

London

1 – 5 Offord Street

London N1 1DH

Telephone 020 7700 6666

design@conisbee.co.uk

www.conisbee.co.uk

Roof Works, Structural Repair Summary**1830 Warehouse – Essential Repairs (LBC Application No.2)****Science & Industry Museum, Manchester**

Ref: 220627/S Wilkinson

27 Feb 2023

Status: For Information

Version 1

Roof Truss Defects

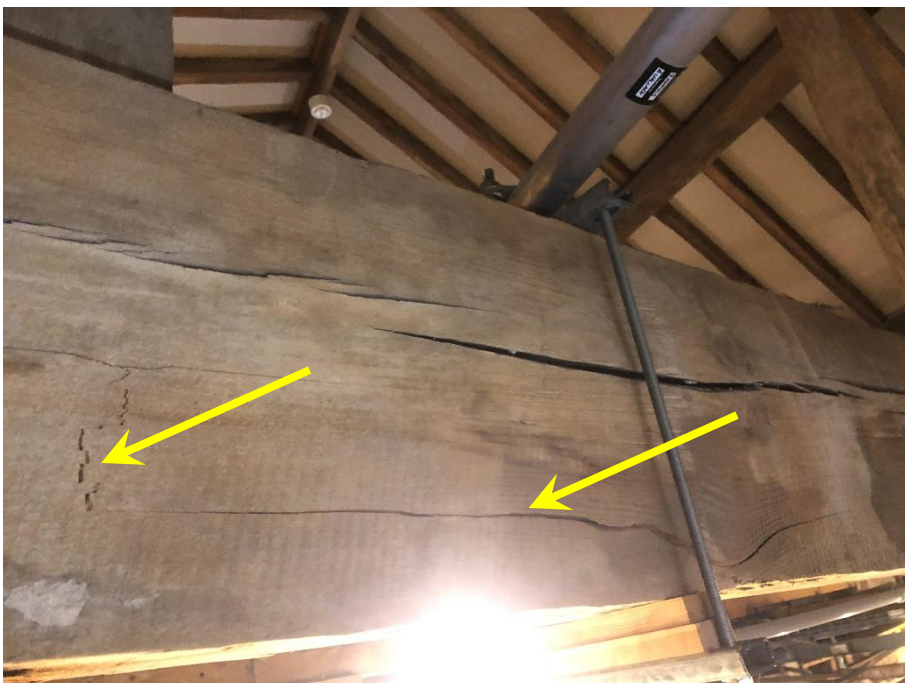
Serious cracking has occurred to the bottom chords of two roof trusses in Bay 2. This has resulted in previous total failure of two chords and installation of long-term propping in the form of steel posts (Photographs 1 & 2) together with partial failure of a second (Photograph 3) which currently has no supplementary support. Refer to Conisbee plan drawing 220627-CON-XX-02-DR-S-1103 for precise locations.



Photograph 1: General view of propped failed trusses in Bay 2.



Photograph 2: Detail view of damaged truss chord. The crack location is arrowed.



Photograph 3: Detail view of damage to unpropped truss chord

The cause of the damage could be conclusively confirmed but is considered most likely to relate to a combination of historic overloading and some inherent timber defects. The roof trusses have historically had imposed loading applied at various points on the structure for lifting operations in the warehouse. Such loads, if excessive, may alter structural function and load paths within the trusses, resulting in partial failure.

The steel posts currently providing support are not necessarily aligned with structural beams below and risk transferring excessive point loads onto second floor boarding and joists. Whilst the posts provide vertical support, they do not restore the full structural function of the truss. The bottom chord is in tension and acts to resolve lateral thrust created by the roof loads. Whilst the props have acted to prevent collapse of the truss, additional lateral loads have been transferred to the brickwork walls between the bays, which is structurally undesirable.

Truss Repair Proposals

Repairs are required to properly restore the structural function of the propped trusses and prevent further damage from occurring to the unpropped truss. A further modest benefit would be removal of the steel posts.

A number of different repair options were considered including traditional carpentered splice repairs. Due to the position of the damage at the mid-span of the truss chord, a traditional lap or scarfed timber repair would require cutting out of a considerable quantity of historic timber fabric to achieve the necessary overlaps between the existing retained timber and the new inserted timber and this was not considered to be a favourable option on that basis.

Previous repairs in other areas of the building had utilised an internal steel 'fitch plate' to reduce the extent of removal and replacement of historic timber. This option was considered here, however the vertical bolt connecting queen post to the bottom chord is located at the centre line of the chord and would prevent a new plate from being inserted. Removal of this bolt and replacement with an external strap would be technically feasible but would also alter the historic truss design and be inconsistent with other trusses in the Warehouse.

Having considered the options, use of external steel plates applied to each side of the bottom chords and bolted through was considered to be the most favourable option. This would restore the structural function of the trusses, whilst keeping loss of historic timber fabric to an absolute minimum. No historic timber would need to be cut out and losses would only occur due to drilling of holes for through bolting. A repair of this type has the further advantage that complex temporary works to maintain structural stability and redirect loading to other parts of the structure would not be required, which also mitigates associated risks. This repair option would remain clearly visible on completion of work but would be generally in keeping with the existing materials and aesthetic.

Please refer to Conisbee drawing 220627-CON-XX-ZZ-DR-S-4101 for full details of the proposed works.

Valley Gutters and Bay 4 Roof

Works are proposed to reline and reconfigure valley gutters to provide a wider zone of leadwork. This work does not directly affect any structural elements (timber rafters, valley beams, purlins) and there is no change overall in the loading regime as existing slate finishes will be locally substituted for lead of the same code thickness as the existing gutter lining.

The proposed works to add insulation and replace torching to Bay 4 will result in a small increase to the dead load on the existing roof structure. This proposed increase has been structurally assessed and found to be acceptable. No modifications to the existing timber roof structure are required.

Both the works to the valley gutters and to Bay 4 will protect the historic structural elements with more robust architectural detailing than is currently present.