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St Mary Magdalene Stockland Bristol

Preliminary Report on Structural Condition

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1.0 Introduction

1.1 This report was commissioned by the PCC of St Mary Magdalene. It should be read in conjunction with the fabric condition report prepared by B2 Architects.

1.2 The report is confined to elements of the structure of the church. Advice on all other non-structural engineering items and services should be sought from others

1.3 The inspections of the church took place in December 2019 when the weather was cold and wet. During the survey only very little opening up of finishes was undertaken

1.4 The report will describe the main structural faults noted in the visual inspection and will give recommendations for further physical investigations. An initial assessment of the likely structural repairs will be given to aid budget costings.

2.0 Observations

2.1 The church stands in a slightly elevated position just above the alluvial and tidal flat deposits of the Steart peninsula. It is likely that the shallow outcrop on which it is founded is the edge of the Langport Member Blue Lias and Charmouth Mudstone formation.

2.2 The church is faced with Lias rubble stone, with Bath stone dressings and window surrounds throughout. It has a relatively modestly sized tower, also in Lias rubble with Bath stone dressings, incorporating an external stair vice turret on the south west corner.

2.3 The church was built in 1865 and replaced a medieval church which stood on the same site, it is understood. An image in the vestry shows the form of the medieval church.
It can be seen that

- The vice turret was originally on the NE corner of the tower
- The porch was larger and integrated with the south transept
- The chancel appears to have extended less to the east than the present form.

2.4 From an engineering point of view, it is quite striking how the Bath stone string course running around the elevations appears to dip around the window openings. This effect is generally seen on old buildings where there has been some degree of foundation movement, allowing the more heavily loaded panels of masonry to settle relative to the lightly loaded windows.

2.5 However, the church does not appear to have suffered from subsidence of the foundations to any significant degree.

For instance, the chancel arch, often in churches showing signs of distress due to movement in the walls on either side, is in excellent condition with no evidence of subsidence related distortion.

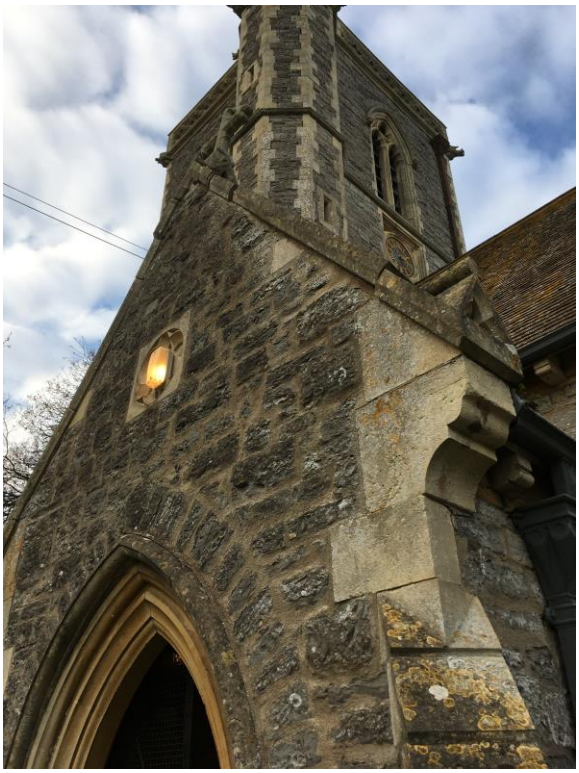
2.6 Apart from the wavy lines of the string course noted in para 2.4, significant dislocations of the Bath stone relative to the rubble lias can be seen in many areas.

This image is of the nave south window nearest the porch. Here the tracery has cracked and been displaced, and a jamb stone has been pushed outwards out of position.

A Perspex tell tale has been affixed by others in the past to record ongoing movement here.

2.7 In the adjacent porch, movement in the front wall has caused the gable to lean inwards quite substantially.

2.8 The structural movement has dislodged and displaced the stone copings.



2.9 In the Bath stone surrounds to the porch windows, and in the stone doorway surround, significant dislocations are evident.

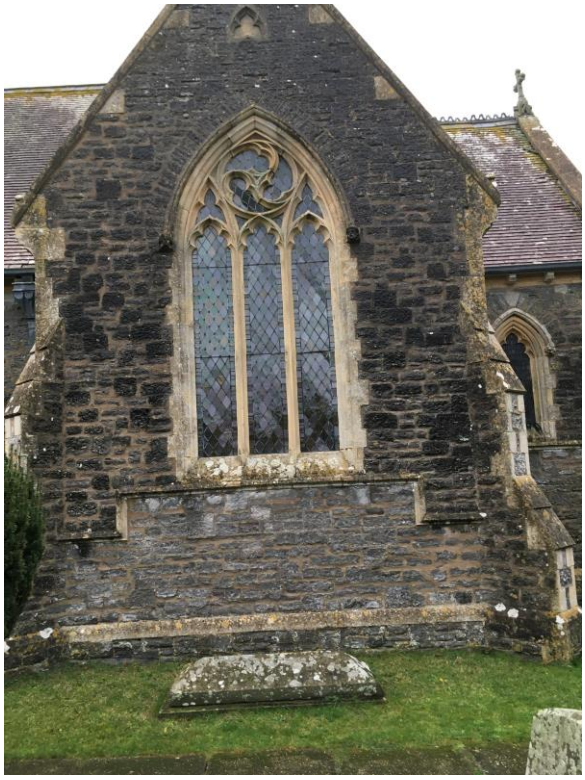
A metal detector was used to seek for signs of embedded ironwork in these areas. These were often used in the 19C to pin back freestone to the backing rubble.

In the porch and other readily accessible areas, no evidence of the general use of iron cramps or ties was found.

2.10 Lower areas of lias have been repointed in recent years. Some areas appear to be very clean an unweathered.

It would be useful to search the church record to see if any areas of lias have been replaced.

This image is of the south wall of the south transept. Again, the dip in the string course away from the window can be seen.



2.11 Another area of significant movement is in the vestry on the north side. Here can be seen the outer leaf of the gable bulging outwards and the top of the gable leaning inwards.

2.12 Within the vestry, the structural cracking is even more pronounced. There is much disruption around the window head, with Perspex tell tales affixed in the past to the worst cracks. These suggest a modest degree of movement since they were installed.

2.13 A small section of loose plaster on one of the cracks was removed to allow the wall construction to be seen. The vestry is apparently built of brickwork with an outer leaf of lias.

The boiler room is positioned beneath the vestry and accessed via an external set of steps. The vaulted ceiling of the boiler room is in good structural condition

2.14 It was decided to remove a small section of plaster 100mm square from the north aisle wall to check the constructional form here. The walling was of lias internally in this instance.

2.15 A ladder was used to check the constructional form at high level of the north aisle at the location of the longitudinal crack. The crack was found to mark the junction between masonry walling and a timber stud make up at the eaves. Although disfiguring the crack is not of structural significance.

2.16 The south wall of the nave has “stretch marks” in the plaster in all locations. The nature and alignment of the cracks is not particularly suggestive of foundation movement but is likely to indicate an increase in height of the wall over time, with the cracks being periodically filled in and decorated.

2.17 The tower is in a good condition from a global structural perspective i.e. it does not exhibit major distortions or bulges. Much of the Bath stone is in a good state with little in the way of major fractures. The lias has weathered in some areas and the whole tower would benefit from repointing in a lime mortar.

2.18 At high level on the north face of the tower, the parapet can be seen to project further outwards at the corners than the central section of this face.

2.19 As the spiral stairs in the vice are ascended, there are some serious cracks in the Bath stone treads. These are up to 7/8mm wide.

It appears that the south part of the vice turret, which may bear on 1880`s foundations rather than the original medieval ones, has settled relative to the main body of the church, causing this dislocation at the junction.

2.20 Exiting the small turret at the top of the vice, one is aware of movement throughout this little structure.

2.21 Removal of a piece of harsh cement repair mortar on the top step revealed an iron or early steel ring member running around the circumference of the tower.

This ferrous ring member has corroded badly and is jacking up the turret, causing much of the structural damage.

2.22 At the door entrance to the ringing chamber, movement in the vice has created a dislocation of the shallow brick arch over the door. This is potentially unsafe and needs pinning to avoid collapse of the arch.

The ringing chamber floor is covered in softwood boards. The condtion of the supporting timber structure cannot be assesed without lifting of a number of these boards.

2.23 Other cracks in the tower appear to more in the way of ringing cracks caused most probably by swaying of the tower during bell ringing.

2.24 These cracks can be followed up though the belfry. They are not considered to warrant sigificant repairs such as the introduction of tie bars.

The roof support timbers are visible from the belfry. The appear in good condition visually, although a close inspection is not possible. The bell frames and supporting structure have not been examined at this stage.

2.25 The pierced parapet has a chunky look to it and apprears to be in a reasobale structural conditon. Some of the sections of the quatrefoil piercings near the vice have broken into smaller fragements – possibly due to movement in the vice.
The north elevation of the parapet has been secured with stainless steel straps and longitudinal timber members -- presumably because of the distotion mentioned in para 2.18. It may have corroding ferrous fixings into the supporting stonework below.

3.0 Comments and Recommendations

3.1 There are myriad cracks, opened joints and other signs of fabric movement throughout much of the external fabric. The nature of these cracks is not generally indicative of significant foundation issues. The exception to this is the vice turret – see para 2.19. However, given all the movement and distortions to the string courses, it would be prudent and advantageous to have some hand dug trial holes excavated to provide more certainty about the nature and depth of the footings.

3.2 It is felt that almost all the fabric movement has been caused by weathering of the outer face of lias, due to constant wetting and freeze thaw action. The inner leaf of the walls (brick and lias have been seen) are protected from the external elements and remained stable. The weathering will cause delamination of the bedding planes within the make-up of the lias causing it to expand in the vertical sense.

3.3 The expansion of the lias would explain:

- Heaving of the lias above the Bath stone windows and other details (the Bath stone being dimensionally stable)
- Heaving of the external face of exposed gables, causing the gable to learn inwards, destabilising the copings and finials
- The “stretch marks” and associated cracks in the nave south wall, and in the vestry.
- Potentially causing the dimensions of the fabric to distort, giving rise to undulations in the string course noted in para 2.4

3.4 Why some parts of the church have suffered more than other is a matter for conjecture. Certainly, the more sheltered north side has much less damage. The lias used in construction of the church may have come from different beds or even different quarries.

There is no real solution to this problem. The best that can be reasonably achieved is to repoint with soft lime mortar to keep as much moisture out of the wall as possible and to let it transpire properly.

3.5 Before a programme of structural repairs can be drawn up, further investigations need to be undertaken.

1. Excavate 3 no trial holes to look at the foundations, including one at the vice turret
2. Use a metal detector to seek for embedded ferrous material at high levels notably in the vice and parapet, and high-level copings.
3. Lift a number of floorboards in the pew platforms, and ringing chamber and belfry floor
4. Have a builder lift a number of tiles to allow the wallplate and a number of common rafters to be inspected.

3.6 To assist in budget costings at this stage, it is suggested that the following actions be allowed for:

- Fully scaffold the church to gain access to high levels of all gables and the tower for repairs.
- Take down and rebuild the top section of the vice turret above tower roof level and extract the iron ring beam. Replace/repair major damage to upper landing stone
- Dismantle and repair say 25% of tower parapet
- Pinning and structural repairs to say 6no treads at the lower levels in the vice
- Pinning and structural repairs to doorway arch at the ringing chamber and the vertical cracks here and in the belfry
- Repointing and localised stone repairs to the tower
- Taking off and repositioning all copings on the gables
- Repointing of all cracks internally and externally, using helifix bars as appropriate
- Cintec tying of bulging outer faces of lias on the porch and vestry gables