MUSEUM BUILDING

BROAD STREET

SPALDING

LINCOLNSHIRE

STRUCTURAL REMEDIAL WORKS STRATEGY

SPALDING GENTLEMEN'S SOCIETY

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PROJECT NO: 7080

DATE : 7 SEP 2022

YORK SILLS CIVIL & STRUCTURAL CONSULTING ENGINEERS	Prepared : **RW** Checked : Approved : **MS**	Job ref : **7080** Sheet : **1 –** Rev No:
	Reference: **REP**	Date : **7 Sep 2022**

INTRODUCTION

The Museum Building of Spalding Gentlemen's Society is a Grade II Listed Building (Ref 1147350) located on a town centre site in Spalding, Lincolnshire. The building has been subject to considerable investigation, monitoring and appraisal from the first inspection undertaken by local engineers Sidebottom, Richardson and Cheng in 2011 up to the most recent concluding report provided by Conisbee Associates in 2021 (Ref 180615/D Hubbard), which includes a detailed summary of the previous investigations and should be read in conjunction with this document.

York Sills Ltd have been commissioned to provide remedial works proposals to address immediate concerns in relation to structural integrity of the existing building structure as highlighted in the Conisbee report. York Sills Ltd have been provided with previous reports and correspondence and have inspected the building on two occasions, initially in May 2022 and again in September 2022 when limited opening-up works were undertaken and access was provided into the roof space.

HISTORY OF DEVELOPMENT AND STRUCTURAL MOVEMENT

The original building was constructed in 1911 of traditional solid brickwork masonry with timber first floor and timber raised-tie roof trusses supporting a slate-tiled roof. Subsequent alterations to the building can be summarised as follows:

- 1925 – Strong Room added (reinforced concrete library floor slab over, walls understood to be of reinforced concrete construction)
- 1955 – Scullery and coal store partition walls removed from the former single storey area of the Caretaker's accommodation to create the Maples Gallery. It is assumed that the second storey was added above the Maples Gallery and the Library constructed above the Strong Room at, or around, the same time (solid brickwork construction with flat roof over library and cat-slide tiled roof and timber first floor over Maples Gallery)
- 1960 – Turner Room/Maples Room two-storey extension added (cavity masonry construction with precast concrete first floor and timber flat roof construction)
- 1986 – Cadas Room created by covering the yard between the boundary walls and the Turner Room extension (timber flat roof construction).
- 1996 – Ship weathervane added to front gable

The main building has suffered from high initial load-consolidation settlement since construction due to the presence of soft silty subsoils, with significant differential settlement between internal areas and the more heavily loaded thick exterior walls. Consequently, the first floor rises nearly 70mm from the west (front) gable up to the internal supporting wall and drops back down by 65mm to the east (rear) gable.

This movement has caused significant distortion to the roof and first floor structures along with masonry cracking, generally concentrated around openings *(Photo 1)*. The purlin splices, located roughly at the high point of the movement, have been pulled open by 25mm by the roof movement to either side *(Photo 2)*. The ridge board, which is not spliced at the same location, has remained largely undamaged. The difference between the purlin and ridge elongation has caused the roof trusses to twist on elevation, with the ridge effectively pulling the gable triangles inwards. This has caused significant cracking at the front gable eaves at the junction with the lower wall *(Photo 3)*.

The first floor joists and beams have remained tied to their respective gable ends, causing all of the differential lateral movement to manifest at the internal wall support position. The floor joists have parted by 40mm at this position, with gaps in the floorboards having been previously infilled on at least one occasion historically *(Photo 4)*.

The 1955 addition of an additional storey above the, originally single storey, scullery area in the Caretaker's accommodation caused significant differential settlement between the two elements, with a mortar-filled tapering gap of over 25mm width having re-cracked by a further 5mm *(Photo 5)*.

Work undertaken at the same time included the removal of the internal buttressing walls from the lean-to Caretaker's accommodation removed much of the lateral stability to the north wall. This allowed significant vertical and rotational displacement to occur when the adjacent passageway below-ground drainage failed, causing subsidence of the north wall and ground floor slab to this area and widespread masonry cracking, particularly around window openings. The vertical and lateral displacement of the north wall relative to the main building has caused the original first floor joists to pull out of the supporting wall by at least 40mm *(Photo 6)*.

Defective drainage beneath the 1960 Turner Room extension and a flooding buried well or soakaway below the Cadas Room caused significant subsidence movement in the superstructure and ground-bearing floor slabs in these areas. Remedial works were undertaken, generally comprising localised repair and re-lining, but the original damaged pipework remains in place in large areas, albeit re-lined.

It is also likely that defective drainage found recently below the adjoining building to the south (the former Leverton's building) has also contributed to the most significant ongoing movement remaining in the building, concentrated around the Strong Room and Library area. The Conisbee report indicates a rate of ongoing movement in this area of 1.02mm between May 2020 and March 2021, which is causing damage and movement in the south-east corner of the Johnson Room as well as damage to the Strong Room and Library.

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REMEDIAL WORKS STRATEGY

The Conisbee Report concludes that the 1960 extension and the Strong Room/Library extension are contributing to the ongoing foundation movement in the main building and, determining that piled underpinning would be economically unviable, recommends the demolition of these areas, returning the building to a building footprint similar to that originally constructed in 1911.

The extent of structural damage which has occurred in the main building is significant. Total vertical movement of 100mm to areas of the lean-to floor and 75mm to the main building have left large cracks in the masonry superstructure. The lateral movements have left large areas of first floor joists with inadequate bearing into walls and wide gaps and discontinuities in the roof and first floor structures.

It is essential, therefore, that a programme of structural repair is commenced in the short term (<2yrs) to reduce the rate of ongoing movement and to reinstate the integrity of the structure before irreversible damage occurs or access to large areas of the building has to be restricted.

The structural remedial works proposals are indicated on York Sills drawings 7080/various and can be summarised as follows:

- Demolition of the 1960 Turner Room, Cadas Room and Strong Room/Library extensions to remove vertical load from the main building foundations and prevent the lateral movement of the extensions from further damaging the main building structure
- Complete replacement of the surface water drainage system in the passageway area and the foul drainage in the adjacent, former Leverton's, building.
- Provision of raft underpinning to the worst affected rear areas of the lean-to former Caretakers accommodation to limit differential foundation behaviour and improve the robustness of the support to the wall above.
- Construction of buttressing masonry piers on the lines of former internal partition walls to improve the robustness of the north wall and to reduce the concentration of load on the north wall by reducing the span of the first floor level beams.
- Provision of ties between the first floor joists and passageway wall to reinstate lateral restraint at first floor level. New steel channel sections fixed to the internal main building wall will reinstate adequate bearing to the joists and provide continuity of lateral restraint between the two areas. Tying will also be provided where the first floor joists have separated in the Turner Room.
- Installation of diagonal roof bracing, straps and ties in three bays to stabilise the gable end masonry and to resolve the out-of-plane forces caused by the twisted roof structure. Steel plate repairs will be required where principal rafters have been split by the movement.
- Slate-packing and repointing of all masonry cracks together with installation of resin-bonded stainless tie bars to reinstate the integrity of the separated masonry panels.

Report prepared by:

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Photo 1 – Masonry Cracking below First Floor Window (South Elevation):

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Photo 2 – Displaced Purlin Splice:

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Photo 3 – Leaning Gable and Cracking at Eaves:

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Photo 4 – Displaced Joists (Originally butted together):

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Photo 5 – Tapered Infilled Crack:

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Photo 6 – Displaced Joist Bearings (Original floor at lower level)