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Condition Assessment and Treatment Recommendations for the Nave and South Aisle Ceilings

St Bridget's Church, Brigham, Cumbria

Diocese of Carlisle

July 2012

St Bridget's Church
BRIGHAM

Contents

1. Project Summary

Scope:	To provide a condition report and conservation recommendations for the nave and south aisle ceilings following replacement of failed plaster and timber, at St Bridget's Church, Brigham, Cumbria.
List Entry Number:	1145196
Listing:	Grade I
Date first listed:	03-Mar-1967
National Grid Reference:	NY 08582 30921
Name and Address of Client:	Bruce Mumford 32 High Rig Brigham Cockermouth Cumbria CA13 0TA
Name and Address of Architect:	Elaine Blackett-Ord Blackett-Ord Conservation Architecture 33 Chapel Street Appleby Cumbria CA16 6QR
Name and address of Conservators who undertook the inspection:	Amanda White & Cassandra Booty Hirst Conservation Laughton Sleaford Lincolnshire NG34 0HE
Date of Survey:	12th June 2012
Author and date of conservation report:	Amanda White, Hirst Conservation July 2012
Methods Employed:	Inspection of the nave and south aisle ceiling decoration from 2 fixed tower scaffolds and from ground level; brief inspection of the exterior from ground level; preliminary moisture profiling; preliminary cleaning tests; further investigation and analysis of paint; documentation of observations, including full photographic record; provision of recommendations for treatment.

2. Introduction

Following a preliminary visit to the church by Elizabeth Hirst on 12th December 2011, Hirst Conservation was commissioned to undertake a condition assessment of the nave and south aisle ceilings at St Bridget's Church, Brigham.

It is understood from the Parish that water ingressed from a valley gutter about 3 years ago and this caused damage to timber and plasterwork. This has now been remedied, and the areas of failed plaster and timber replaced. The remaining works consist of the restoration of the painted ceilings to the east end of the nave and south aisle.

An inspection was required to allow the current condition in these areas to be assessed, and for informed conservation proposals to be provided. The condition survey was undertaken by Amanda White and Cassandra Booty of Hirst Conservation, on Tuesday 12th June 2012. Access, which was provided by the Parish, was from 2 fixed tower scaffolds; one under the area of replaced plaster at the east end of the nave, and the other at the east end of the south aisle.

The church clearly retains significant 19th century painted ceilings and it is understood from Elaine Blackett-Ord that decoration of this kind is quite rare in Cumbria. In addition, the detailing is more elaborate than many ceilings of this kind, depicting sacred monograms and foliate designs.

3. Description, History and Significance

3.1 Description and History

Figure 1. St Bridget's Church, Brigham from the south (12th June 2012).

The parish church of St Bridget is located at the far north of the village of Brigham, near Cockermouth, Cumbria. It was Grade 1 listed by English Heritage in 1967.

Figure 2. Map showing the location of St Bridget's Church to the north of the village of Brigham[1].

[1] Taken from website: http://list.english-heritage.org.uk/resultsingle.aspx?uid=1145196. Accessed on 26/06/12.

The church, believed to date from the late 11th century, has 12th, 13th and 14th century additions and alterations, and was largely restored by Victorian architect William Butterfield in 1864-76. It is constructed from calciferous sandstone ashlar, and has a graduated green slate roof with coped gables, cross finials and shaped ridge tiles. The church consists of a 3-bay nave and south aisle, a 2-bay chancel with a north vestry, a square 3-storey west tower and south porch[2], see figure 3 below[3]. The stencilled roofs in the Nave, south aisle and chancel are part of the Butterfield restoration and date to 1865 and 1875.

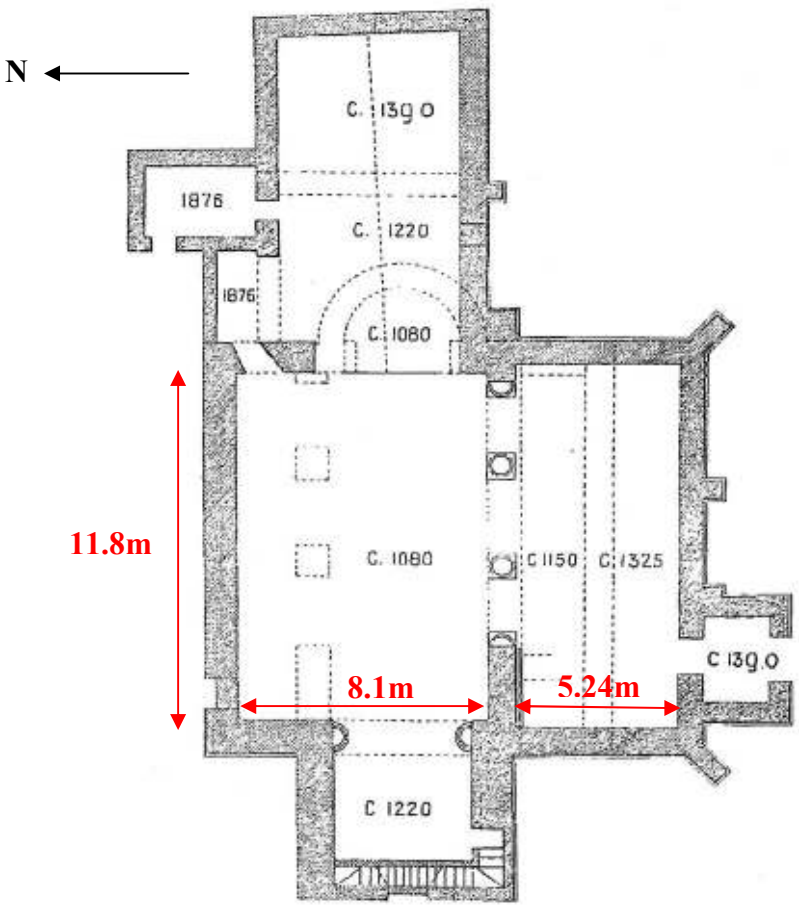


Figure 3: Plan of St Bridget's Church showing approximate dimensions.

The 3-bay nave has a painted timber. There is a blocked north doorway under a round-headed niche, 19th century 2-light windows and a pointed chancel arch.

The south and east chancel walls were partly rebuilt as part of the 19th century restoration, but the lower courses retain a small rectangular window and blocked priest's doorway on the south wall. In 1875-6 the chancel was restored by Butterfield, at a cost of approximately £4,000 (paid for by Lord Lonsdale), with a vestry and organ chamber added. The purpose was to repair the whole building, preserving old

[2] Taken from website: http://list.english-heritage.org.uk/resultsingle.aspx?uid=1145196. Accessed on 26/06/12.
[3] Fletcher, I. (1878) '*Brigham Church*', Reprinted by Rev Christopher Goddard, 1996, p3.

work as much as possible and, where old work had disappeared or been defaced, to replace it as nearly as possible to the original appearance.[4]

The south aisle was rebuilt in the early 14th century and the south doorway has a re-used late 13th century arch. It is known that in 1323 rector Thomas de Burgh founded a chantry in the chapel of St Mary, which is probably the present aisle. Various sculptured fragments from the medieval and earlier church are located within the aisle, which also contains a piscina, triple sedilia and canopied tomb to Thomas de Burgh, treasurer of Ireland, who died about 1337. It has a characteristic almond shaped west window, with a sunk quadrant moulding and a slight ogee tip. The east and south windows in the aisle are by Butterfield (1864 – 76) as is the 1876 painted timber ceiling[5].

The tower dates from around 1220, though William Butterfield added the saddle-back top storey during the restoration of 1864-76. There is a blocked 14th century west door, which has a medieval cross slab built into it on the interior.

Records held at the CBC library were searched (file CARE 07/316), but very little information on the history of the decoration and previous interventions were found, other than the booklet by I Fletcher. A letter dated 2nd February 2001 from William Hughes, Honorable Treasurer, to the CCC requesting funding states: Following the Quinquennial survey, essential repairs were recommended by the architect, including repairs to the gullies and gutters. The following photographs were also on file, showing the church before and after Butterfield's restoration.

Figures 4 and 5: Photographs of St Bridget's Church, Brigham dated 1863 (left) and 1876 (right), before and after Butterfield's restoration.

3.2 Significance

Painted decoration is not very common in Butterfield's architecture, with about a dozen painted roofs, including Ottery (1849) and Keble (1876), but mostly wooden ceilings picked out with formalised flowers, stars and monograms, such as at Langley,

[4] Ibid, p24.
[5] Pevsner, N (1980), Buildings of England: Cumberland and Westmorland, Penguin Books Ltd, Harmondsworth, pp 78-79.

Kent and Brigham.[6] "By far the most attractive tie-beam roof.. is at Brigham in Cumberland, where gay painted patterns set off the foliated principals and posts.[7] These paintings were executed by a variety of artists, including village craftsmen at Brigham, and it is thought that Butterfield must have supervised the work closely.[8]

Statement of Significance by Elaine Blackett-Ord

The unusual and almost complete painted plasterwork and timberwork ceilings of the Nave, Chancel and Aisle of St Bridget's formed part of the later, extensive restorations carried out between 1864 and 1876, by William Butterfield, (1814-1900), a leading architect of the early Ecclesiological movement of the mid nineteenth century and whose influence is recognised today as one of the forebears of the modern movement in architecture.

Butterfield, a London architect, worked extensively across the north of England during his early to middle period, where he carried out restoration at St Bega's Priory at St Bees (1855), and built new churches at St Mark's Church, Cautley (1847) and St Michael's Church, Lamplugh (1870). His work at Brigham spans the period after the mid-century revolt against pure imitation of early medieval design and the later reaction in the 1870's against robust High Victorian Gothic novelty. However, the glories of High Victorian originality can be seen best at Brigham in this highly significant and important work, where the rich and varied expression of soaring roofs are embellished and decorated on all surfaces. Here the exuberant patterned ceilings set off the foliated trusses, principles and posts of the roof structure and contrast delightfully with the older architecture, but do not overshadow it. The overall effect is light and airy with none of the over-ornamentation and heaviness of his later dark and polychromatic work.

Decorated roofs are not very common in Butterfield's work and mainly comprise painted wooden ceilings picked out with stars, foliage and monograms. Brigham is one of very few painted plaster schemes and has a lightness of touch. He was influenced in this art by his pupil master, the antiquarian scholar and architect, E L Blackburne, the author of a history of applied decoration applied to English architecture, *Decorative Painting of the Middle Ages (*London 1847).

The painting was carried out in 1876 by trusted local village craftsmen, the Robinson family, to Butterfield's full size cartoon designs and under the close supervision of the architect, adding to the home-grown significance of this work of exceptionally high quality.

The roofs and ceilings formed part of a wider scheme of interior design and applied arts, including metalwork, the lectern and low screen at the Chancel arch (now lost), and an extensive joinery scheme of pews, the pulpit and the inner entrance lobby.

The painted decoration in St Bridget's has survived in remarkably good condition for almost 150 years and is one of the glories of this exceptional Grade 1 listed church. It's importance cannot be understated as it remains one of only a handful of examples

[6] Thompson, Paul (1971), *William Butterfield,* Routledge & Kegan Paul, London, p457.
[7] Ibid, p196.
[8] Ibid, p457.

of painted decoration in Cumbrian churches[9], as part of a wider scheme of restoration and, conceivably, formed part of a more extensive design, included wall paintings or stencilling, none of which remains except possibly beneath layers of limewash and paint.

[9] Early examples are rare: Dacre Hall, Lanercost, (1500's) being the most complete, and there are no surviving medieval examples in Cumbrian churches, Kirkby Hall in Furness (1530) being the rare survival in a disused private chapel. Decorated work was painted or stenciled onto plain walls with repetitious patterns and later in richer colours. Early timber ceilings are also rare with only the reused C17 ceiling panels in Topenhow church remaining. Fragments of the Lord's Prayer and other religious texts painted onto wall survive at Ulpha and later examples at Grange, Borrowdale. Most examples, although surprisingly few, date from the mid nineteenth century at Wreay church (1840), Warwick Bridge Our Lady and St Wilfrid by Pugin (1841), St Bees (1855), and the tradition continued with the painted ceiling of Carlisle Cathedral by Phillip Webb (1870's) and later work by Stephen Dykes-Bower at Wigton St Mary and elsewhere in the 1950's.

4. Condition

Assessment of the interior and exterior of St Bridget's Church was undertaken to enable an understanding of the ceiling and its context in the surrounding fabric and the building envelope. By understanding the rainwater expulsion system and drainage, and the fabric of the building, potential/current hazards can be identified and noted. A photographic survey of the condition of the church can be found in Appendix 1.

4.1 General Condition of the Exterior

The evaluation of the condition of the exterior is based purely on observations made from ground level as no access was available to higher levels of the building. In general, the condition of the exterior of the church does not appear to be having a detrimental impact on the condition of the painted decoration within the church. However, the following observations were noted:

Most areas of the slate tiled roof appear to be in a generally sound condition; some lead grips and wires are evident on the west side of the south porch, holding some tiles in place, and there is a broken tile to the lower west side of the vestry roof. The lead flashing also appears to be in relatively good condition; some areas of replacement cement flashing were noted to west end of the nave roof, north side (see figure 11). In addition, many of the decorative ridge tiles have lost the upper sections of moulding.

There is extensive re-pointing to the north side of the nave and to all faces of the tower, figures 12 & 13. There appear to be at least two phases of repointing, one of which is cementicious. The later re-pointing is failing in several areas, particularly on the north and west faces of the tower, where a pile of pointing and disaggregated stone work can be found on the ground. The surface of the stonework in this area is particularly weathered. The prevailing winds come from the west, buffeting the tower with driving rain.

Figure 6: Aerial photograph of St Bridget's Church, by Simon Ledingham[10].

[10] Taken from website: http://www.visitcumbria.com/wc/brigham-st-bridgets-church.htm. Accessed on 26/06/12.

There are also areas of failed pointing on the south wall of the south aisle and at the east end of the chancel, again much of it cementitious. There appear to be traces of a previous render in numerous areas on the chancel walls, suggesting it may have been rendered in the past.

A gully runs around the base of much of the church, which the guttering and downpipes run into. There are several drains in the gully, most of which are clear from debris, however, the drain at the east end of the south aisle gully is blocked with silt. Some biological growth is evident in the gullies, particularly on the north side of the church, figure 18.

The gutter on the west side of the porch has split slightly (figure 14) and the gutter to the east side of the vestry has dropped at the end. There is a lot of white staining and flaking paint to this section of guttering, suggesting it blocks and overflows regularly. There is small overflow pipe about 2 ½ feet above the ground coming out of the north wall of the vestry (see figure 16). Iron corrosion staining can be seen to the stonework below, and the surface of the stone is quite friable, suggesting water overflows regularly.

There are large areas of lichen on the stonework of the church, particularly at low level, and localised areas of larger plant life such as ferns and grasses, in several areas (figure 17); there is significantly more biological growth on the north side of the church. Areas of grass, ferns and mildew are evident, particularly around the steps down to the undercroft/basement, where it is very damp. A holly bush is located against the west wall of the south aisle, beneath which the drain is blocked with leaves.

4.2 Interior

A survey of the ceilings was undertaken and the findings were recorded and transcribed onto plans of the ceilings (see Appendices 2 and 3). The ceilings were visually assessed in diffuse and raking visible light and the condition and visible extent and nature of failure was recorded. The results of this investigation provide an archive document for future reference and will allow comparison of any ongoing failure in the future.

<u>General condition:</u>

- Generally a lot of surface dirt and cobwebs.
- It is clear that there has been some water ingress in numerous areas, highlighted in the ceiling plans in Appendices 2 and 3, presumably as a result of the blocked gully.
- Flaking paint is evident in some areas, particularly in areas of previous water ingress.
- It is believed that repairs to the roof in 2010 stabilised the condition within the church and halted water ingress.

Nave

The plaster nave ceiling has 4 bays of full panels and 2 bays (one at each end) of part panels, each bay consisting of 6 panels (see figure 19 and Appendix 2). The 6 bays are separated by 5 timber tie beams, and all surfaces are decorated with stencilled designs and applied gold stars.

Substrate:

Two of the western-most part panels on the south side of the nave ceiling have been replaced with new plaster, and have yet to be repainted (figure 20). These were replaced following a leak from a blocked gully, and all of the part panels in this western-most bay are suffering from water damage. The 4 part panels that have not had their plaster replaced, all show signs of water ingress; there is a whitish bloom and salts evident, particularly to the lower panel on the north side (see figure 21).

At the far south east corner of the nave, the lower third of two full and one part ceiling panel have had the plaster replaced, and have yet to be repainted (figure 22). This damage was again as a result of water ingress from the blocked gully. The replacement plaster is clearly lime based, but the surface is quite rough and the junction between the earlier and replacement plasters is stepped and uneven (see figures 23 and 24). A large section of wall plaster has also been replaced in this area. The ends of the two easternmost beams, trusses and spandrels have been spliced in to the existing, to replace rotten timber.

There are numerous fine fractures in the plaster panels, but these exhibited no movement and do not sound hollow, so can be presumed to be stable. Unfortunately on the day of inspection it was not possible to closely asses each panel from the access tower, so it is impossible to comment on the structural stability of most areas of the ceiling. Some of the fractures in the plaster appear to have been present before the painted scheme was applied, as paint can be seen over the edges of the fractures.

Paint Layer:

Initial inspection on site suggested the decoration has been undertaken in a distemper type paint; they are very porous and soluble in water. Testing for lead by the addition of sodium sulphide was negative, indicating that no lead is present. The paint on the timber areas appears to be under-bound as it is powdery and can be wiped away with a dry finger. The ceiling flats appear to be harder wearing; samples have been taken from both areas for analysis, results of which are discussed in the following section.

The painted surfaces are heavily soiled; there are cobwebs running along the panels and beams and numerous water stains are evident, particularly on the tie beams and trusses (see figures 25 and 26). There are also splashes of plaster on the paint surface of the panels and timber beams surrounding the replaced panels (figure 28). Areas of original paint have been lost by wiping away residues during repair, particularly evident on the timber beams (see figure 27).

Numerous areas of flaking paint are evident, particularly on the timber spandrel, where the paint surface is heavily crazed and along the edges of fractures (figure 29). Generally the flaking is evident along the grain of the wood, which suggests that this

flaking is as a result of expansion and contraction of the wood, possibly due to the previous water ingress or condensation events within the church (figure 30). Areas of paint fell away when it was touched, so extensive pre-consolidation may be required prior to any cleaning being undertaken.

Around the corbel block to the western-most tie beam, on the south side of the ceiling, there is evidence of water ingress. The surface of the paint is disrupted, with some areas of paint loss and evidence of salt efflorescence.

Stars:

The gilded stars are made of lead and are attached to the ceiling with brass screws. Although slightly dull in appearance they are in good condition and appear to be reasonably stable. Their appearance could be improved with surface cleaning with a weak solution of ammonium hydroxide.

South Aisle

The barrel vaulted south aisle ceiling consists of 80 plaster panels (10 bays of 8 panels) separated by timber frames, with applied gilded stars in the corners of the frames (see figure 31).

Substrate:

The lower four ceiling panels in the far north east corner of the south aisle have been replaced, following extensive damage from water ingressing from the blocked gully, and new timber frames spliced in. Several panels towards the west end of the ceiling, and the wall beneath, also show signs of previous water ingress, including staining, disrupted plaster surface and water run off marks (see figures 32-34).

On close inspection, some fine fractures in the plaster panels were noted, although these can't be seen from ground level and they appear to be stable, with no movement detected in the area examined (figure 38). As it was not possible to closely assess each panel from the access tower, it is impossible to comment on the structural stability of most areas of the ceiling, although no significant fractures or bulging in the plaster were evident. There are some holes in the replacement timber frames that have not been filled.

Paint Layer:

As for the nave ceiling, all surfaces of the ceiling are painted with stencilled decoration, and a similar paint type and palette has been used. The quality of the stencilling on this ceiling does not appear to be as refined as the nave.

There is a large build up of surface dirt, dust and cobwebs (see figures 36 and 39). The timber frames surrounding the replacement panels have plaster residue on them and some of the original paint has been removed, seemingly when an attempt has been made to remove the excess mortar (figures 35 and 37). There appear to be water run off marks coming down from the beam above one replacement panel, possibly from washing off excess plaster from the beam. There are areas of minor paint loss along the edges of some fractures (see figure 38) and some recent impact damage in the form of scratches (figure 37).

Stars:

As with the nave ceiling, the gilded stars are made of lead and are attached to the ceiling with brass screws. Although slightly dull in appearance they are in good condition and appear to be reasonably stable.

4.3 Summary of Types and Causes of Deterioration

- Water ingress – assumed to be resolved following repairs to roof
- Flaking of paint – As a direct result of historic water ingress. Limited flaking caused by expansion and contraction of wood along the grain, and possible denaturing of the size and paint layers.
- Water staining to ceiling panels – As a direct result of historic water ingress. With water ingress halted, staining will remain but should not increase.

Although it is assumed that the existing damage is historical and the conditions within the church have stabilised since the repairs to the roofs, a moisture survey was carried out to detect any moisture related problems. The results from the moisture survey will determine if any remedial work is required prior to any further works to the decorative finishes of the ceilings.

5. Technical examination – Paints and Moisture

5.1 Paint Analysis

In order to evaluate the potential factors of decay and establish appropriate treatment recommendations, it is essential to understand the nature of the original coatings, together with any later additions (for example, plastic repairs, consolidants and waxes), and products of alteration/ deterioration of the original materials. Three samples of paint were removed for analysis, two from the nave (timber and plaster panel) and one from the south aisle (plaster panel).

Method

Samples were taken using mechanical means, given individual reference codes and the sample sites recorded photographically; see Appendix 4 for sample locations. The samples were mounted in clear casting resin and polished to provide a cross section through the paint layers. Assessment at 40x or 100x magnification in incidental light allowed the layer structure to be assessed, and 200 x magnification was used for more detailed evaluation of specific layers. In addition, fluorescence microscopy was employed to identify the basic stratigraphy of paint schemes and to establish basic composition of paint films. Photomicrographs included within the report were photographed at 10x magnification in incidental light unless otherwise stated.

Results

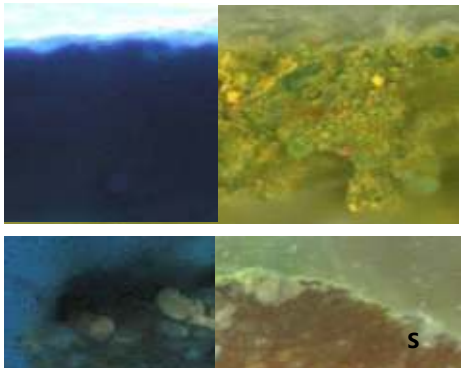


Figure 8: Photomicrograph of sample 02 taken from a timber truss in the nave (**S** denotes substrate).

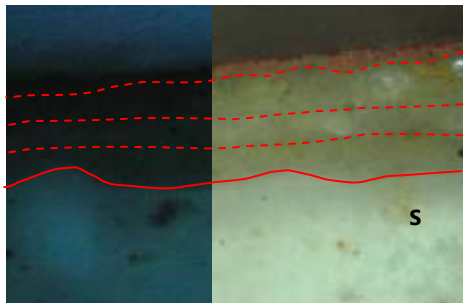


Figure 8: Photomicrograph of sample 03 taken from a ceiling panel in the nave. (**S** denotes substrate).

Samples taken from the ceilings indicate that there is only one scheme of paint on the plaster panels and timber elements.

Assessment of the samples in cross section, at 100x magnification, indicated that there is no ground layer to either the timber or plaster panels.

Only one coat of green paint was evident in sample 02 taken from a timber element to the nave ceiling, see figure 7. The lack of auto fluorescence suggests a distemper paint and the most likely pigment used is terre vert.

Three coats of a cream base colour topped by a red stencilled layer were evident in sample 03 taken from a plaster panel to the nave ceiling, see figure 8. The lack of auto fluorescence again suggests a distemper paint.

Figure 9: Photomicrograph of sample 04 taken from a ceiling panel in the south aisle.

Unlike the sample from the nave ceiling, only one coat of a cream base colour topped by a red stencilled layer was found in sample 04 taken from a ceiling panel in the south aisle, see figure 9.

Micro-chemical and stain tests

Further investigation was achieved by stain tests and simple chemical techniques. These tests were undertaken following visual assessment, in order to understand the basic composition of the layers and to identify any health and safety risks.

Tests strongly suggest the panels and timber were originally painted using a glue-bound soft distemper. The following tests were performed to establish this:

Microscopic examination
Shows chalk microfossils (coccoliths) present – visible under crossed polars of polarising microscope (chalk – calcium carbonate).

Solubility tests
Paints are dispersed readily in water, soluble in mineral acid with carbon dioxide effervescence (indicating carbonate).

Flame test
Tested positive for calcium ions (Ca^{2+}), giving red flashes after being dissolved in acid.

Stain tests
Purple colour seen using Biuret test for protein – suggesting collagen in animal glue.

Summary of results of paint analysis

The conclusion of the analysis of the paint films is that there is one scheme of decoration to both the nave and south aisle ceilings. The limited sampling undertaken suggests that the decoration of the nave ceiling panels was undertaken in three base coats, with the stencilled design applied over the top in one coat. It appears that only one base coat was used on the timber elements of the nave. Likewise, only one base coat was evident in the sample from the ceiling panel of the south aisle, with the stencilled design applied over the top again in one coat. Testing established that the original paint media is likely to be a glue bound soft distemper.

It is known that the decoration of the nave and south aisle ceilings was undertaken at different times. The quality of the finish to the decoration of the south aisle ceiling does not appear to be as refined as for the nave ceiling, possibly suggesting that they were undertaken by different contractors using different decorative techniques.

However, as only one sample was taken from the south aisle ceiling, it is not possible to know whether this result (of only one base coat) is an anomaly.

5.2 Preliminary Moisture Profiling

Introduction and Rationale

Not only is the condition of the building envelope/rain-water goods important in determining the moisture dynamics of the fabric, the environment within the building plays a crucial part in determining its stability, as well as the types of plasters and paints employed in redecoration/repair.

The interior fabric of the Church is essentially in a good condition. However, the previous catastrophic water ingress was extensive, and this, along with the plaster repairs resulted in high levels of moisture penetrating the fabric. Any conservation and restoration works should only be undertaken once the fabric has 'dried out'.

The paint surfaces are also veiled by a layer of dirt, which can act as a deleterious absorbent 'poultice', holding atmospheric pollutants and salts against the surfaces of the fabric.

For these reasons it was decided to carry out a preliminary moisture survey of the accessible localised areas of the ceilings as part of the condition survey. This allows a better understanding of the conditions within the church, limited to the conditions found on the day of the site visit.

Methodology

Measurements of relative moisture concentrations in the fabric (up to 4cm depth) were made using a non-intrusive capacitance meter (calibrated for lime mortars) and protimeter.

The capacitance meter relies on the electrical capacitance of a material increasing with its moisture content (anomalies can arise with high salt content); the protimeter relies on the electrical conductance of the fabric (and more readily gives anomalously high readings with high salt content, even if the moisture content is low). Therefore the protimeter can behave more like a 'salt meter' than a moisture meter, but used together with the capacitance meter can indicate the relative salt/moisture concentrations.

Results

<u>Environmental Recordings:</u>

In order to place the moisture measurements in some context relative to the environmental conditions prevailing on the day of the investigations, the conditions were measured using a digital hygrometer.

The Environmental readings were as follows:

Tues. 12/06/12 10am (Dry, cloudy day)

Location	RH %	Temp.°C	Dew pt.°C
Nave, foot of scaffold	67.5	15.2	9.2
Nave, top of scaffold	59.9	17.4	9.7
South aisle, top of scaffold	61.9	17.1	9.7
Outside south porch	53.1	15	

These results indicate that at the time of the recording the air inside the church was wetter than that outside.

Capacitance and Protimeter Readings within the Nave and South Aisle:

See annotated photographs in Appendix 5 for the readings taken.

Moisture equivalents of Meter Readings for Lime Plaster:

FOR LIME PLASTER GENERALLY:

Capacitance D mode	Comments
0 -300	Very dry
300 – 400	Dry
400 – 500	Dry – Damp
500 – 600	Damp
600 – 900	Damp – Wet
>900	Very wet and/or high salt content

Protimeter %WME	Comments
0 – 17.0	Dry, with or without salts
>17.0	Damp and/or high salt content
>24.0	Wet and/or high salt content

Note: %WME = Wood Moisture Equivalent. If wood is 'dry' %WME = 8–10%(>17%).

Both the capacitance and protimeter readings show the fabric of the nave and south aisle ceilings and walls (in the areas of repair accessible from the scaffold) to be essentially 'very dry' up to ~ 4cm depth. The highest capacitance meter readings were 189 in the nave and 190 in the south aisle, with the majority of the protimeter readings below 10.5%.

Conclusions

We might conclude that the fabric of the church (in the areas examined) is essentially dry, with no significant water ingresses or residual moisture, otherwise the air inside the church would be significantly 'damper', and the capacitance and protimeter readings would be higher. The environmental readings show that there is minimal chance of condensation events occurring at the time of the site visit, as indicated by the large difference between the recorded temperatures and dew points.

6. Cleaning Tests

The surface dirt to the ceilings compromises the visual appearance and function of this painted decoration, and providing that a safe and effective manner of removing it can be established, the cleaning of the ceiling would re-establish its aesthetic integrity as well as improving the thermo-hygric characteristics of the painted surface.

Trials on site using various dry methods, water based reagents and solvents were tested to help to identify the most appropriate methods of cleaning the painted decoration. Specifically a number of low-polar solvents and reagents were tested to establish the characteristics of the surface dirt as well as the sensitivity and response of the paint film to the various cleaning strategies.

Dry methods:

- Smoke sponge (adsorbent silicone sponge): achieved some tonal lift, but with a patchy appearance.
- Wishabs: Cleans quite effectively, and a good tonal lift is achieved. Will help to unify overall appearance of panels. Even where little tonal lift is achieved significant amounts of hygroscopic dirt is removed.
- Artgum erasers (natural gum, non-abrasive eraser with a deep cleaning powder additive): Cleans the lighter colour fields better than with Wishabs but needs to be used locally and with care as it removes some of the more under-bound paint.

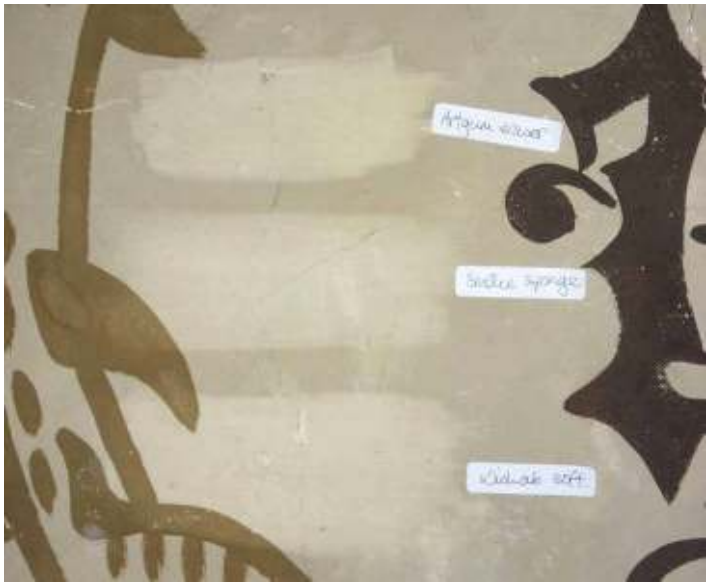


Figure 10: Detail of results of dry cleaning trials using Artgum eraser (top), smoke sponge (middle) and Wishab sponge (bottom).

Water-based reagents:

- Deionised water: The paint is very fugitive in water and was instantly removed with deionised water. No water based reagents should be employed to clean the ceiling.

- Accordingly, no other water-based reagents were tested.

Solvents:

- White spirit: White spirit removes some dirt and does not affect paint. However, the application of white spirit completely saturates the paint and causes it to darken.
- Propan-2-ol and IMS were not effective as free water in the solvent affected the paint layer and slightly solubilised the paint

Summary of cleaning tests:

It is felt that the most successful way to clean the ceiling is using the Wishab sponges. This can be supplemented with some further cleaning with Artgum erasers to the lighter passages.

7. Consideration of an appropriate strategy for conservation

The aim of a conservation program should be to preserve as much of the original fabric as possible and achieve the structural integrity of all elements using conservation methods and materials compatible with the existing materials. Therefore all treatments to be carried out should meet the following fundamental requirements:

- not introducing any deleterious materials into the building structure
- the existing significant fabric should not be additionally damaged by the treatment
- the appearance of all treated areas should be improved but the surface structure not changed

In general the condition of the building envelope appears sound and no major faults were detected during the site visit, therefore it is considered that no work is required at this stage to the external fabric. However, to prevent any future water ingress into the building the following measures are recommended:

1. The rainwater goods should be inspected for any leakage and all necessary repairs undertaken.

2. Manholes should be opened annually and observed during the cleaning process. Any blockages should be cleared by gentle use of rods with screw or segment heads to pull back obstructions rather than to compact them. Pressure jetting should not be used on old drains.

This work should be undertaken by others as a priority, before any conservation work to the painted decoration is started.

Historic water ingress is the largest contributing factor to the deterioration of the paint films. Since the blocked gully has been repaired and areas of failed plaster and timber replaced, and preliminary moisture profiling has indicated that the areas of repair are essentially dry; it can therefore be concluded that the ceilings are suitable for further treatment.

8. Conservation Recommendations

The preferred option for treatment of the ceilings of the nave and south aisle of St Bridget's Church would be to undertake conservation work to all areas of the ceilings. However, it is understood that the Church has extremely limited funds. If this is the case, it would be possible to undertake the work in phases, with the first phase focussing on the treatment of the areas at the east end of the church, which have undergone extensive repair[11].

Whether complete or localised conservation is undertaken, the treatment process should follow the same general programme as outlined below (subject to further treatment trials).

8.1 Preliminaries

A fully boarded fixed scaffold will be required to undertake the works. Water and power will be required, and suitable welfare facilities should be made available for use by the conservators.

Risk assessments should be undertaken prior to commencing the work on site and appropriate PPE should be worn at all times.

8.2 Initial Clean

Carefully vacuum and dry brush stable areas to remove surface cobwebs and debris. Vacuum extraction should be used to prevent relocation of dirt.

8.3 Pre-Consolidation

Given the friable nature of the paint in many areas, consolidation prior to any further intervention will be required. Initial tests will be required to establish the most appropriate materials.

Lascaux® 4176 medium for consolidation is an effective way of consolidating matt paint films such as those found on the ceilings of St Bridget's Church. It is an aqueous dispersion of an acrylic copolymer based on acrylic ester, styrene, and methacrylate ester. It is excellent for consolidating chalking and matt paint films and water sensitive films despite containing water. This is due to the minimal amount needed to achieve penetration and it is fast drying so doesn't cause spotting and staining on the surface from dwelling. Excess adhesive on the surface doesn't appear shiny or cause darkening, and once dried, excess consolidant can be removed using acetone or aromatics. Methacrylate and acrylate monomers are considered to be very stable and resistant to degradation. The presence of styrene has some drawbacks, as it may degrade under UV irradiation, can lose some of its mechanical properties and has a tendency to yellow. However, ageing tests have showed good performance despite its presence.

[11] Phased costs have been provided in a separate cover letter.

Traditional animal based glues such as gelatine or isinglass should also be considered as they are appropriate consolidants of any powdering of the glue distemper where it is underbound. It has been used extensively with success on similar projects such as All Saints, Cambridge and many European examples. This glue should only be used as a very dilute solution to avoid darkening of the paint films and in stable conditions only. Spray consolidation prevents any detrimental impact on a water soluble paint layer.

Other synthetic consolidants to be tested may include Plextol B500 in varying concentrations.

8.4 Cleaning

Cleaning of the paint surfaces should be conducted to remove hygroscopic dirt deposits and to enable recreation of the lost areas of decoration in the correct colours. It should be agreed on the extent of the cleaning before the start of the programme. Given the extreme sensitivity of the paint films to water and solvents, only dry cleaning methods should be used to remove the hygroscopic dirt deposits. Initial cleaning trials suggested that Wishab sponges (AKA pad) provided the most effective clean without causing any damage to the paint films. This can be supplemented with some further cleaning with Artgum erasers to the lighter passages if required (natural gum, non-abrasive eraser with a deep cleaning powder additive). Surface cleaning will not be conducted until after the initial phase of consolidation and tests confirmed that pigment loss is not occurring with dry cleaning.

Initial testing of dry cleaning methods indicated that some of the plaster splashes were able to be removed, but any remaining residues may need to be touched in to integrate with the surrounding.

The gilded stars can be surface cleaned using a weak solution of ammonium hydroxide pH 8.5. It is not thought that any re-gilding is necessary.

8.5 Consolidation

If required, any further consolidation can then be undertaken using the method and materials determined following testing.

8.6 Surface preparation & filling

The junction of the new and old plaster will need preparation prior to redecoration. This will include sanding and filling as appropriate. The surface of the replacement plaster may also require some finishing as it is much coarser than the existing plaster surface.

To facilitate retouching, filling and making good of areas of loss can be undertaken using Mowiol 4-98 and gilder's whiting. Mowiol 4-98 is a polyvinyl alcohol (15%) dissolved in demineralised water. Mixed with chalk or whiting it produces a flexible, stable and fully reversible (in water) filling material. A flexible filling material is important as it is able to accommodate structural movement without cracking. Filling material will be applied using small hand held spatulas and once dry will be levelled using saliva and cotton wool swabs.

8.7 Re-creation of Stencil Decoration & localised retouching

Tracings should be made of the decoration to the ceiling panels, beams and trusses in order to allow re-instatement, using stencils cut from archival quality Melinex™. Bespoke, colour-matched distemper paint can then be used to re-create the designs on the new timber and plaster. Integration of localised areas of paint loss can be undertaken, without filling of lacunae, using dry pigments and water or watercolours.

8.8 Varnishing

The ceiling should not be varnished due to the darkening effect with saturation and because it has never been varnished previously.

8.9 Documentation

A detailed written record of all work should be maintained and the nature and extent of the conservation and recreation work graphically and photographically recorded during the course of the project. All tracings and references should be accurately labelled and ordered for future reference and for archival purposes, and included as part of the final treatment report.

Appendix 1 – Photographic Survey (June 2012)

Exterior

Figure 11. Detail of north-west corner of nave roof, showing lost detailing to ridge tiles, cement flashing, mildew and grass growth.

Figures 12 and 13: Details of extensive repointing to tower, west face (left) and north face (right).

Figure 14: Guttering to west side of south porch, showing deformation and slight split.

Figures 15 and 16: Detail of damaged downpipe to south porch (left) and overflow pipe in the north wall of the vestry, with iron corrosion staining to wall beneath (right).

Figure 17: Detail of area of failing pointing on the south porch, with small plant growing out of void.

Figure 18: Extensive biological growth found in the north gully.

Nave

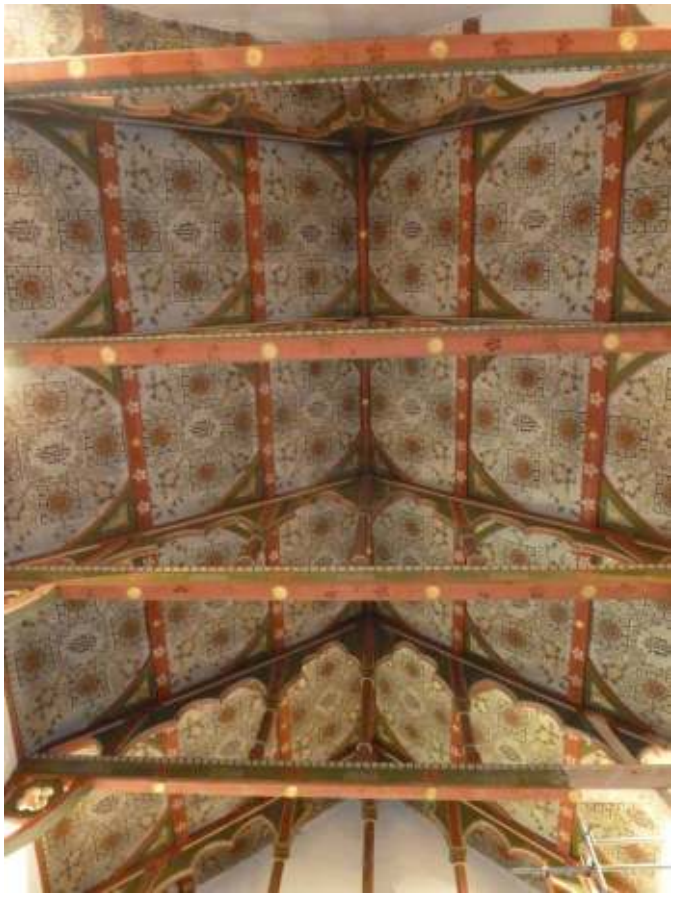


Figure 19: Overview of nave ceiling looking east. The top of the access scaffold can be seen in the bottom right corner of the photograph.

Figure 20: Detail of replaced plaster to two westernmost panels on south side of the ceiling. Note the water damage to the right side of the panel above.

Figure 21: Detail of water damage and staining (possibly mould) to lower westernmost panel on north side of the ceiling. Access to this panel was not available on the day of the inspection.

Figure 22: Overview of replacement plaster and timber to the central of the three repaired panels.

Figure 23: Detail of junction between replacement plaster and original decoration. Note the uneven finish and step in plaster edge.

Figure 24: Detail of replacement plaster surface, showing uneven finish.

Figure 25: Detail of ceiling panel to north side of the ceiling showing cobwebs (blue circle) and evidence of water ingress, including staining and paint loss (red circle).

Figure 26: Detail of replacement timber and water run-off marks and lost paint to original decoration.

Figure 27: Detail of area of damage to original decoration following the fixing of replacement timber.

Figure 28: Detail of ceiling panel to south side showing white splashes of plaster, presumably from the recent repairs.

Figure 29: Detail of paint losses along the edge of a fine fracture.

Figure 30: Detail of timber beam showing unfilled fixing holes and paint losses, particularly evident in the text following the grain of the wood.

South Aisle

Figure 31: Overview of the south aisle ceiling. Note the replaced plaster panels in the north east corner, with access scaffold beneath.

Figures 32 and 33: Detail of water damage to north westernmost panels, showing staining (possibly black mould), water run-off marks and disrupted wall plaster and paint beneath (right).

Figure 34: Detail of staining and water run-off marks as a result of historic water ingress.

Figure 35: Detail of area of replacement plaster, showing staining to original decoration of surrounding timber frame.

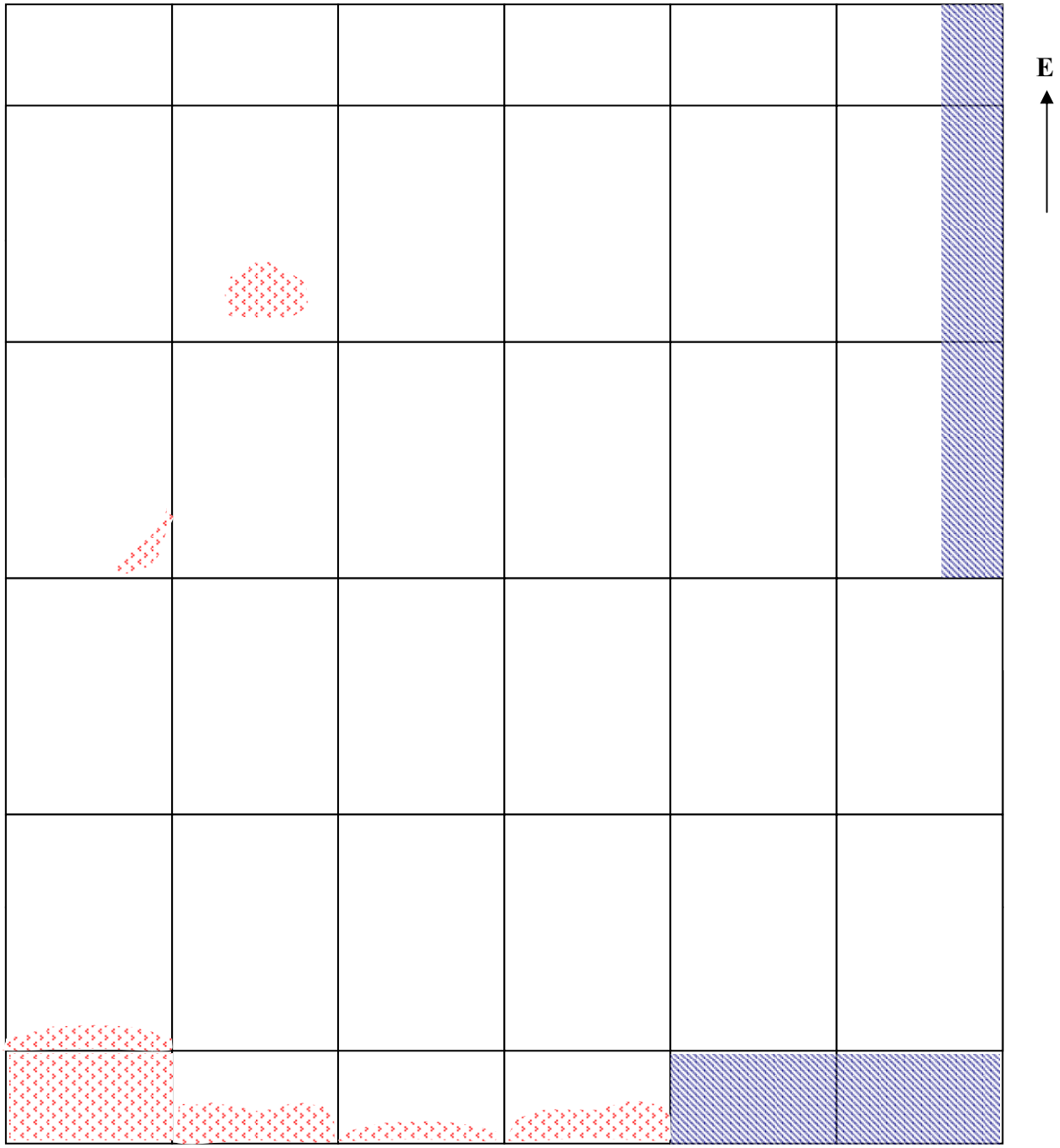
Figure 36: Overview of south east side of ceiling showing surface dirt and cobwebs.

Figure 37: Detail of areas of impact damage – scratches and paint loss; these appear to be recent as there are no dirt deposits on the exposed plaster. Water staining and plaster marks can also be seen on the lower timber frame.

Figure 38: Detail of fine fracture in surface of panel, with minor areas of flaking paint along its edge.

Figure 39: Detail of area of cleaning trial using a Wishab sponge.

Appendix 2 – Nave Ceiling Plan

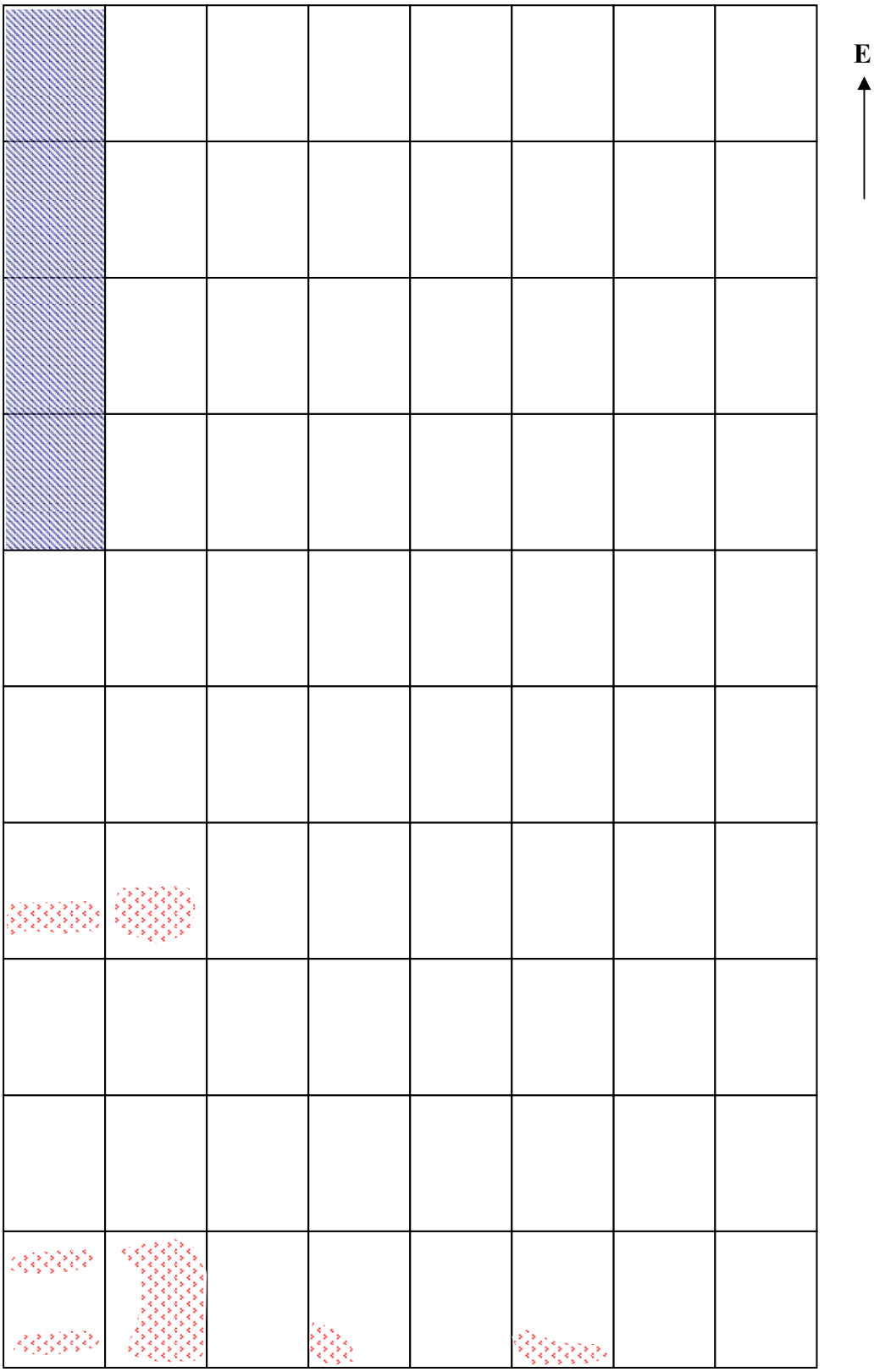


Reflected view plan of the nave ceiling showing areas of replaced plaster and areas exhibiting signs of water ingress (staining, water run off marks).

Areas of replaced plaster

Areas exhibiting signs of water ingress; staining, water run off marks etc.

Appendix 3 – South Aisle Ceiling Plan

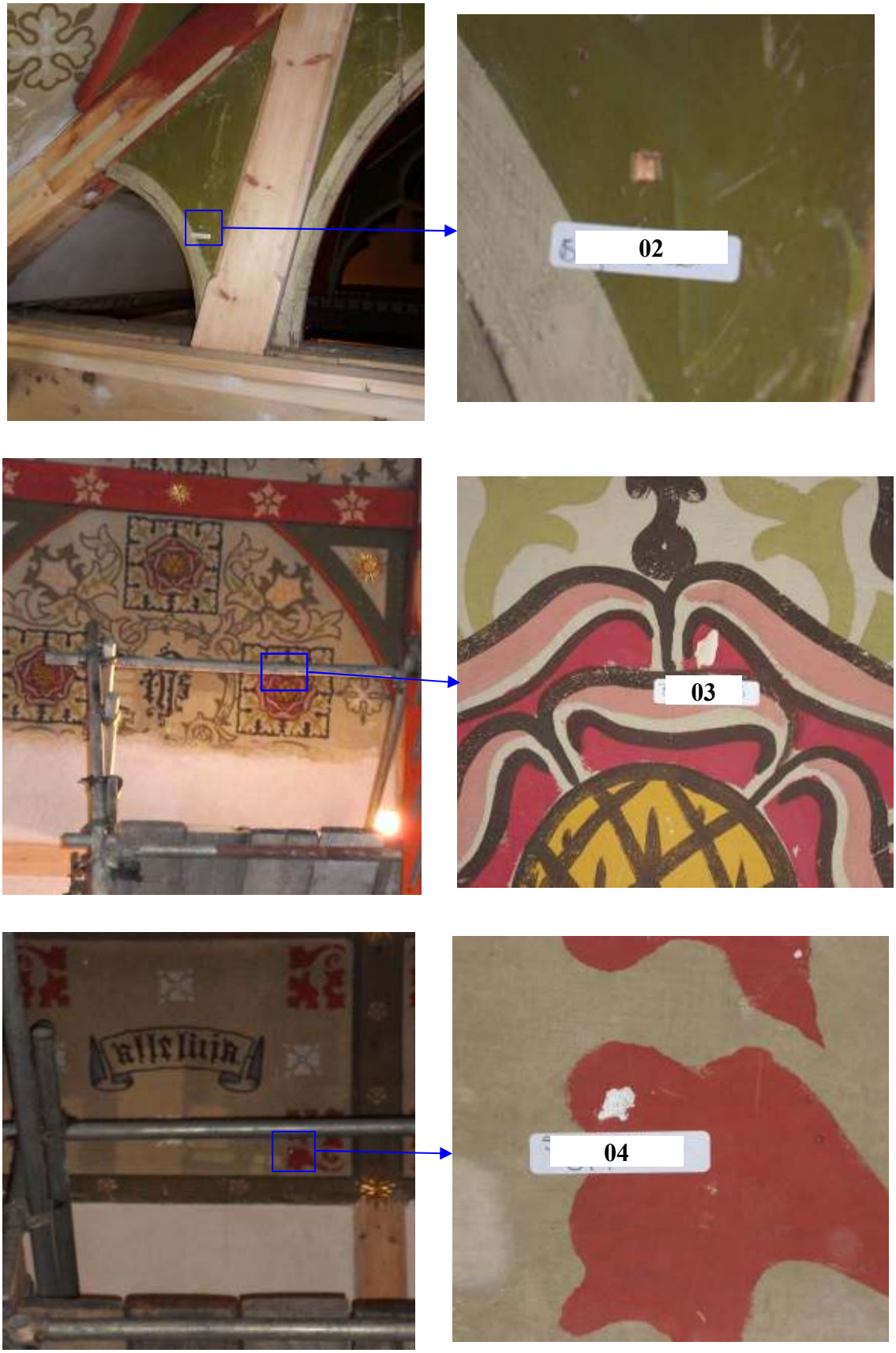


Reflected view plan of the south aisle ceiling showing areas of replaced plaster and areas exhibiting signs of water ingress (staining, water run off marks).

Areas of replaced plaster

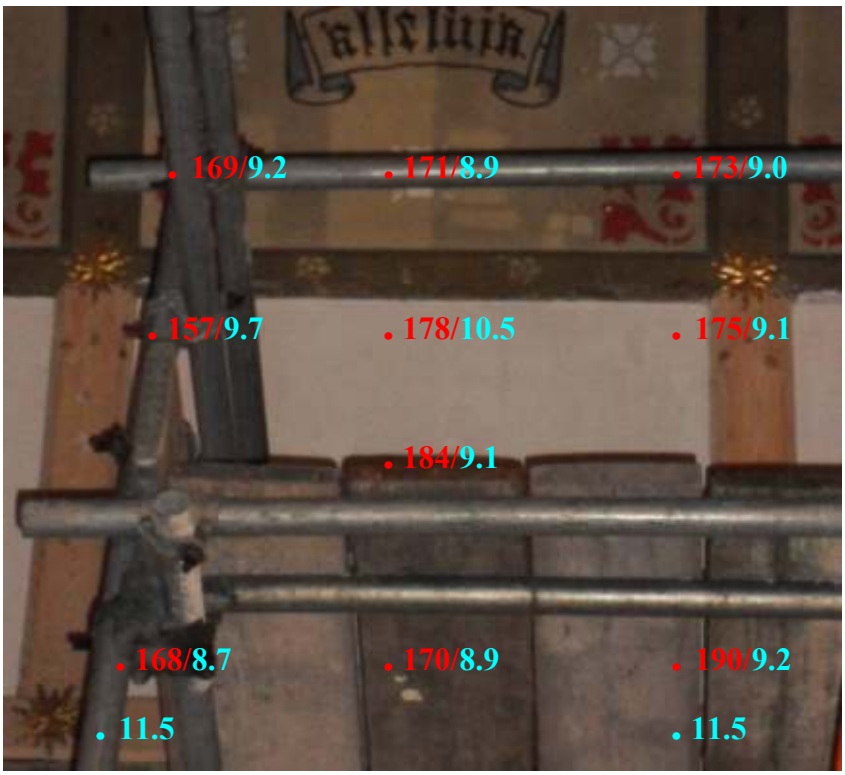
Areas exhibiting signs of water ingress; staining, water run off marks etc.

Appendix 4 – Paint Sample Locations



Paint sample locations in Nave (top and middle) and south aisle (bottom).

Appendix 5 - Moisture Readings



XX Capacitance D and XX Protimeter readings for the nave ceiling (top) and south aisle ceiling (bottom).