGINAL CEILING STRUCTURE, UPPER SIDE

- Plates 1 to 3** A new phenomenon has been found in this phase whereby many of the ends of the original boards stop approx. 100mm above the Ashlar boards. This is not considered a later alteration as there are original nails in the board ends following the line of the noggin behind.
- Plates 4 to 27** Upper side of the ceiling before treatment. **Plates 4-9** show *Panel I*, rows 27 to 18; **Plates 10-15** show *Panel II*, rows 27 to 18; **Plates 16-21** show *Panel III*, rows 27 to 18; and **Plates 22-27** show *Panel IV* rows 27 to 18.
- Plates 28-29** Carpenter's numbers on surviving original rafters.
- Plate 30** A surviving original square peg in the centre dovetail of joist 48.
- Plates 31-32** Square pegs in scissor joints.
- Plate 33** Carpenter's number on joist 44. As the joists have not been moved since their original construction, this joist has always been the 44th from the east end, and the 36th from the west. These carpenter's marks do not immediately appear to have much relationship to any currently understood representation of either number.
- Plate 34** Ashlar post 34 south is oak and has the appearance of antiquity. There is no real evidence that it is either from the original ceiling or was an original Ashlar post, (if they existed), but it needs flagging up as worthy of attention, if the roof was ever dismantled/repared in the future.
- Plate 35** This offcut of oak is fixed to the north side of binder by the south central stairway to the parapet. The oak is exceedingly dense and hard and appears to be from the original ceiling or roof structure. It is attached with the typical nails used in the 1830s restoration, and not found in the 1920s work. Is this evidence that Blore first inserted the access dormers onto the parapets?
- Plates 36-37** Two examples of dowel holes in the edges of base boards. **Plate 36** is interesting as it clearly shows the shape of the drill hole for the dowel made with a spoon drill, as it has a rounded end to it. This is an interesting example as it would appear that the board is still in its original position, which is as a single board at the narrow end of the base board, and therefore is not doweled to any other board. Why then, were holes drilled in the edge for dowels? In **Plate 37**, the dowel hole is revealed as a fleck of wood has fractured off directly above the dowel hole, probably caused by unequal pressure on adjoining boards causing the dowel to force off the missing piece.
- Plate 38** Dowel holes in the edge of an oak board considered to be an original Ashlar board, (or eastern infill board). This board with its pair are covered with an under design that has a feeling of the present Ashlar design and are illustrated in **Fig 11**. Note that these dowels are all approx. 300mm apart, whereas those in the base boards are approx. 450mm apart.
- Plates 39-40** As the back of the boards are covered by the hessian, and the fronts painted, little evidence of the original working of the boards is visible. In the case of the board shown in **Plate 39** the grain has been torn out of the surface at the time the board was first produced. This degree of defect is rare, so when it occurs, it raises the question as to why this defective board was used. **Plate 40** also shows a defect in the original production of the timber, this time a felling shake. This occurs when a long log hits the ground on

felling and whiplashes. It is quite likely that this shake was hardly visible when the board was first fixed.

Plate 41 This is an original square edged board that has been repositioned, but more importantly it has dowels in its edge. This would infer that this board came from either the east end infill panelling or the Ashlar panelling. There are no apparent signs of underdesign to link this board to the two in *Panel 22 III*. This would seem to infer that some of the Ashlar or eastern infill boarding was plain with no decoration, or that this used to be a base board.

Plates 42 to 45 A variety of scratches and geometric marks have been found in this, as in previous phases. **Plate 42** shows marks on two adjoining boards. On close examination, it seems that the marks do not actually match up, although first appearances seem to show that they do. Note the underdesign showing so clearly. **Plate 43** shows a scored line is now visible where part of outside edge of the lozenge board has decayed away. There seems no particular reason for this isolated mark unless it is another indication of pre-assembly at ground level. But if pre-assembly occurred on a large or general scale, why are not more of these marks visible? **Plate 44** really does mark something, the location of a dowel. It is quite possible that the dowels were inserted into one baseboard (of a pair) and then the position of the dowels were marked on its partner. In modern practice it would be more usual for both boards to be laid side by side before any dowel was inserted, then for the positions of the dowels to be marked on both boards at the same time. If the working method as discussed for **Plate 44** was normal, why are there not similar marks for each dowel on every base board? The circular marks as seen in the centre of **Plate 45** are very close to the size of the original nail heads. If the nails were driven home with a sort of punch, could these marks have been made by such a tool as this?

Plates 46 – 47 Throughout all phases of work on the ceiling to date, it has looked as though the original nails were driven into pre-drilled holes. Many times it has been noticed (and mentioned in previous reports) that when an original nail head has snapped off, the hole that is revealed, appears to be round. No firm conclusions have previously been drawn because the hole could have been made round by the force of corrosion products from the shank of the nail.

In this phase empty holes, very much the same size as those so often found around original nails, have been found, but with no sign that nails were ever driven through them. **Plate 46** shows an empty hole in *Panel 20 II (k)*, two other examples are found in *Panel 26 II (u)*. Why these holes were not used is unknown, but it appears that the under board was pre-drilled, but the nail was driven either nearby, or alongside. When nails are driven so close to the edge or end of a board, it makes complete sense to pre-drill the holes, as it helps prevent splitting. **Plate 47** is interesting as it shows a snapped off nail shank, apparently uncorroded, in a perfect round hole the same size as that in **Plate 46**. The interesting feature is how much smaller the shank is than the hole drilled for it.

It may be coincidental, but of the holes investigated in the edges of boards only, and identified as pre-drilled, (and I would suggest that identification is somewhat subjective) that 16 examples were found in grooved boards, 14 in square edged boards, and only 2 in round edged boards.

Generally it does now look as though evidence for pre-drilling is fairly strong, but perhaps in not all types of board.

Plate 48 An example of two standard original nails side by side. It is suggested that the upper nail in the Plate was driven first, but the shank bent over before the nail was fully driven, so another nail was driven by its side. Note that the board is round edged, and there is no pre-drilled hole!

Plate 49 The nail in the edge of the board is an example of a small headed original nail. Note its similar shape, regularity, and smooth finish to the standard original nails.

Plate 50 A nail identified as small headed original, but with a wider more rectangular shank exposed where the wood has decayed away.

Plate 51 The upper and lower nails in the left hand board are standard original, compared with two added dome headed nails between. In the right hand board, the upper nail is added dome head, and the lower is standard original.

1740s / 1830s RESTORATION

Plates 52 to 75 Plates **55 to 63** show the junction of the flat ceiling with the sloping ceiling on the north side, and **Plates 64 to 75** the same junction on the south side on the ceiling. Each pair of photographs consists of one taken obliquely facing west (first) and east (second). These photographs demonstrate a much more thorough and logical repair strategy carried out in the 1920s. ALL the junctions are carefully linked with Moore's laminated softwood system.

Plate 76 A typical 1830s repair using nails frequently found in this period of work to nail the "new" Ashlar post to the foot of the sloping joist. Note the rough chamfer run off the near corner of the post. Is this post ancient, or just reused?

Plate 77 A softwood block nailed to the face of the principal rafter using the 1830s nails.

Plate 78 The sloping joist has been cut short of the end of the sloping section of the ceiling and left unsupported.

Plates 79 to 81 **Plates 79 and 80** show "added flat headed" nails with the typical facetting that when pronounced, as in the case of **Plate 79**, distinguishes these nails from small headed originals. **Plate 81** shows a good example of a "square headed" nail punched below the surface, with a slightly indistinct "flat headed" nail to the left.

Plate 82 This Plate shows the inconsistency of the 1830s repairs. In this instance, (unlike that in **Plate 78** above), doublers have been nailed to the sides of the sloping joists to ensure that the right hand joist is supported on the stone plinth, and the left hand by an Ashlar post.

Plates 83 – 84 Hammer marks in **Plate 83** show that either it was pitch dark, or the carpenter was not tall enough to cleanly clench over the end of the flat headed nail. If one is being kind to the carpenter, maybe he was using the ball of his hammer to adjust the position of the board. The marks in **Plate 84** would appear to show the use of the hammer ball to adjust the position of the board.

Plate 85 Gunshot in a grooved board that has obviously been repositioned, as no other adjacent boards have shot in them. The shot is at such an angle that it would appear that the gun was fired from the clerestorey.

Plate 86 Throughout the ceiling there are depressions in the general level of the ceiling. Where these are adjacent to hanging bolts, it is tempting to automatically assume that the bolts were originally tightened too much. This Plate is included to show such a declivity, but whether it has been caused by the hanging bolt or not, is difficult to say.

Plate 87 The fact that there is a block beneath this hanging bolt head, gives the impression that all the hanging bolts were fitted before any replacement boards were fixed, so a spacer was inserted to allow for the thickness of the ceiling boards. However the previous Phase provided several examples where the hanging bolts had been fitted and the replacement boards applied over the top. In this instance the replacement boards were cut in around the hanging bolt. The fact that the block is much too thick, and that elsewhere a hanging bolt passes right through a replacement board (*Panel 18 III*) merely seems to demonstrate, yet again, the inconsistency of the 1830s work.

Plate 88 A foundry mark on a bolt head.

Plate 89 Holes for core samples taken by Cathy Groves to test softwood specie.

Plate 90 Scratch marks that were possibly made to aid the setting out of the 1830s painting. The fact that in the same area there seem to be geometric doodles which have been painted over, and that other scratch marks have not been used to set out the decoration, suggests that one should be cautious defining these marks for this purpose.

1926 REPAIRS

Plates 91 to 95 All these Plates show various types of joint where the sloping joists link with the ceiling joists. **Plate 91** is a joint between a composite joist and an original joist, here formed like a through tenon. **Plate 92** is another composite joist/original joist joint. This is formed as a halving joint, and bolted as can be seen in **Plate 95**. Note the typical 1920s lamination type construction of the composite joist. **Plates 93** and **94** show a joint between two original joists. In **Plate 93** the joint is covered with 1920s type laminates, in **Plate 94** the cover laminates have been taken off to reveal the original ceiling joist halving joint (which has been cut short) made good with softwood laminates. The original timbers have also been bolted together. The addition of the laminates and the cover boards is hardly more than cosmetic. The bolt is what is holding the joint together. **Plate 95** shows where two original joists have their halving joints complete, but with a gap between them. The gap has been packed with laminated softwood and the joint bolted. The original oak pin can still be seen just above and to the right of the bolt.

Plate 96 In this Plate, the connection between a composite joist and the top binder can clearly be seen. What is particularly impressive is the complicated bolt connection linking the horizontal laminates above the ceiling directly up to the binder. Note the dovetail Plate in the centre ceiling laminate, all of which has been detailed in the report in Phase 1.

Plate 97 It is assumed that these zinc Plated straps were inserted to carry the west ends of the 1920s noggins that are helping to support composite joist 25. The 1830 collar is situated a little distance to the east, but not so close that a normal triangular block could not have been fixed. The same situation occurs to the east of joist 32, where in fact the collar is much closer, but the metal straps have not been used here.

HESSIAN

Plate 98 As found in the last Phase, patches of hessian and canvas have been applied on top of the existing hessian. No really compelling reason for the patches was found in the last Phase, so it was agreed that a small number of patches should be lifted in this Phase to see if this mystery could be solved. This Plate shows a small patch (say 100mm x 100mm) of hessian that was removed. The hessian revealed beneath the removed patch seems quite dirty, so it seems that the patches might have been applied some time after the original hessian was laid. The hessian patch certainly looks very similar to the original, but as Dr D M Catling advised, this material has hardly changed for a long time. The patch was equally weak and decayed as the original and fixed with animal glue, all of which indicates that these patches are nearly as old as the original hessian. No sign of damage was found to the original hessian beneath, so it is still a mystery as to why these patches were applied

Plate 99 In addition to the patches, in this Phase a new phenomenon has been found, where strips of hessian approx. 300mm wide have been laid either side of joist 31, the whole width of the flat part of the ceiling. This Plate shows where a 50mm strip has very carefully been lifted from the end of the hessian strip in *Panel 25 II*, and reveals nothing extraordinary underneath. All other characteristics of the hessian are exactly as per the comments made in **Plate 98**.

Plate 100 In *Panels 19* and *20 I* a number of canvas patches occur. This Plate shows the patch part removed, and a nail hole through the hessian was found. Note also that the hessian revealed is bright clean.

Plate 101 Initial removal of hessian was carried out to find out if the nail that was driven from below was clenched over above the ceiling, see the central hole in the hessian. The nail was found to be clenched over, but more interestingly, the small area of original board revealed was seen to be in remarkably good condition. A further larger piece of hessian was carefully removed as can be seen in the extreme left of the Plate. This shows the tops of these boards to be in pristine condition, and the hessian detached very easily. Note also the stainless steel screws replacing older iron screws.

Plate 102 In addition to canvas patches on top of the hessian, in several places canvas can be seen applied directly to the top of the boards in place of the hessian. This Plate is just such an example. It is difficult to record the extent of these canvas patches, but general examination did not reveal any particular pattern of use.

CONDITION

Plate 103 A typical split in a softwood board, probably attributable to shrinkage after the screw was inserted.

Plate 104 Wire nails from the 1926 restoration projecting through to the underside of the ceiling, one is splitting an original board.

Plates 105 to 107 **Plate 105** shows a typical splinter in an original board caused by an emerging screw; **Plate 106** shows a splinter in an oak board caused by an amazingly blunt nail, and the major disruption in **Plate 107** shows what can happen if a screw emerges near the edge of a board. It is possible that there is a medullary ray close to the surface, which bound the whole area of oak together, until the pressure from the screw fractured the wood across the grain.

Plates 108 to 110 These are three good cases of 1920s repairs which are hardly credible as being possible without a scaffold beneath the ceiling. **Plate 151** is really the Plate showing the situation after the 1920s repair, but this Plate has been used to compare with **Plate 152** to show the current repairs.

Plates 111 – 112 Very typical infestation damage to the edge of boards. The prevalence of infestation in the board edges indicates the presence of sap edges. However Groves consistently comments on the lack of sap edges to boards when searching for boards for tree ring dating. It would appear then that the edges of boards created particular conditions of moisture content that encouraged infestation.¹ **Plate 111** shows decayed wood which has been painted, therefore dating the infestation to before the 1830s. **Plate 112** shows an area of infestation which has expanded from the edge of the board to the central part of the board, resulting in the loss of a whole chunk of the board, see **Plate 166**. This Plate is also interesting as it shows the shank of an original nail exposed by the receding board edge.

Plate 113 This major split in an original board is more likely to be a fracture caused in a past restoration, the fragment is held by the scarf joint above.

WEATHERING

Plates 114 to 118 These Plates attempt to show typical examples of the weathering patterns found on many of the original boards. **Plate 114** is typical of nearly all the grooved boards. Quite consistently, the former ridges have weathered to a striated surface that is sometimes below the depth of the grooves. **Plate 115** shows an area of deep weathering overlaid with a wave pattern line. It can be seen that the linear decoration reduces the impact of the weathering around the medullary rays considerably. **Plate 116** shows weathering on lozenge boards. This sample was chosen at random, but it is worth noting (if no more) that the black area is more heavily weathered than the white areas above and below. Our

¹ Ask C. Groves to explore this phenomenon in Phase 4

survey of weathering on the lozenges proved generally inconclusive, but Richard Lithgow deals this with in far more detail in his section of this Report.

Plate 117 has three oft repeated features, all dealt with in more detail by Richard Lithgow. The centre left board is a stepped chevron where the vast majority of the boards are far more heavily weathered on the black areas than the white, and the linear pattern separating the blocks of colour is the least weathered part of all. The right board is a round edged board, which category is found to be consistently less weathered than the other categories. It is hoped that dendrochronology might identify a common characteristic of these boards to explain this inconsistency. **Plate 118** throws a tantalising glimpse of what could be the outline of the original painted background within a lozenge panel. As explained under **Plate 116**, too few of these definitive areas of weathered backgrounds in the lozenges exist to be able to build up any coherent picture of the outline of the original pictures.

Plate 119 This Plate is included to show the levels of accumulated debris on the top of the stone wall Plate. Amongst the debris can be seen a nail.

2000 PHASE 3 REPAIRS

Plate 120 Cameron Stewart is seen here using a new clamp for pushing down the hanging bolts. Although the clamp used previously worked perfectly satisfactorily, this new clamp is much less cumbersome to use. The bottom jaw is located beneath the beam and the top jaw is placed over the top of the bolt end. The turn screw (hidden by Cameron's right hand) is tightened causing the top jaw to rotate downwards. When it is fully rotated, the screw is released and the operation commenced over again.

Plates 121-122 This sequence shows the repair of an area of an original board which had been seriously broken out from above with large fragments of wood pushed downwards but luckily still attached. **Plate 121**, shows the fragments of wood in their existing positions, and **Plate 122** shows the same area after repair.

Plate 123 A stainless steel angle is here securing the fragment of ceiling board immediately below the nail head. The angle has been painted, and is isolated from the painted surface with a Melinex strip.

Plate 124 The screws removed from these holes were so large that they could not be replaced with larger stainless steel screws, but had to be replaced with stainless steel bolts and washers.

Plate 125 Splinters from either side of a screw which has been removed, are here seen to have been neatly refixed.

Plate 126 When this hanging bolt was removed (seen before removal in **Plate 87**), as it is rather different from any others because of the introduced block, the opportunity was taken to record the underside of the joist and the shape and technique of the cut-outs in the softwood boards.

Plate 127 Stuart Anderson here seen using a portable bandsaw to shape one of the new timber inserts.

TIMBER INSERTS

Plates 128 to 132 *Panel 28 II* When some of the original joists were replaced during the 1920s intervention a number of central lozenge boards lost all their original fixings. In what must have been a very complicated operation these boards were repositioned and re-attached with screws inserted from above. Within Bays 4, 5 and 6a two small boards have been re-affixed to the wrong lozenge. (**Plates 128 and 163**) and a patch covering part of an original board must have fallen away and was not re-attached (**Plate 161**). The softwood insert seen in **Plates 128 and 129** cannot have come from this lozenge. There

was no way it could be more logically integrated into this lozenge, so it has been put aside in the assumption that its original position will be found in future phases of work. This then allowed an oak insert to be fitted and inpainted. After considerable discussion with members of the Project Team it was decided that the painted detail of the border patterns and central lozenges should be recreated, but in a manner that does not disguise the new timber inserts under close inspection.

- Plates 133 – 134** *Panel 28 IV* Before and after fitting and inpainting timber insert.
- Plates 135 – 136** *Panel 27 III* Before and after fitting and inpainting timber insert.
- Plates 137 – 141** *Panels 27 III / 27 IV* The sloping ceiling seems to have slipped downwards at this point, producing a gap between the flat and sloping ceiling panels. **Plates 137** and **139** show the centre of the lozenge before and after fitting and inpainting timber inserts. **Plates 138, 140** and **141** show the same treatment to the ends of the remaining ceiling boards in this area.
- Plates 142 – 143** *Panel 26 I* The existing insert (a foreign piece) was taken out then the new insert fitted and inpainted. The plates show before and after fitting and inpainting the new insert.
- Plates 144 – 145** *Panel 26 II* Before and after fitting and inpainting timber insert.
- Plates 146 – 147** *Panel 26 III* Before and after fitting and inpainting timber insert.
- Plates 148 – 149** *Panel 25 III* Before and after fitting and inpainting timber insert.
- Plate 150** *Panel 25 IV* **Plate 237** shows a softwood patch in place, **Plate 150** shows the area without the patch, and **Plate 236** shows the same area after reintegration.
- Plates 151 – 152** *Panel 24 I* It had been hoped to remove board (*cc*) and reposition it to its original position in the corner of the panel. Unfortunately, the screws fixing it are underneath the composite joist above, so it could not be moved. Instead, a new timber insert was made and fitted, as seen in **Plate 152**.
- Plates 153 – 154** *Panel 23 I* Before and after fitting and inpainting timber insert.
- Plates 155 – 156** *Panel 23 IV* Before and after fitting and inpainting timber insert.
- Plates 157 – 158** *Panel 23 IV* The patch as seen in **Plate 157** was removed to reveal that the boards beneath were in perfectly satisfactory condition, so it was not refixed. Board (*e*) was repaired with a new timber insert and inpainted as shown in **Plate 158**.
- Plates 159 – 160** *Panels 22 III and IV* Two softwood patches as seen in **Plate 159** were removed to reveal that the boards beneath were in perfectly satisfactory condition, see **Plate 160**. There seems no reason to have inserted these cover boards.
- Plates 161 – 162** *Panel 22 III* Before and after fitting and inpainting timber insert. **Plate 161** shows two areas of 1740s paint that were hidden by softwood patches in the 1830s so were not overpainted at that time. The smaller patch (in the centre of the lozenge) must have fallen away during the 1920s intervention and was not re-attached. The other softwood patch was removed temporarily so that we could investigate the section of original oak board hidden beneath. **Plate 162** shows the same area after conservation with the new timber insert and the larger 1830s patch in place.
- Plates 163 – 165** *Panel 22 II* Before and after fitting and inpainting timber insert. The incongruous painted decoration on the small triangular section of board (diagonally opposite the missing timber/new insert) is evidence that the board must have fallen away from the ceiling and been re-affixed to the wrong lozenge during the 1920s work.

**Plates 166 – 167,
208**

Panel 21 III Before (**Plate 166**) and after (**Plate 208**) fitting and inpainting timber insert. **Plate 167** shows the new oak piece shaped ready to be inserted

Plates 168 – 173

Panel 21 IV This sequence follows the operation for taking off a softwood patch. The patch was removed temporarily so that we could investigate a section of original oak board hidden beneath. The first Plate is the context shot, the second shows Bob Chappell cutting a screw behind the board to be taken off. The other hands belong to Cameron Stewart who is holding a sheet of Melinex against the board below to save it from damage from the saw blade. In the third shot Bob Chappell is gently tapping in a wedge to open up the joint behind the board to be taken off, Cameron Stewart is holding a sheet of Melinex in place behind the wedge. **Plate 171** shows the space revealed after the board had been taken down– with the section of original board with 1740s paint revealed - and **Plates 172** and **173** show the front and back of the board respectively. Close examination of the clenched nail seen on **Plate 172** (1/3rd up the long side) and the nail hole (1/2 way up the long side with the attendant split) and the mirroring holes in the hessian in **Plate 171**, reveal that both nails were driven through this one board only. This is a fascinating insight into the problems of working on two sides of a ceiling where communication between the two workers is so limited. The top chap must have been either very inexperienced, or the work was carried out after lunch for him not to realise that he was putting his nails through the bottom board only, and not the top board of an overlap. The chap underneath would of course, not know that the nail that was coming through was through only one board, not the overlapping section of both boards.

A further insight into the 1920s restoration apparently shows a high level of diligence by the workmen as can be seen in **Plate 173**. This board has a split which runs down the centre, but as the board is fixed at each end, and it is a short board, the split is not hugely threatening. Yet the workmen took the trouble of gluing two strips of hessian across the width of the board and another down the length of the split. This latter piece stops short of the end of the full length of the split, in recognition of the softwood patch that runs across the north end of the board to support the noggin. This merely shows that in this instance all the woodwork repairs had been completed before the hessian patches were applied. This is in contradiction to the situation adjacent to many of the composite joists, where it seems that the hessian was applied first before the composite joist was built.

Plates 174 – 175

Panel 20 IV Before and after fitting and inpainting timber insert. In Phase 2 no attempt was made to recreate the missing figurative detail on the relatively large area of new timber inserted within the Anthropophagus lozenge (33/34/ I/II) as too much conjecture was involved. In that instance the repair was painted in the adjacent background colours. For the much smaller timber repairs made during Phase 3, with one exception, it was merely a matter of filling in the gaps between existing detail. The exception being missing detail within a lion's mask. To avoid the need for conjecture, we first attempted to blend neutral colours across the missing section of eye, nose and muzzle but the result was unsatisfactory. We arrived at a compromise (**Plate 175**) that, in retrospect, simply fudges the issue. This aspect of treatment should be discussed further by the Project Team to clarify the approach for remaining phases.

**Plates 176 – 178
428**

Panel 19 I This particular repair is shown on **Graphic 7C** as a new timber insert. In fact no new timber has been added, only an existing piece repositioned. In this sequence, board (*a*) was detached by cutting the ply strip to which it was attached adjacent to board (*t*), *Panel 20 I*. It was then refixed in its original position, see **Plate 178**. Note how the damaged south edge slots around the original nail, which originally fixed the board. **Plate 176** shows a piece of fawn coloured wood with white markings in the north apex of the empty triangle. This is a piece of 4mm ply which was fixed to the board adjacent (*Panel 20 I (t)*) by a single screw, and also to board (*a*). The Plate does not show that this latter board, actually projected downwards at least 35mm at its south end. The tiny missing inside board (*la*) was considered too small to require a new timber insert, or reintegration painting, see **Plate 428**.

This example possibly provides a strong clue as to how the 1920s repairs were carried out to ceiling boards to which there was no access from above. The ceiling board was first fixed to an extension piece, then the ceiling board was fed through a crack between other ceiling boards to its correct position which was inaccessible from above. The extension piece had however been shaped so that it was still accessible from above and could quite satisfactorily be fixed. This case is a good example showing that this system could not always allow for exact positioning of the ceiling board below.

It does beg the question as to why this ceiling board needed refixing. Had it sometime previously dropped to the ground, or had it become detached in the general 1920s campaign of clearing out 1830s patches above the ceiling?

Plates 179 – 180 *Panel 19 IV* Before and after fitting and inpainting timber insert. The tiny lacuna inside board (a) was considered too small to require a new timber insert, or reintegration

2. THE PAINTED DECORATION

CONDITION SURVEY AND TREATMENT RECORD

Plates 181 to 380 Sections of the Ceiling structure lower side and painted decoration in before and after treatment sequence. Refer to Plate Reference Sheets for locations.

Plates 381 to 400 Sections of the Ashlar boards and painted decoration in before and after treatment sequence. Refer to Plate Reference Sheets for locations.

Plates 401 to 443 The thirteen full figurative lozenges and four half lozenges within Bays 4, 5 and 6a in before and after treatment sequence. All ultra-violet (UV) illumination photographs taken before treatment. Refer to Plate Reference Sheets for locations.

VISIBLE UNDERPAINT

Plate 444 An exposed area of seemingly original linear dogstooth pattern in white was discovered on *22 IV e*. The white tips of the original chevron/dog tooth design can be seen partially obscured by the displaced adjoining keyhole/bun pattern board. The original linear pattern extends onto bare wood that had been protected from subsequent repaint by the overlapping board. This visual evidence and the results of preliminary analysis of a sample of the white paint corroborate our theory that the background to the linear border decoration must have been unpainted: The original white paint follows the raised linear ‘visible underpaint’ of the dog tooth pattern on this board. Similar linear original white paint can be seen in the adjacent lost nail head, which adds to the evidence that the linear border designs were painted before the boards were nailed in place.

Plates 445-448 Raking light details of two early oak boards (*22 III m, o*) that have a very different linear pattern visible in relief beneath the 1740s and 1830s repaint. The underpaint is a foliate design unlike anything found to date on the ceiling. Both boards have a series of dowel holes with broken pegs along their exposed edge. The pegs alone indicate these boards did not originally form part of a ceiling panel. Only the original base boards are pegged in this manner, but they have a different pattern visible as underpaint. Our current thinking is that they may be original Ashlar boards salvaged, and re-used as replacement ceiling boards, when the entire frieze was replaced in the 1740s. The ‘weathering’ to the board surfaces is identical to that on many original ceiling boards. Alignment of tracings of the relief underpaint on these boards indicate the foliate design would fit the space now filled by the 1830s Ashlar boards. Preliminary results from sample analysis indicate the leaves were a bright red and the linking tendrils a dark red or purple.

Plates 449 & 450 Examples of the original scheme visible in raking light beneath the 1740s and 1830s overpaint. These are included to illustrate the continuing widespread occurrence of the original painted designs covered by later repaint but visible in relief due to weathering of the unpainted background surfaces. **Plate 449** shows that the end scroll design on a wave

pattern board was originally a more delicate design much and finely painted than variations in the trefoil shape and end scroll design on different boards. **Plate 450** depicts an elaborate variation in the original trefoil pattern design. Tracing made from numerous trefoils within Bays 2 and 3 showed considerable variation in shape even across a single board and proved they were not stencilled.

Replacement Boards with Frieze Decoration Underpaint

Plates 451 & 452 Examples of softwood replacement boards, which have as underpainting the same or similar foliate designs painted on the 1830s Ashlar boards. **Plate 451** is a detail of the red and black frieze design on a white background. This small section was protected from subsequent repaint by the overlapping board. **Plate 452** shows, under raking light, part of a sequence of 7 such boards within *Panel 27 II*. Only 15 softwood ceiling boards with the frieze decoration as underpaint were identified within the area covered by Phase 3. Of these 11 are within Bay 4, 4 in Bay 5 and none in the east half of Bay 6. It may be that we will find no further examples within the west half of the ceiling. The softwood ceiling boards with frieze underpaint are thought to be 1740s Ashlar boards, salvaged in the 1830s, and re-used as replacement ceiling boards. This theory was brought into doubt by the presence of barytes in the white underpaint of one sample obtained during Phase 2; however, this finding is considered to be an aberration since previous and subsequent paint samples taken from such boards had no barytes present.

1740S/1830S REPAINTING

Plates 453 & 454 Details of drapery within the angel playing trumpet lozenge photographed in incidental light and UV illumination. Losses within the overpaint have revealed earlier black line drawing, possibly original. The losses fluoresce strongly under UV illumination.

Plates 455 to 457 Examples of the paint layer exposed from under temporarily removed 1830s Ceiling bolts and washers. The 1740s paint has been protected from subsequent overpaint and surface accretions. These examples indicate the condition of the painted decoration immediately prior to the 1830s intervention and provide visible confirmation of the analysis findings and our interpretation of the conservation history. **Plate 455** shows the bright 1740s paint temporarily revealed within the face of the organistrum player. The extent of surface discoloration is illustrated by the narrow band of 1830s overpaint that has been protected from surface accretions under the rim of the square metal washer. **Plate 456** shows where a ceiling bolt covered the edges of an original board and an adjacent 1830s softwood replacement. On the original board 1730s red and white paint is revealed while there is no paint at all on the section of replacement board protected by the metal washer. **Plate 447** shows what was a very good example of the 1740s grey chevron decoration before it was overpainted: the 1740s chevron colour and the white 'leaf' motif detailing were clearly visible.

Plate 458 A finding during Phase 3 throws into doubt the view that the coloured bands board was not repainted in the 1740s. **Plate 458** shows the tip of a coloured bands board identified through observation from the scaffold as a 1740s softwood replacement. The 1830s overpaint does not extend to the tip so a small triangle of supposedly 1740s paint - a black band over a white background - remains exposed. If this is indeed 1740s paint it indicates the 1740s scheme on this board was similar to the 1840s overpaint: two coloured bands, black and red over a lead white ground on the outer half of the board, a grey/brown thinly applied wash covering the inner half. Further sample analysis of paint from original coloured bands boards is required to establish whether or not the outer coloured bands board was repainted in the 1740s.

Plate 459 & 460 A section of original board with stepped chevron decoration under raking light and UV illumination. One of the stepped chevrons shows the 1740s composite brown/black paint, the other has been overpainted with the dark 1830s black. Clearly the 1830 restorers neglected to complete their work on this board, but this section illustrates how they first painted over the white background and then more carefully defined the stepped black edge. Only if the 1740s paint was particularly damaged or discoloured did they repaint

the main body of each stepped chevron; presumably in an effort to save time and paint. The 1740s brown/black paint surface is considerably blanched. This damage may have resulted from preliminary surface cleaning during the 1830s restoration. Our own tests have shown that the paint from both interventions is moisture sensitive. **Plate 460** shows the area under UV illumination before treatment. Glue that has seeped through the gaps between boards onto the paint surface fluoresces a bright green.

Plate 461 Detail of an original stepped chevron board under raking light. This shows an 1830s composite brown/black paint that is indistinguishable in appearance from the 1740s composite brown/black. Were it not that the overpaint covers losses within the underlying 1740s paint as well as overlapping the white 1830s background paint, we would have taken it to be from the earlier intervention. Throughout Phases 1, 2 and 3 it has been a mystery to us why the 1830s restorers used such a wide range of black paints. On certain boards they seemed to take care to match closely the underlying paint, yet nearby they made no effort at all. Compare the 1830s black paint on the stepped chevrons in **Plates 459 and 461**.

Plates 462 – 470 A series of photographs in incidental light and UV illumination showing how UV light enhances the difference between the restorations.

Plates 462/3 show a wave pattern board with two layers of black paint: a thin matt black over a thick resinous black. In Bays 1, 2 and 3 the wave pattern – with one or two exceptions - appeared not to have been overpainted by the 1740s restorers: the 1830s black paint being directly over the wood. Observation from the scaffold suggests there are generally two layers of black paint on the wave pattern boards in Bays 4, 5 and 6a. Both layers resemble paint considered to be from the 1830s intervention. Although, there are numerous instances of two different layers of black paint on 1830s softwood replacement boards, it is possible that the wave pattern was indeed overpainted in the 1740s. Analysis of further samples from the black wave pattern boards is required.

Plate 464 shows 1830s white background paint on a wave pattern board covering the tip of a black stepped chevron design that, in the 1740s had extended over from the neighbouring board. That stepped chevron board was replaced in the 1830s.

Plates 465/470 are details showing how in UV light the 1830s white paint appears as a brown wash over the earlier white layer and that other unidentified residues which are practically invisible in incidental light show up clearly under UV.

GRAFFITI

Plates 471 & 472 As in Bays 1, 2 and 3 there is a lot of pencil graffiti on the Ashlar boards dating from the 1880's work of scraping the walls. Several names found in previous phases reappear, along with new ones including that in **Plate 472** 'H. Butler age 18 years 1890. Worked at this Cathedral scraping the whitewash off the walls'. There is also a cartoon/portrait? of a bearded man with glasses – **Plate 471**. Macreth suggested that the gentlemanly air of the figure may indicate a portrait of either the architect or some other 'important' figure, rather than a self-portrait of one of the labourers.

SURFACE ACCRETIONS

Plates 473 & 474 On the lower side of the ceiling within Bays 4, 5 and 6 it was just noticeable that less surface dirt had accumulated where the ceiling boards are backed by structural elements. As a result before surface cleaning it was just possible to discern the position of some ceiling joists from below. This preferential accumulation of dirt is particularly noticeable on the north and south transept ceilings.

Plates 475 & 476 As for previous phases of treatment surface cleaning was carried out in the following manner. Loose surface dust particles were brushed from the surface, using small and very soft brushes; the dust sucked into a vacuum cleaner nozzle held close by. Small, shaped pieces of the Wishab sponge were applied to the paint surface with gentle circular strokes

(Plate 475); with constant attention to guard against surface shine as well as disruption of loose paint or raised, granular particles. The particles of Wishab remaining on the surface were removed with a soft brush. This method achieves a satisfactory and uniform level of clean, removing much of the efflorescence and bloom as well as most surface dirt; however, a slight surface discoloration remains. Plate 476 shows an uncleaned witness area within a section of the Ceiling decoration during treatment.

- Plates 477 - 479** The patchy white surface accretions shown here in incidental and UL illumination are associated exclusively with the thick resinous black paint/ coating. Analysis by Dr Brian Ridout² indicates they are accumulations of irregularly shaped translucent, plate-like crystals. In Bays 4, 5 and 6 there were far fewer examples of these white patches than in previous phases. This is because there are fewer instances of the resinous black paint, applied in the 1830's as an outline retouching material.
- Plate 480** Detail of a matt white powdery deposit on the black of a wave pattern board. This may be an accretion not previously identified on the ceiling or it may be similar to the white crystalline deposits associated with the resinous black paint, applied in the 1830's. In any case it has been recorded as a separate category (matt white patches) in Phase 3. It occurs on the earlier of the two black layers on wave pattern boards - and on some extended chevron boards - where it is not covered by the matt black overpaint.
- Plates 481 & 482** Detail in incidental light and UV illumination of an unidentified patchy deposit found on the red background of a lozenge board.
- Plates 483 & 484** Examples of the surface bloom that occurs on the repainted backgrounds of the lozenge boards, where the 1830's red and blue has been laid over the olive green or red of the 1740's. It is patchy, white, and matt. It can be reduced with a Wishab.
- Plates 485 & 486** Examples of blanching. This is prevalent on the 1740s composite black paint of the base boards, stepped & grey chevrons. It may be moisture damage resulting from surface cleaning in the 1830s. This is a permanent change in the paint structure. The visual appearance includes the washed-out, white 'spotting' and the denser white areas often found on the edges of boards with brown/black paint. **Plate 486** also shows large white spots on the edge of the board. These may be residue from water drips.
- Plate 487** Detail of around the edges of a split. This is similar to the 'chalk line' efflorescence before now associated exclusively with wave pattern boards. In Bays 4, 5 and 6 very little 'chalk line' efflorescence was found largely because the different paint layers on the wave pattern boards.
- Plates 488 - 490** Minute white deposits found on the red band of a coloured bands board. The deposits had the appearance of efflorescence and were removed by cleaning with a Wishab sponge.
- Plates 491 & 492** Further examples of efflorescence: along the edge of a board (**Plate 492**) and on the edge of a grey chevron(**Plate 491**).
- Plates 493 & 494** Examples of possible microbiological growth. **Plate 493** depicts a brown deposit surrounding an insect body. Plate 494 shows a white accretion found on the end grain of a ceiling board.
- Plates 495 & 496** Details in incidental light and UV illumination of an unidentified, clear surface coating overlying the paint on one section of an 1830s board. This was the only example of a surface coating within Bays 4, 5 and 6a.
- Plate 497** An example of resin that has exuded through the paint layer from a knot on an 1830s softwood replacement board..

² Dr B Ridout. Unpublished letter to J Limentani, 16 June 1999.

Plates 498 & 499 An area of decoration on the Ashlar boarding in incidental light and UV illumination with staining and surface accretions consistent with bat urine and degraded faeces.

FLAKING PAINT

Plates 500 to 511 In Bays 4, 5 and 6a there was much more flaking paint than in the two previous phases, particularly on the lozenge boards. At the time of writing there is no apparent reason for this. Analysis of paint samples taken from the lozenge boards may find a variation in technique. This paint damage was generally in the form of large flakes that had lifted rather than the micro-flaking found in Phases 1 and 2 and the scrolling or cupping flakes treated in the Emergency phase. **Plates 500/501, 502/503, 507/508 and 509/511** depict examples of such paint flaking paint, in raking light, before and after treatment. **Plates 504 and 505** are further examples of flaking paint on lozenge boards and **Plate 510** shows drapery on the Angel Playing Trumpet lozenge following paint re-attachment and during surface cleaning. **Plate 506** shows shrinkage cracks within the thick layer of 1830s paint layer on the edge of a grey chevron board.

Plate 512 & 513 Showing the process of paint re attachment. Following pre-wetting with industrial methylated spirits, a 5% solution of Plextol B500 is injected behind the paint flake (**Plate 512**). The flake is pressed black into place and then gentle heat and pressure applied with a tacking iron through a protective layer of polyester film.

SURFACE GLUE

Plates 514 to 517 Details showing typical damage caused by thick glue drips over the paint surface before treatment. The water-soluble animal glue was used to adhere hessian to the Ceiling boards upper side during the 1926 intervention. The liquid penetrated between the boards, accumulating on the horizontal board edges and in places running across the surface of the Ashlar boards and canted ceiling boards. In these examples the thick glue has contracted and detached from the surface pulling away the underlying paint. **Plate 514** show glue drips on a curved-edged horizontal board before treatment. In **Plate 515** the glue trail along the edge of a board has contracted massively, pulling away the underlying paint and curling back on itself. **Plate 516** show the paint affected by a thick glue trail has lifted and cupped. **Plate 517** shows the same area after treatment. It was not possible to re-attach all the glue affected paint.

Plates 518- 522 A series of photographs before treatment in incidental light and UV illumination illustrating that UV light is particularly helpful when checking for glue residue during the treatment process. **Plates 518/519** show how the glue has formed puddles on these horizontal, central lozenge boards. **Plate 520** shows how the glue has splashed laterally through a gap between boards. **Plate 522** depicts a section of canted panel in UV light with numerous glue trails across its surface.

Plates 523 to 530 Examples of glue trails on canted ceiling boards before, during and after treatment. The 'blanched' or 'cleaner' areas of paint resulting from glue removal were toned down with water-colour paints to match the surrounding Wishab cleaned paint. **Plates 523/524/525** show an area during glue removal, following glue removal but before reintegration with water-colour, and after treatment respectively. **Plates 526/527/528** show a different area in the same sequence. **Plate 529** is a detail following the removal of two glue trails, during the reintegration process. **Plate 530** shows a conservator applying the water-colour paint to a blanched area.

STAINING AND WATER DAMAGE

Plate 531 to 538 There are a number of different categories of staining, all resulting from liquid material penetrating down between the boards or through cracks in deteriorated boards. **Plates 531 to 533** show a dark stain over the 1830s repaint before and after reduction and after reintegration of the resulting blanched area: acetone was the solvent used to remove the stain. Analysis of a sample from a similar stain in Bay 1 indicated the presence of shellac

in the stain material.³ It is likely a preservative material used to coat roof timbers caused the stain. **Plates 534 to 536** depict, in the same before during and after sequence, widespread trails of a light brown material across a canted panel. **Plate 537** show characteristic light-brown drips on the edge of an original board. These were prevalent across Bays 1, 2 and 3 but occurred less frequently across Bays 4, 5, 6a.. Plate 538 shows a conservator removing a stain with solvent applied with a swab.

Plates 539 to 546 Examples of staining and water damage on the Ashlar boards. **Plate 539/540(UV)** show stains resulting from a light brown liquid being spattered onto the paint surface. **Plates 541 to 543 and 544 to 546** show two areas particularly affected by surface stains, water damage and glue drips in before, during and after treatment sequence.

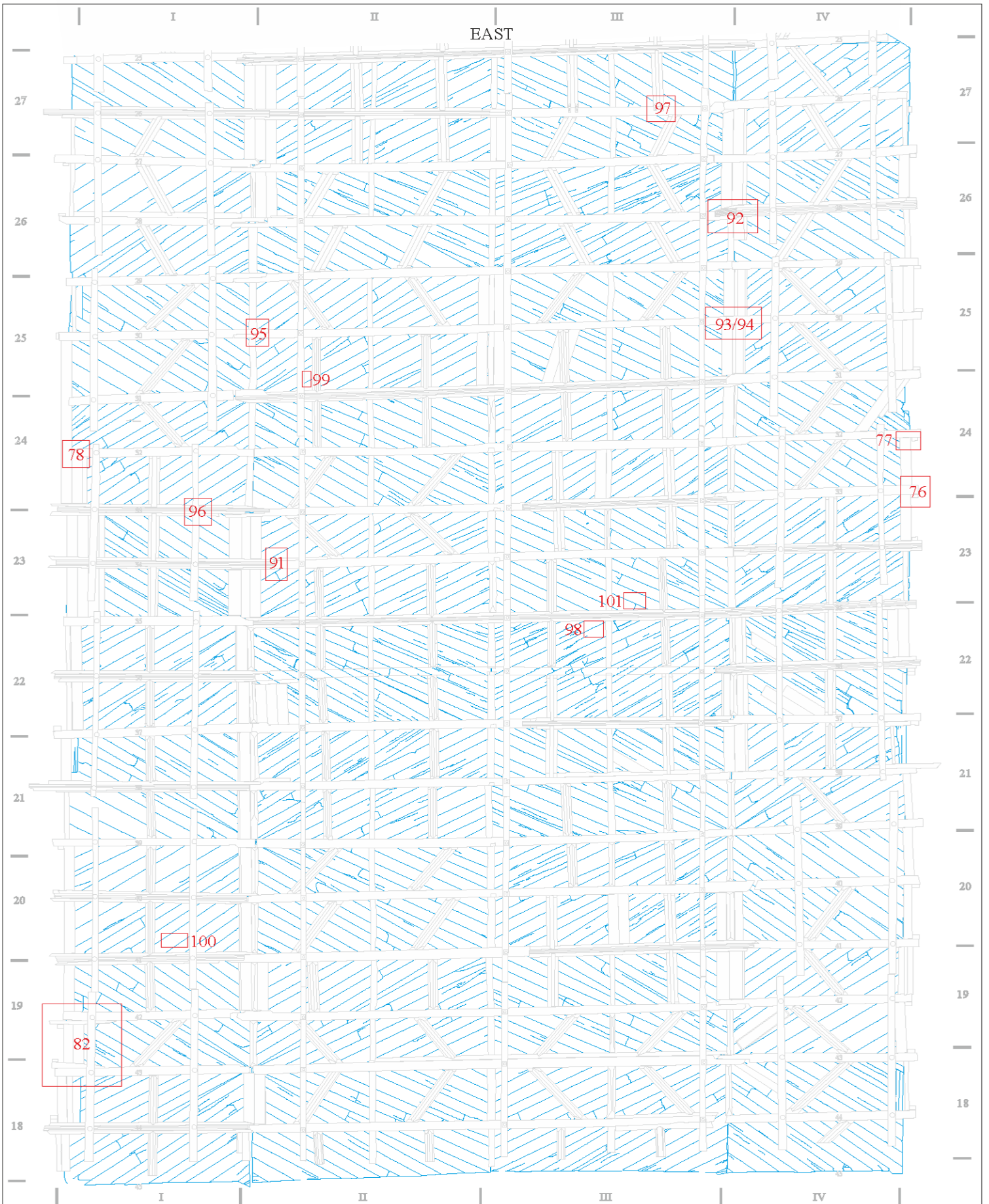
REINTEGRATION OF UNPAINTED STRUCTURE



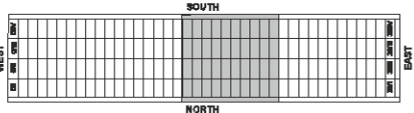
Plates 547 to 552 During this phase some areas of distracting wood loss and unpainted gaps between ceiling boards were disguised by inpainting the exposed edge of damaged board or underlying structural elements such as softwood patch, hessian and, at the junction between canted and horizontal panels, noggins. **Plates 547/548** before and after reintegration of a gap between the horizontal and canted panels of the organistrum player lozenge. **Plates 549 to 551** show an area at the junction of the canted ceiling boards and Ashlar boards in Rows 24/25 on the south side. In **Plate 549** the gap on the right of the photograph has been reintegrated, the gap on the left is still unpainted. **Plate 550** shows a section of white painted softwood inserted in the 1830s to fill a gap. **Plate 551** shows after reintegration the same softwood insert in Plate 550 and the unpainted gap from Plate 549. **Plate 553** depicts a reintegrated section of hessian visible through an area of wood loss.

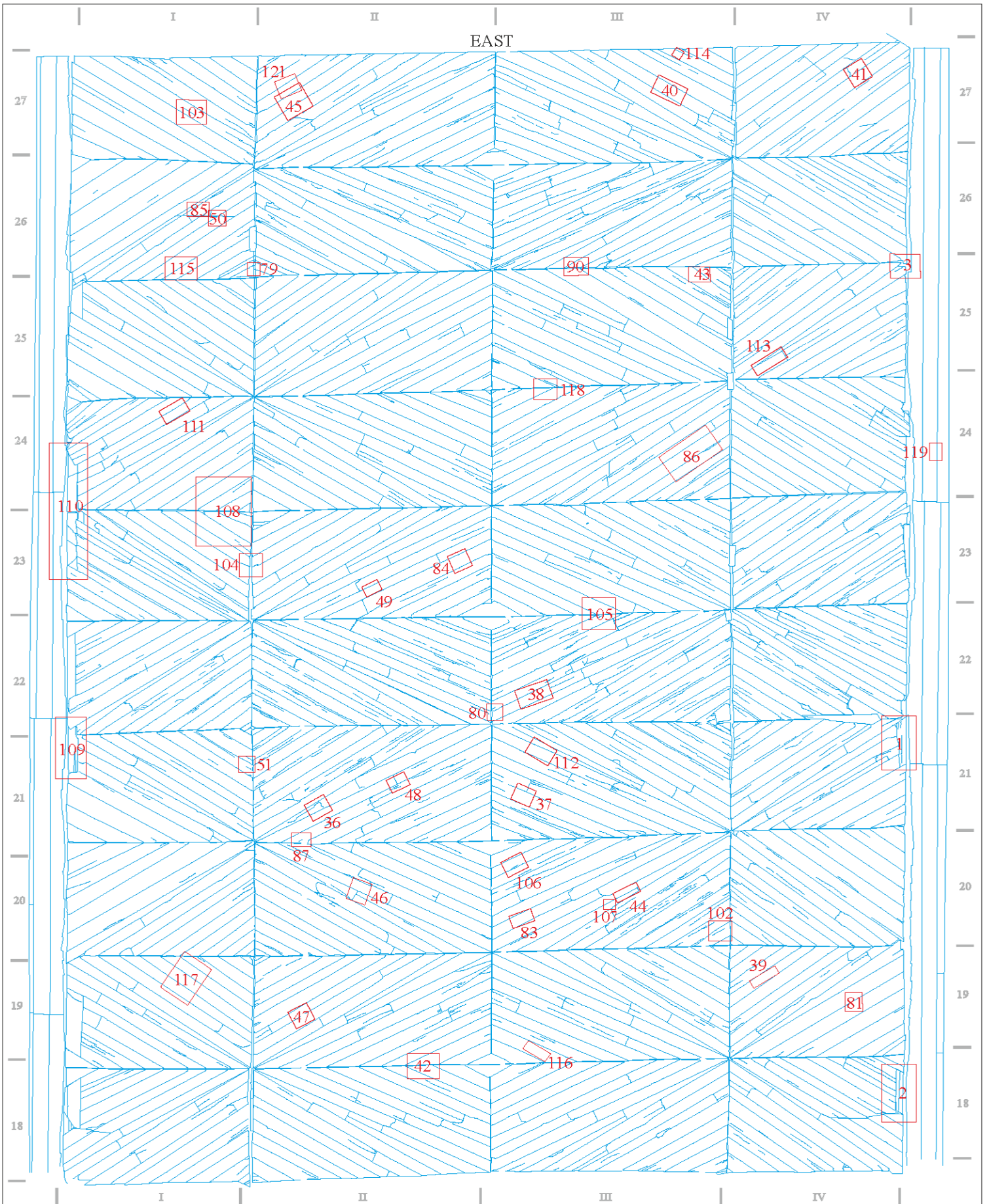
Plate 553 As an added precaution against loss of both wood and overlying paint, following consolidation treatment, a filler was inserted to secure vulnerable edges where appropriate. **Plate 553** shows, before reintegration, the filler applied to the damaged edges of a number of straight edged boards.



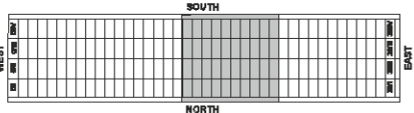
Plate 554 Detail showing two stainless steel screws and washers inserted during this phase to secure a softwood board. All visible stainless steel fixings are disguised with acrylic paint.

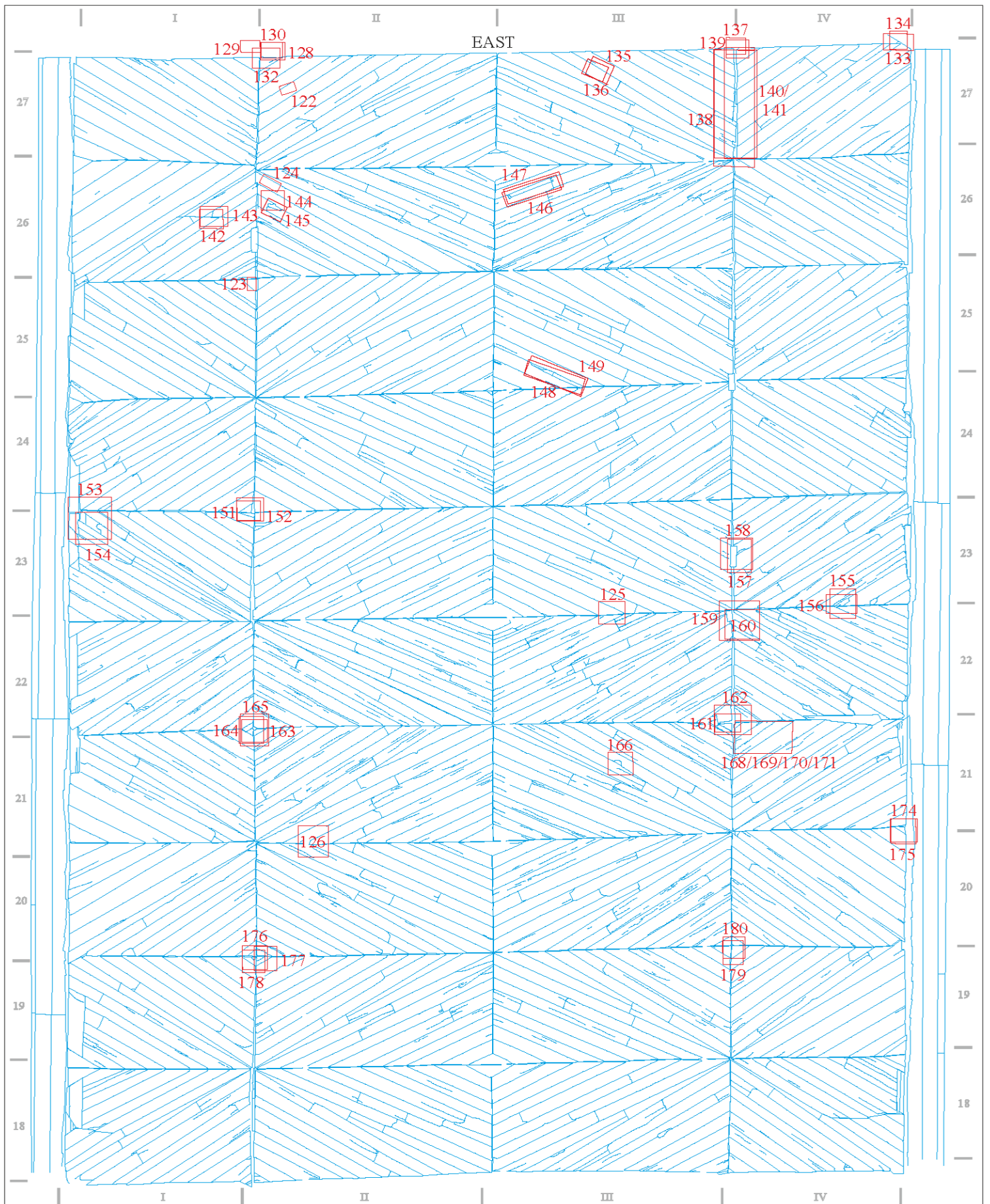
³ Howard 1998: Sample 11



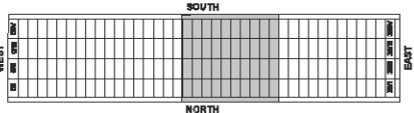
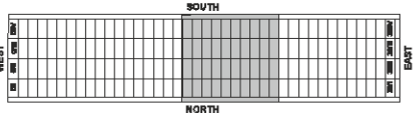


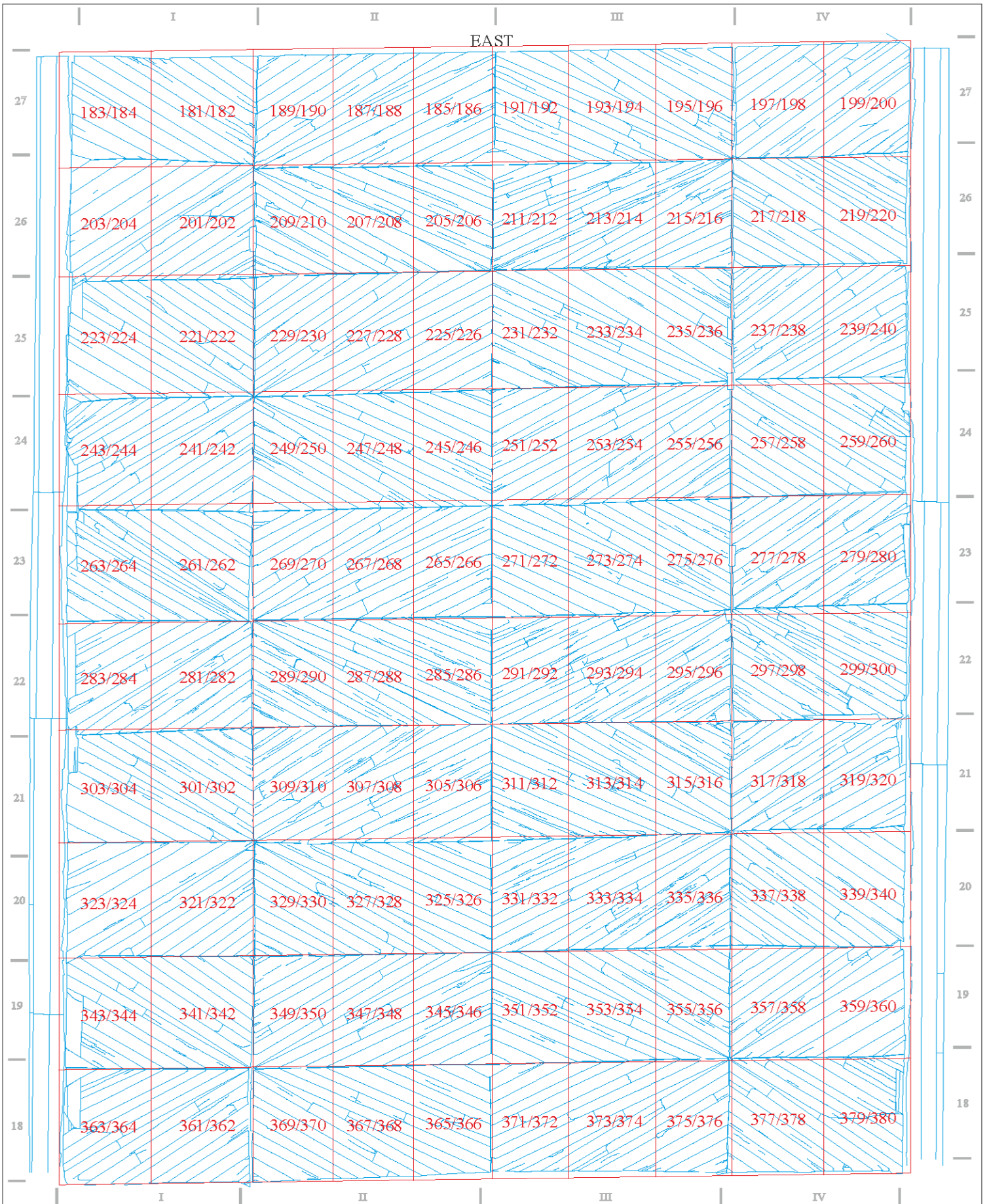
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Plates are in before and after treatment sequence. Ultraviolet (UV) illumination photographs taken before treatment.	TITLE PETERBOROUGH CATHEDRAL - NAVE CEILING Conservation Programme Phase 2 (May - October 2000)		PHOTOGRAMMETRY COURTESY OF ENGLISH HERITAGE SURVEY TEAM & PHOTARC SURVEYS LTD. THE PERRY LITHGOW PARTNERSHIP 1 LANGSTON LANE, STATION RD, KINGHAM, OXON OX7 6UW Tel. 01608 658067
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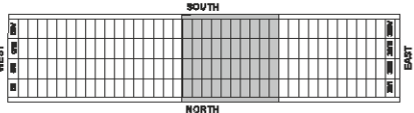


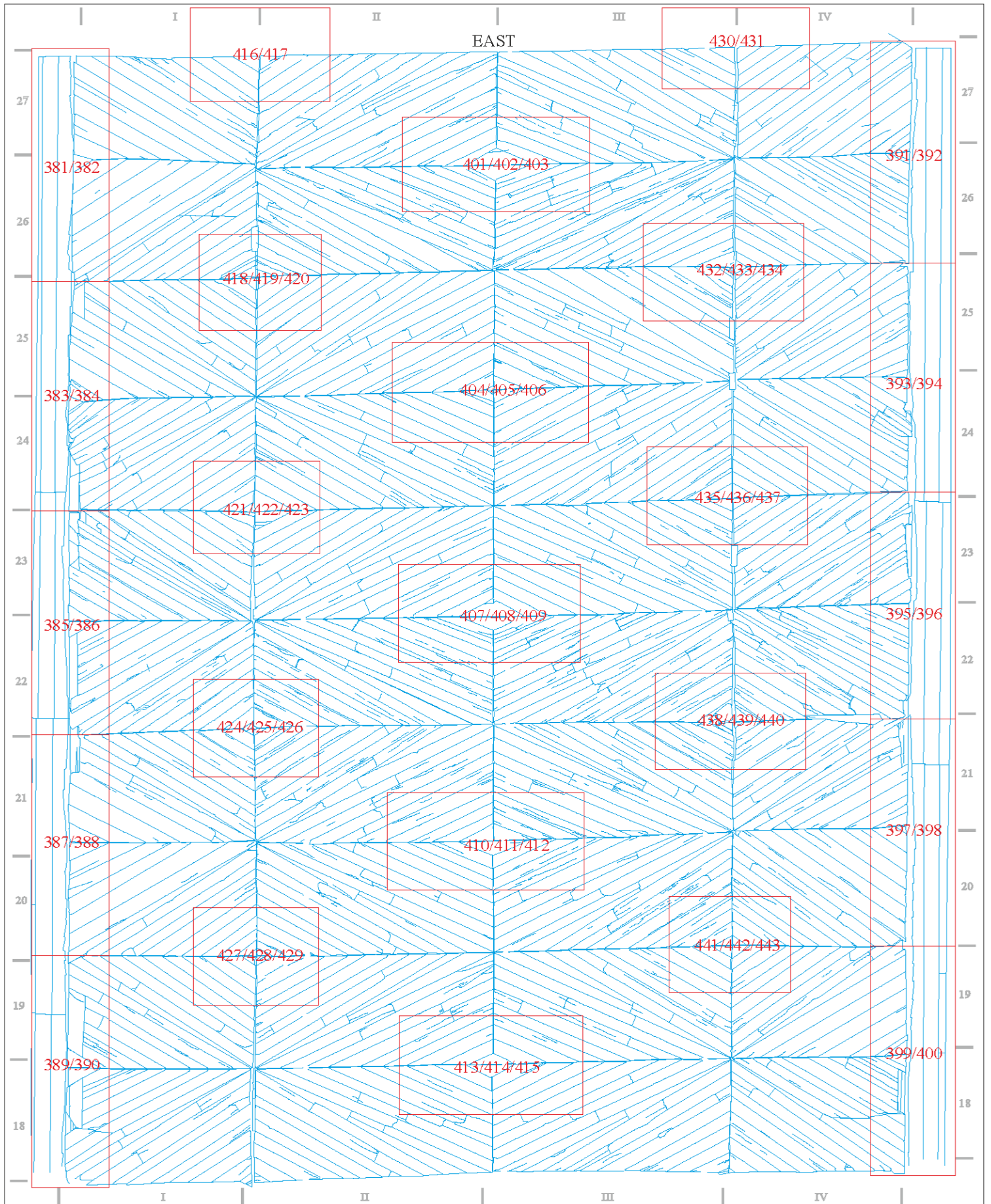
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	STAGE CONDITION SURVEY AND TREATMENT	DESCRIPTION PLATE REFERENCE SHEET	THE PERRY LITHGOW PARTNERSHIP 1 Langston Lane, Station Rd, Kingham, Oxon OX7 6UW Tel. 01608 658067



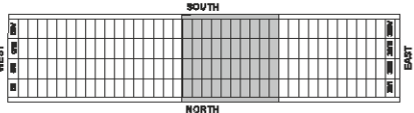


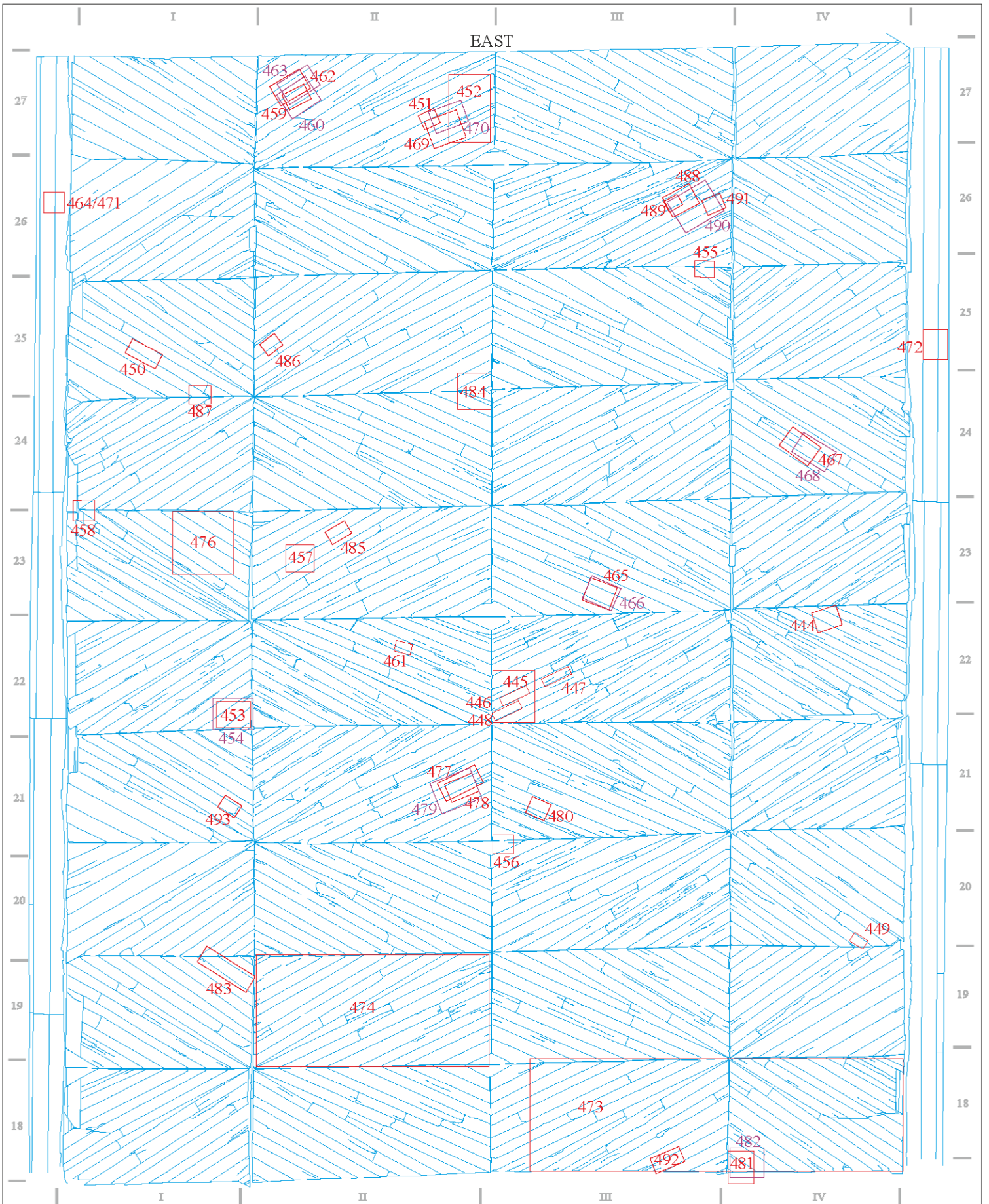
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	STAGE CONDITION SURVEY AND TREATMENT	DESCRIPTION PLATE REFERENCE SHEET		



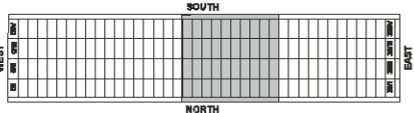


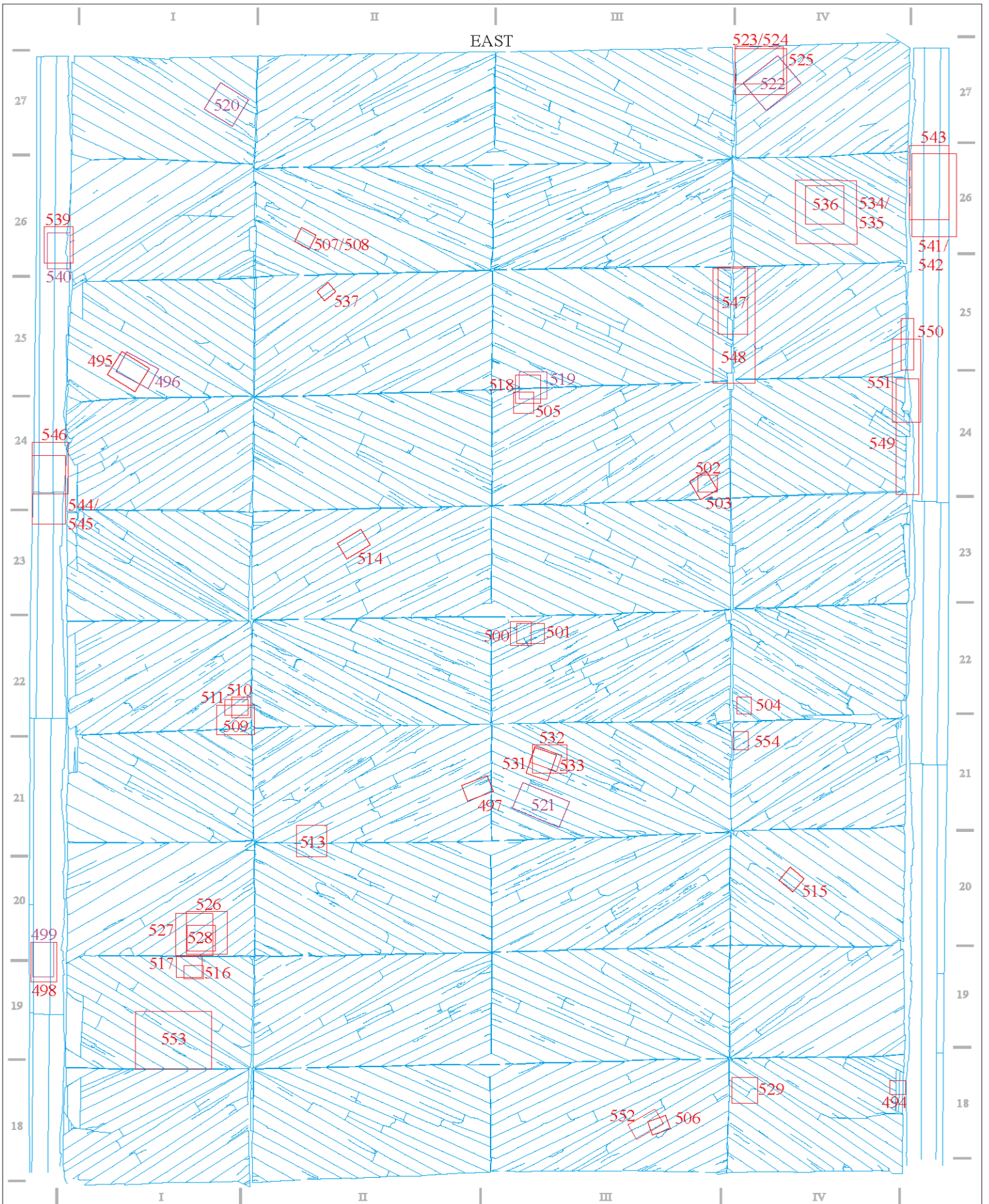
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Location of Plates: 181-380	SCALE c. 1:70		POSITION Bays 4, 5 & 6 
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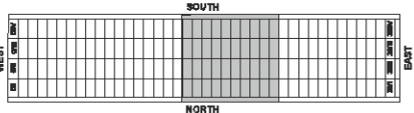


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		DESCRIPTION PLATE REFERENCE SHEET	Photogrammetry courtesy of English Heritage Survey Team & Photarc Surveys Ltd. The Perry Lithgow Partnership 1 Langston Lane, Station Rd, Kingham, Oxon OX7 6UW Tel. 01608 658067



Sheet Number: 7			LOWER SIDE OF STRUCTURE
Location of Plates: 444-493	SCALE c. 1:70		POSITION Bays 4, 5 & 6 
Plates are in before and after treatment sequence. Ultraviolet (UV) illumination photographs taken before treatment.	TITLE PETERBOROUGH CATHEDRAL - NAVE CEILING Conservation Programme Phase 2 (May - October 2000)		PHOTOGRAMMETRY COURTESY OF ENGLISH HERITAGE SURVEY TEAM & PHOTARC SURVEYS LTD. THE PERRY LITHGOW PARTNERSHIP 1 LANGSTON LANE, STATION RD, KINGHAM, OXON OX7 6UW Tel. 01608 658067
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Location of Plates: 494-554	SCALE c. 1:70			POSITION Bays 4, 5 & 6 
Plates are in before and after treatment sequence. Ultraviolet (UV) illumination photographs taken before treatment.	TITLE PETERBOROUGH CATHEDRAL - NAVE CEILING Conservation Programme Phase 2 (May - October 2000)		PHOTOGRAMMETRY COURTESY OF ENGLISH HERITAGE SURVEY TEAM & PHOTARC SURVEYS LTD. THE PERRY LITHGOW PARTNERSHIP 1 LANGSTON LANE, STATION RD., KINGHAM, OXON OX7 6UW Tel. 01608 658067	
	STAGE CONDITION SURVEY AND TREATMENT	DESCRIPTION PLATE REFERENCE SHEET		