



The Rum Store
Royal Clarence Yard
Structural Report

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Revision R2

31 The Square,

Winchester,

Hampshire SO23 9EX

T: 01962 865321

E: admin@marbas.co.uk

W: www.marbas.co.uk

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Author	Chris Smith
Approved	Sam Farzam
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1 INTRODUCTION AND INSTRUCTIONS

- 1.1 The Rum Store at Royal Clarence Yard has long been out of regular use and has fallen into disrepair. The building comprises a single-storey pitched roof section to the west, a two-storey section in the centre with a jack-arch floor and roof construction spanning between cast iron beams and a two-storey section to the north and east comprising timber joists spanning between main carriage beams.
- 1.2 The roof of the east section is in very poor condition and has suffered partial collapse in several locations. The collapsed roofs have allowed the floor below to be damaged as well and the floor has also collapsed at the north end. Water ingress is apparent through the roof of the central section and corrosion of the cast-iron beams has occurred. The pitched roof section has suffered water ingress at the truss location at hopper and valley gutter outlet positions. Some of the truss tie-beams are in poor condition.
- 1.3 Instructions were received on the 6th April 2021 to carry out a survey of the building in order to assess its condition, to make recommendations for temporary works to prevent further collapse and to advise on the types of repairs required to bring the building back into a useable condition. Further instructions were received in February 2023 to update this survey to assess the current condition and to inform a study of how to utilise the buildings.
- 1.4 The original inspection was carried out by Chris Smith BEng (Hons) MSc CEng MStructE MICE, Conservation Accredited Engineer and Josh Bargh MEng (Hons) on the 30th April 2021. The updated survey was carried out by the same persons on 20th February 2023.
- 1.5 The weather at the time of the updated survey was dry.

2 GENERAL DESCRIPTION

- 2.1 The building was used as a store house originally for brewery dry goods and beer, later rum and sugar. The west range dates partly from 1758 and was extended and remodelled in 1897/98. The building was damaged and reduced in height in 1940, the result of bomb damage.
- 2.2 It is a large compact rectangular range of building single to three storeys in height with three long parallel ranges. The earliest of these is the west range. This is single storey with an original pitched and hipped roof laid to slate. The later work provided a three-storey, double range L-plan structure also with a pitched hipped roof. As a result of the 1940 destruction, most of the building now has two storeys, but a small NE corner section still has three storeys.
- 2.3 The walls are of brickwork laid to Flemish bond.
- 2.4 The single storey west range retains the wide-span trusses carrying two purlins, the upper purlin in each case supported by strutted posts in a combined king-and queen-post design. Close-spaced plain rafters carry close-boarding, and there is a series of roof-lights to the internal slope.
- 2.5 The centre range has heavy fire-resistant construction, because of both the heavy loadings envisaged, and also because rum storage implied a heavy fire risk. The floors comprise clinker concrete jack arches spanning between riveted cast iron beams spanning the width of the section at relatively close centres. The spine wall between this section and the outer range has a series of piers connected by wide segmental arches to a low wall.
- 2.6 At the NE corner is a wide closed-string timber staircase with sturdy handrail and square newels, to close-spaced square balusters.
- 2.7 The west range has timber carriage beams to the flat roof with joists spanning between. The first-floor construction is very similar but the carriage beams have been supplemented with channel sections each side.

3 OBSERVATIONS AND RECOMMENDATIONS

- 3.1 The roof structure of the east range has generally been kept dry due to the covering of slate on the pitched roof. The problems with this roof are at the bearings of the main trusses where water ingress has occurred due to poor maintenance of the valley gutter and the parapet gutter and hoppers on the west side. This has caused decay in the truss tie-beams in a number of locations as well as the wallplate and rafters local to the gutter. One truss has decayed and dropped to such an extent that the longitudinal bracings to the purlins have dropped out. **This truss was propped with acrows in 2021. Some other trusses have also been propped. Other trusses in areas of water-ingress should also be propped until the gutter and hoppers have been overhauled and the extent of timber decay can be properly assessed. The wallplate will need to be replaced in a number of locations and the rafters will have to be paired-up where their ends are decayed.**



Truss Condition 2021



Truss Condition 2023



Truss Condition 2021



Truss Condition 2023



Truss condition 2021



Truss condition 2021



Truss Condition 2023



Truss condition 2023

- 3.2 The dragon-tie in the south-west corner is decayed. **The extent of decay will need to be assessed when the parapet gutter has been overhauled but it is likely that it will need to be replaced and the hip rafter will need to be repaired. The condition has not changed significantly since 2021.**



Dragon tie 2021



Dragon Tie 2023

- 3.3 The central range exhibits signs of water ingress through the roof. At first-floor level corrosion of the embedded steel beams of the roof has caused cracking in the brickwork. The roof was not originally flat and would have originally been a floor. The flat roof coverings have obviously failed and water is penetrating the structure. Some of the arches over window and door openings have failed under the load from the floor beams. **The roof coverings should be replaced as soon as possible to allow the structure to dry out. The failed arches will need to be strengthened with stainless steel bar. The cracking is not significantly worse than in 2021.**



Roof of central section in 2021



Roof of central section 2021



Roof of central section 2023



Cracking in 2021



Cracking in 2023



Crack over window in 2021



Crack over window in 2023

3.4 In 2021 there were two major collapses to the roof of the west section with several other carriage beams fractured or close to collapse. Since then, a further collapse has occurred towards the south end. Generally, this roof is in very poor condition with the extent of decay in both the beams and joists likely to be such that they will need to be replaced. **This roof is now in such a poor condition that it is unlikely that any of the structure can be saved. Collapsed sections of roof should be removed to avoid exerting undue forces to the outside walls. However, this will need to be carried out in a controlled manner due to the fragile nature of the first floor.**



Collapsed roof in 2021



Collapsed roof in 2023



Partially collapsed roof in 2021



Partially collapsed roof in 2023



Collapsed roof in 2021



Collapsed roof in 2023



New collapse in 2023

- 3.5 The first-floor structure is also in poor condition due to the water coming through the collapsed roof and the weight of the collapsed structure above. There is one major area of collapse at the north end of the east range which is below a collapsed section of roof. However, the floor must be considered to be at risk of collapse under the other section of roof collapse. The floor beams have generally not collapsed because they have been reinforced with steel channels to the sides throughout. The timber lintel over the door to the furniture store office and the floor beam bearing onto it are in poor condition **and they are likely to need to be replaced. In the short-term they should be propped.**



Lintel over door in 2021



Lintel over door in 2023



Floor beam in 2021



Floor condition in 2023



Floor condition in 2021



Floor Condition in 2023

- 3.6 The section of the building to the north is accessible from the main range of buildings. Part of the first floor was in a condition such that it was not deemed safe to access it at this time so the roof structure and the third floor were not inspected. However, the condition of the floor in the north west corner suggests that the roof is not in good condition. **Similar to the other areas the floor and roof beams are now in a condition such that they will need to be replaced.**



Floor beam condition in 2021



Floor beam condition in 2023



Floor in 2021



Floor in 2023

- 3.7 The brickwork to the east elevation is in fair condition except for the softer rubbing bricks in the flat brick arches. These arches have been re-faced in a number of locations and **similar repair work may be required to others in the future**. The stone bands are eroded to varying degrees along their length. There is no significant bowing of the wall to this elevation. The mortar joints are also eroded and the elevation will require repoint



East elevation in 2021

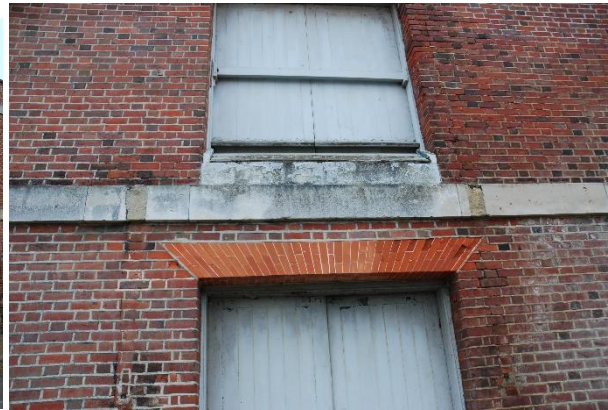


East elevation in 2023

- 3.8 The brickwork to the north elevation is in fair condition again except for the flat brick arches. These arches have been re-faced in a number of locations and **similar repair work may be required to others in the future.**



North elevation 2021



North elevation 2023

- 3.9 The brickwork to the west elevation is in poorer condition, particularly in the areas of the hoppers and at the south end where the brickwork and the mortar joints are severely eroded. **In time the wall will need to be repointed in lime mortar with loose cement and lime mortar removed. The condition of the wall has not deteriorated significantly since 2021.**



West elevation in 2021



West elevation in 2023



West elevation in 2021



West elevation in 2023

3.10 The brickwork to the south elevation is in poor condition. One flat brick arch has dropped a brick, one has dropped and others have been re-faced. The mortar joints are severely eroded, particularly in the south east corner where there is little mortar left. **The flat brick arch lintels need to be strengthened and the wall repointed in lime mortar. The south-east corner should be repointed as a priority. The condition of this wall has deteriorated slightly further since 2021 and repointing of this wall should be given priority during repair works.**



South wall in 2021



South wall in 2021



South wall in 2023



South wall in 2021



South wall in 2023

4 CONCLUSIONS

- 4.1 The roof of the west range is in danger of partial collapse in some areas and recommended propping is shown on the appended drawings. The condition of the wallplate under the valley gutter will need assessment in the future and any timbers adjacent to the parapet gutter will need their condition assessed. The valley and parapet gutters, hoppers and downpipes need to be overhauled to take water efficiently away from the building. The rafters near to these gutters are likely to need to be strengthened. In the long term the trusses will need to have new sections of timber spliced into the bottom chord in a number of locations.
- 4.2 The central range of the building needs to have the roof coverings replaced in order to prevent water-ingress in order to stop further corrosion. Some brick arches in the external walls will need to be repaired in the future to give them sufficient strength to carry the loads from the cast-iron floor beams.
- 4.3 The flat roof of the east range has partially collapsed in a number of locations and is in imminent danger of collapsing further. One section of roof has collapsed since 2021. The first floor is similarly compromised but has not fully collapsed due to the steel channels used to strengthen the floor beams. It is concluded that both the first floor and roof structure are now too badly deteriorated to be able to retain. The best option now is to carefully remove the collapsed roof structure from above and to install a new roof structure based upon the layout of the original beams. Similarly, the floor structure beneath can be replaced.
- 4.4 The first-floor and roof structure of at the north end will require replacement similar to that detailed in 4.3 above.
- 4.5 Some future work is required to the brickwork walls to remove loose mortar, repoint and re-face arches. Some arches will also need strengthening. The south elevation has severe mortar erosion on the east side and some bricks are already becoming unstable. This section of wall should be repointed in lime mortar as soon as possible.

4.6 The existing buildings are already relatively sub-divided and repair works could be carried out in stages on these individual areas. These are as follows;

- The north end. This is of two and three storeys with the three-storey section having a pitched roof and the two-storey section a flat roof. Under the pitched roof the structure is in fair condition but the flat roof structure and first floor below are likely to need replacement. Some sub-division of the space could be achieved at ground floor level but would be more difficult at first floor level.
- The east side range which is of two storeys and has a flat roof, collapsed in several areas. The roof and floor structures here are believed to be beyond economic repair but the walls are currently sound despite the collapsed roof. Access through this section would be required to serve the central section both at ground and first floor levels. The staircase could become a communal area. This area could be sub-divided into two areas at both ground and first floor level, although staging of the roof works would not be possible.
- The central range which is of two storeys with a flat roof. The roof coverings need to be overhauled and specialist investigation of the beams supporting the jack arches will be required. If separated from the east range dividing walls will need to be inserted at ground floor level. This area could be divided into two at ground floor level and possibly the same at first floor level if access can be achieved.
- The west range which is single storey with a pitched roof over. The roof trusses, rafters and gutters need repair work. This area could be split in three at an existing wall line if required but would require one new access doorway.

4.7 The west range would seem the most appropriate starting point for repairs because the structure would be the most cost-effective to repair and the area can be simply sub-divided. The roof is in a condition currently where it can be easily retained, but should a collapse occur, this would become more difficult and costly. The recommended propping should be actioned as soon as possible.

5 APPENDIX 1 – CONDITIONS AND LIMITATIONS

1. The report is a record of a visual inspection carried out by, or under the direction of a Chartered Structural Engineer and must not be misinterpreted as a Structural Survey such as would be carried out by a Chartered Surveyor. The report is not a Valuation Survey.
2. The inspection is strictly limited to the items requested and these will be detailed in Clause 1 of the report. No consideration will be given to any other aspects or parts of the building.
3. The report is confidential to the Client(s) stated in Clause 1 and has been prepared to their instructions for their own purposes only and it is not permitted to disclose this report to any other parties (except the Clients own Solicitors, Surveyors, Building Societies or Estate Agents) without the prior consent of Marbas Group Limited.
4. The copyright of this report remains the property of Marbas Group Limited.
5. No liability for the contents of this report is accepted to any parties other than the Client(s) stated in Clause 1.1.
 - 1.1. No parties other than the client stated in Clause 1.1 should rely upon this report.
6. Unless specifically stated otherwise: -
 - a) Trial holes will not be excavated prior to the preparation of the report and the depth and construction of the foundations and type of sub-soil will not be inspected.
 - b) All external observations will be carried out by eye from the ground level only. Internal inspection is made within the limits of ready accessibility and it is not normal practice to lift floor coverings or floor boards, remove fixtures, panels or plaster, or move heavy items of furniture or bulky goods or materials.
 - c) No inspection will be made of any roof voids, floor joists, wall cavities, drainage pipework or any other hidden or inaccessible parts.
 - d) No timbers will be checked for damp, rot, infestation by wood-boring insects or other defects.
 - e) It should not be construed that any parts of the construction comply with the requirements of the Building Regulations Act or standard practice either current or as current at the time of original construction. No enquiries to any Authorities will be made.
 - f) No testing or enquiries into the presence of or susceptibility to pollution, contamination, radiation, methane, radon or other gases or hazardous substances has been carried out.
7. Unless specifically stated otherwise in the report, any recommendations for works given in the report are outline only and are to be confirmed or modified as appropriate at detailed design stage.
8. Where trial holes are specifically included in our instructions the condition of the footing and the founding soil relates only to the point of excavation and does not necessarily confirm a continuation of the same conditions throughout the non-inspected areas of the structure. Whilst such trial pits will usually provide a reasonable indication as to the general state of the foundations and ground conditions, these cannot be determined with complete certainty.
9. Under the Construction (Design & Management) Regulations latest edition, the Client has obligations for ensuring Health and Safety arising from any construction work. If it is proposed to proceed with construction work based upon information or recommendations contained in this report, these regulations probably apply. Further details of any issues arising from our report or the Clients obligations generally are available on request.
10. Unless dealt with more specifically above the Association of Consulting Engineers Conditions of Engagement Short Form Agreement 2002 apply.