



## STAINED GLASS CONSERVATION REPORT

**Date received:** 21st March 2019

**Date returned:** 8th May 2019

**Conservators:** Jack Clare, Jim Clare, Helen Bower, Helen Bree, John Pullen.

### INTRODUCTION:

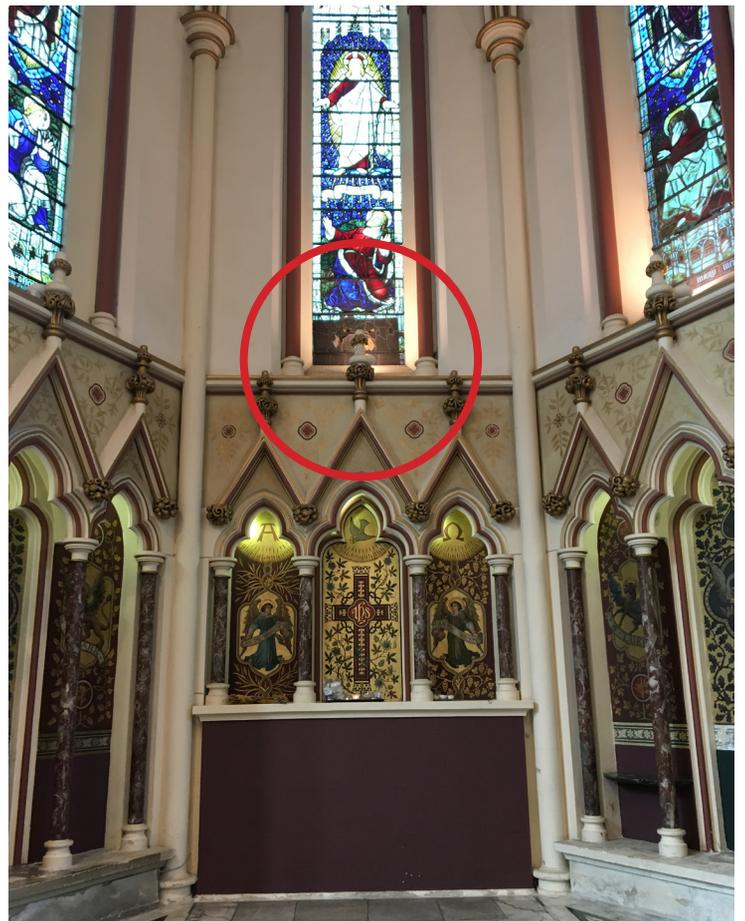
Following a condition survey Holy Well Glass was asked to carry out conservation repair works at St. Michael's Without, Bath. This focused on localised vandal damage to the base panel (1a) of the central lancet of the East Window, 820mm x 843mm approximately. How the damage occurred is uncertain, as the entire area outside was covered by heavy duty bird netting. There were no objects heavy enough to have caused the damage within the netting. It is most likely someone got inside the netting via the adjacent rooftops with the intention of breaking in, but were put off by the extent of the drop revealed when pieces of glass were smashed out. The broken panel can be seen in the accompanying images. Sympathetic repair works included the removal of the panel to the workshop, partial dismantling to allow access to the broken sections, complex edge-bonding of the many fragments of glass, re-leading, waterproofing, and finally refitting in-situ.



East Window, panel 1a, internal view, before removal for repair



East Window, panel 1a, internal view, before removal for repair



East Window, panel 1a, internal view, before removal for repair

## CONSERVATION RECORD:

### ON SITE

Access on-site gained internally via ladder, ensuring surrounding church fabric was protected. Externally access was very limited, with only a narrow steel girder to stand on between the building and a ventilation unit, and a substantial drop below. This necessitated the use of a safety harness, and as there was no suitable anchor point, a fall arrest point was permanently affixed to the external wall to accommodate this (and help for future use). This solution was discussed with the architect before work commenced.



Substantial bird droppings across two thirds of the external panel surface



External view - limited access between the window and the ventilation unit

### Removal of traditional stained glass panel from stonework.

The single panel was removed from the surrounding stonework, and eased from the panel that sat directly above it. The two internal support bars and the mortar were in good condition. Mortar was removed by hand, with dummy and tungsten tipped chisel, from around the perimeters of the lights. Copper ties were released from the support bars, and the stained glass panel freed from the opening. Panel removed from church, stacked securely with bubble wrap and boards, and transported to workshop for conservation. The sill was checked for glass fragments, after which debris was removed from opening and sill with a vacuum cleaner. Templates were made of the stone opening and measurements taken. Space glazed temporarily with twin wall polycarbonate, attached to bars with cable ties. Site left clean.

### IN WORKSHOP: -

#### Photography

The panel was digitally photographed, including before and after pictures, processes, site work etc. Images and conservation diagrams are stored as JPEGs and are included in the digital copy of this conservation report (on USB).

#### Assessment

Once in the workshop the panel was assessed for damage prior to works. The glass was assessed to determine the glass types, bonding methods, and cleaning methods, and the lead was assessed to determine if it was structurally sound or failing.

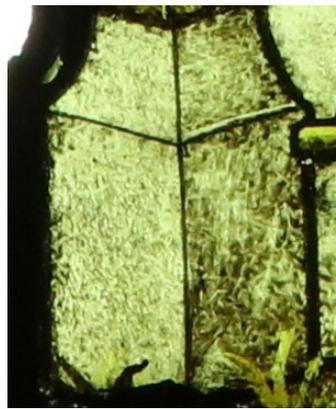
The panel (height 843mm x width 818mm approximately) forms the bottom section of the central lancet window. The design is based on traditional medieval gothic style and layout, with robed figures featured within an ornate architectural framework, with crockets and finials. The inscription at the bottom of this C19th panel reads; "To the Glory of God 15th February 1898". The panel consists of hand-blown pot



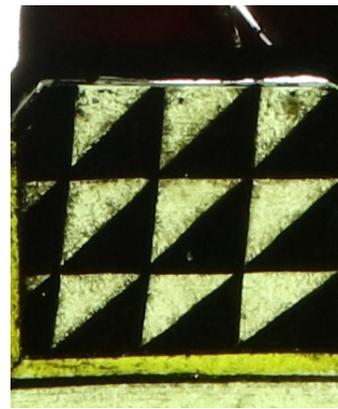
Yellow silver-stain



Paint pattern on external face



Stippled paint washes for graded highlights



Darker line work



Delicate highlights scratched through paint layers



Complex breaks and holes in the glass



Distorted lead came, where glass and lead have become separated



Solder joints intact



Cement brittle and leaching out of the leads



Cement missing/lost from underneath lead came



Dirt/soot etc. collected behind the support bars



Stray black bar paint evident on the glass and lead

metal glasses in blue, and green. The red is most likely to be a 'flushed' glass whereby a thin flash of red colour sits above a layer of clear glass. Without the clear glass to dilute the red it would be a very dense, impenetrable colour. There is a great deal of clear/tinted glass, often with silver-stain to stain the glass varying shades of yellow. The traditional glass paint is a brown/black metal oxide pigment, which is fired and fused onto the surface of the glass. It has been applied chiefly to the internal surface, although paint can also be seen on some of the blue drapery pieces externally, to add depth to the overall appearance. Layers of washes and stippling of the pigment provide the shading effects, whilst the intricacies of the design are painted on with a darker line-work. Further highlights have been scratched through the paint layers, most likely with brushes and wooden sticks. The localised vandal damage resulted in multiple complex breaks and holes in the glass. Some of the lead had become distorted and/or separated from the glass leaving light gaps. Elsewhere the glass was in good condition, and the lead was stable. All the solder joints remained intact. The leaded light cement was brittle throughout and missing in places, and had leached out from under the leads, both inside and out. The glass paint was stable, and in good condition. Some paint loss was evident through shaling of the surface where the glass was broken.

Internally there was generally a low level of surface dust. This was more extensive behind the two support bars at the top and centre of the panel, where splashes of black bar paint were also evident. Externally splashes of bird droppings covered the bottom two thirds of the panel.

**Rubbings**

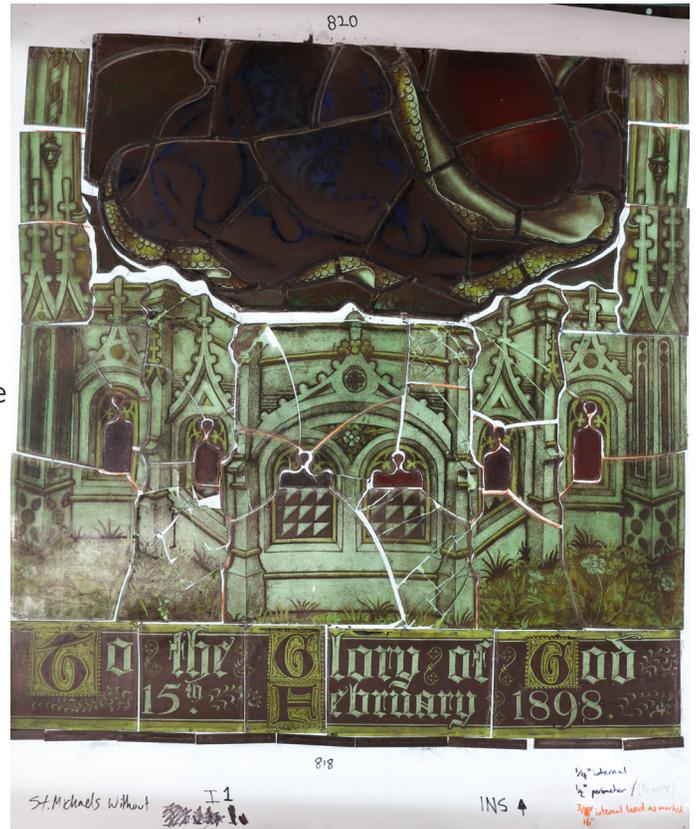
Before the panel was dismantled three rubbings taken of lead matrix and lead profiles noted. First rubbing used to lay glass pieces on after removal from leads, second rubbing as a guide for re-leading, and third for annotation with Church Building Council (CBC) conservation symbols.

**Dismantling**

It was necessary to dismantle some sections where the panel had suffered most damage, and to facilitate repairs to the glass. Presumed in favour of retention of leads whenever possible. Therefore, the top section of the panel remained intact.

**Cleaning**

The painted surface of the glass was monitored with a binocular microscope. Each piece of glass was cleaned using a 50/50 mixture of ethanol and de-ionised water on cotton buds and soft brushes. Leaded light cement was removed with a scalpel. Areas not dismantled were also cleaned, as above, but within the lead matrix.



Part dismantled panel, top drapery section remained intact

**CONSERVATION OF GLASS: -**

**Edge-bonding**

All broken glass was re-assembled and edge-bonded. Impact breaks, single/double breaks and gaps repaired and filled using Araldite 20:20; a conservation grade two-part epoxy resin. One cracked section and simple glass break was repaired employing the copper foil method; the break edges of the glass were coated with a thin adhesive strip of foil, the pieces were brought together, and the foiled sections soldered to made one re-united piece.



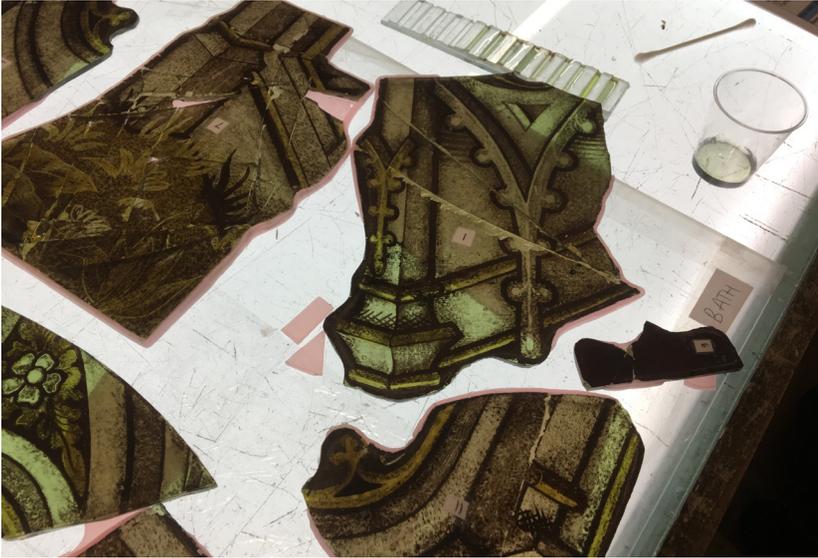
A severely cracked piece to be edge-bonded



A cracked piece clearly showing glass severely shored off at the broken edges, assembled for edge bonding



Cracks as well as gaps in the glass, assembled for edge bonding



Preparation for green tinted resin infills



Broken piece after edgebonding, and before cold painting the resin fill

### Cold Painting

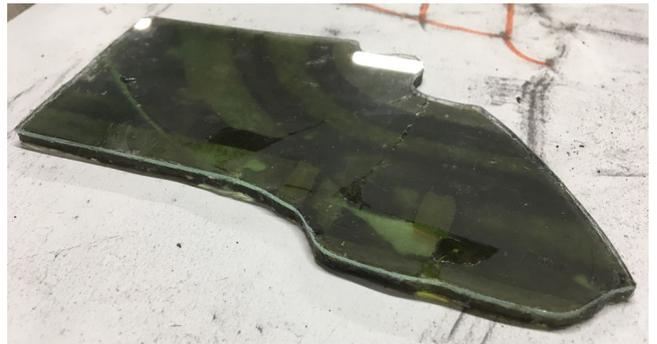
For edge-bonded areas, glass with stable paint was then cold coloured for legibility.

### Backing plates

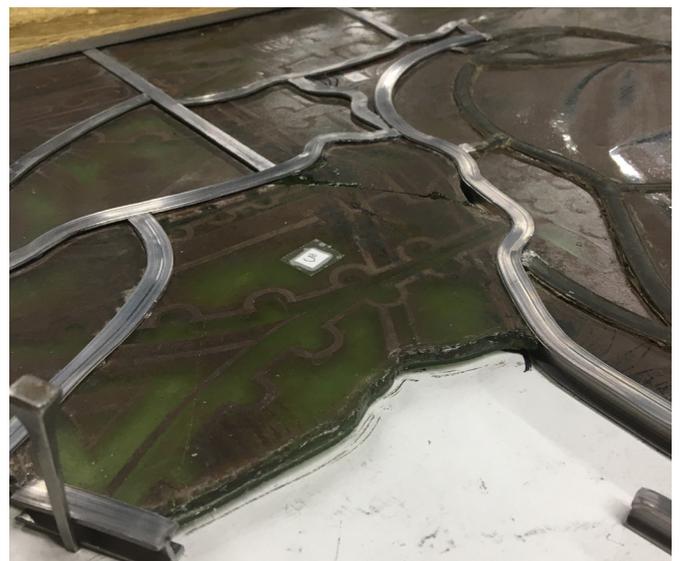
To protect the newly edge-bonded pieces against the elements clear backing plates were made for each individual piece. 1.4mm optical glass was used, heat moulded to match the curves/texture of the original glass. All plated pieces were sealed about the perimeters with silicone.



Clear kiln-formed backing plate attached to edge-bonded piece, internal face



Clear kiln-formed backing plate attached to edge-bonded glass, external face



Above and left: - re-leading, incorporating the repaired glass and the non-dismantled panel section

### Re-leading

Panels have been leaded with commercially available lead comes, in a profile matching the original lead width and depth; 3/16" and 1/4" for internal leads, 1/4" for the top perimeter lead, and 1/2" for all other perimeter leads. The soldering technique has been mirrored also, soldered with 60/40 lead/tin solder.

### Waterproofing

The painted front face, of the panel was hand puttied with linseed oil putty stained with lamp black pigment. The back face was cemented with traditional leaded light cement, to the following recipe:  
- 4 white spirit, 1 boiled linseed oil, 1 raw linseed oil, 5% gold size, calcium carbonate and lamp black pigment.

### Ties

New copper ties were applied to the inside using 1.4 mm soft copper.

### SITE INSTALLATION/RE-FIT

The panel was returned to the building in the week of 8th May 2019. Internal access was gained via ladder. As during removal, external access was very limited, and a safety harness was used once again, using the temporary fall arrest point. Upon return to site the temporary twin wall polycarbonate sheet was removed. In-situ saddle bars were de-scaled, and the panel fitted into the stonework. The panel was installed in the original 'stacking' or 'saddle' formation, and sealed into the building with traditional lime-mortar (3 Aggregate: 1 St Astier lime NHL3.5). Copper ties were tied, and the panel division puttied with linseed oil putty stained with lamp black, to make water tight. Left site clean.

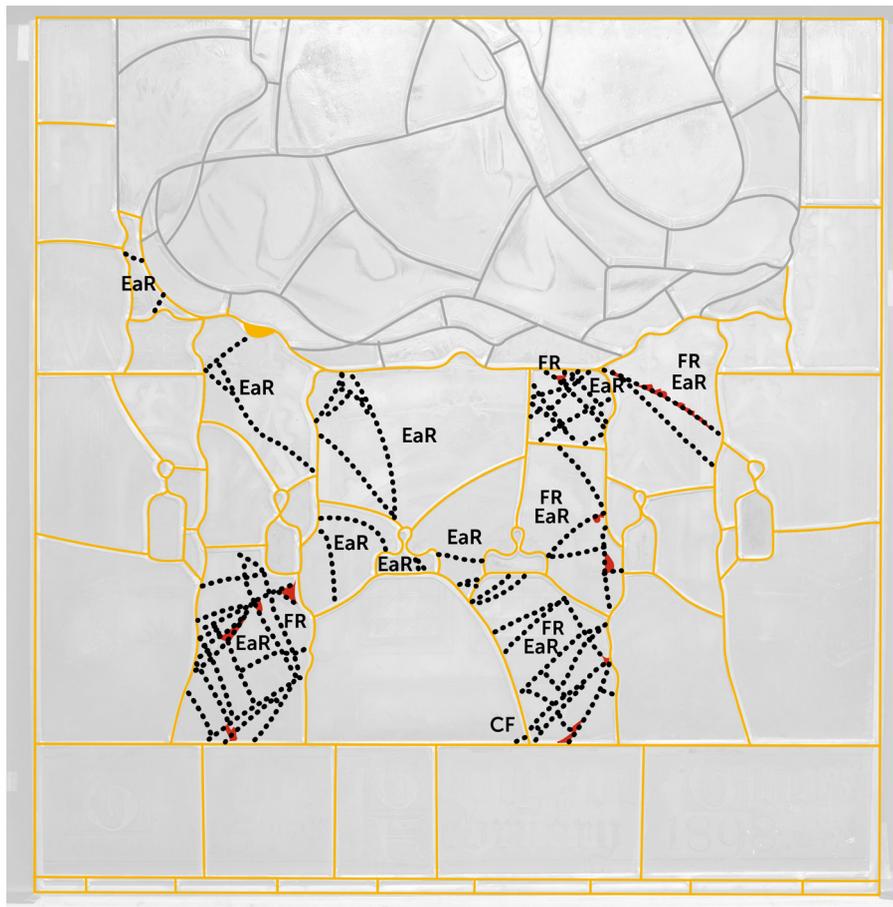


On site refit to East Window panel 1a, internal view



On site refit to East Window panel 1a, external view

**CONSERVATION DIAGRAMS** – full post conservation documentation carried out, including written report. These were prepared digitally using a specially made key/ using CBC (Church Buildings Council) annotations.



### DOCUMENTATION KEY

- Edge bond
- EaR** Epoxy resin edge bond
- CF** Copper foil edge bond
- Old lead retained
- New lead
- **FR** Epoxy resin infill

East Window panel 1a, documentation diagram

### TREATMENT MATERIALS USED

#### CLEANING AND FIXING

- Ethanol TS DA (DEB)
- De-ionised water
- Acetone 99.5 % BP APC
- Silicone adhesive (Silcoset 153 ACC Silicones Ltd)
- Linseed oil putty (Hodgeson)
- Abrasive block Garyflex (Garryson, coarse grit)
- Amino silane primer A-1100
- Araldite (20:20 Huntsman) Epoxy resin
- Orasol dye various colours (Ciba)
- Water-based aqua glass transparent glass paint, Anita
- Galleria acrylic gloss medium/flow improver
- Windsor & Newton acrylic paints various
- Lamp Black pigment (L Cornelissson & son)
- Cotton wool
- Black Patina Art - Nr 5011103
- Edco copper foil tape 7/32 5B

#### GLASS

- 1.2mm thermoformed optical backing glass

#### GLAZING

- Lead came - Heaps Arnold and Heaps
- 3/16", 1/4", 1/2"
- Tallow
- 60/40 lead tin solder (k grade)
- Soft gauge copper wire 1.4mm

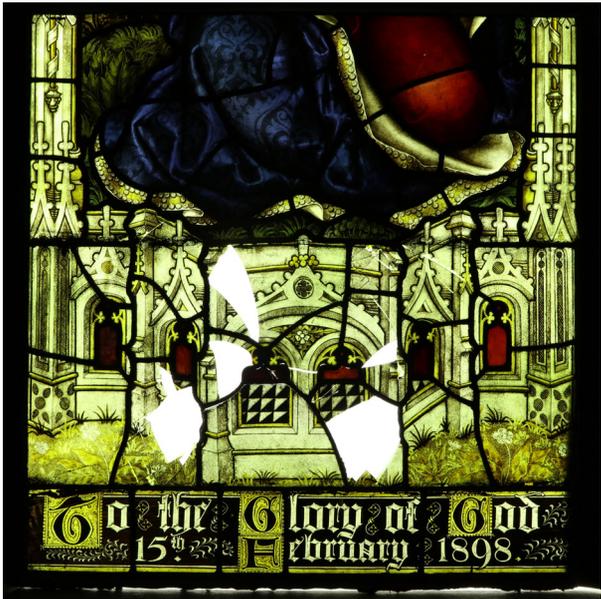
#### WATERPROOFING

- Linseed oil putty (Hodgeson)
- White spirit
- Boiled linseed oil
- Raw linseed oil
- Gold size
- Calcium carbonate
- Lamp black pigment

#### SITE FIXING MATERIALS

- Linseed oil putty
- Lamp black pigment
- Hydraulic Lime NHL 3.5
- W60 silver sand
- Brown sharp sand

PHOTOGRAPHIC CONSERVATION RECORD



Panel 1a, **before conservation**, internal view, transmitted light



Panel 1a, **after conservation**, internal view, transmitted light



Panel 1a, **before conservation**, internal view, reflected light



Panel 1a, **after conservation**, internal view, reflected light



Panel 1a, **before conservation**, external view, reflected light



Panel 1a, **after conservation**, external view, reflected light

**Post Conservation Condition**

The panel is stable, clean, fixed sound, and weatherproof. The integrity of the panel has been maintained by collecting, keeping, and repairing all the original broken fragments, and re-inserting them into the panel.

**Future Care**

It is important for the glass to be regularly monitored in the usual quinquennial inspection by the architect. Due to the delicate nature of the surface glass paint, any future cleaning should be carried out by a specialist.



Panel 1a, after conservation refit, internal view



Panel 1a, after conservation refit, external view



Panel 1a, after conservation refit, internal view



After conservation refit, internal view