



Figure 6: Rear view of connection between steelwork supporting clock and masonry pier. Image shows archway 1 on left hand side and archway 2 on right. Brickwork appears to have been removed around plate girder beam (in red).



Figure 7: Individual brick removed near base of piers of central opening. From left image, crack noted emanating from removed brick.

## 4 Assessment

### 4.1 Archway 1

- The concrete arch (likely to be constructed after the bomb damage, Figure 3), is not adequately supported at the north end. The brickwork that would have provided some support has recently been removed and shuttering plywood appears to have been left in place (Figure 9).
- The masonry infill does not appear to be supporting the arch above (the gap between the infill panel and the arch above is not fully mortared on the inside face; the similar panel in archway 2 has been removed without any problems). However, because of the removal of the brickwork (previous point) the infill may be providing some temporary support to the arch (Figure 8).

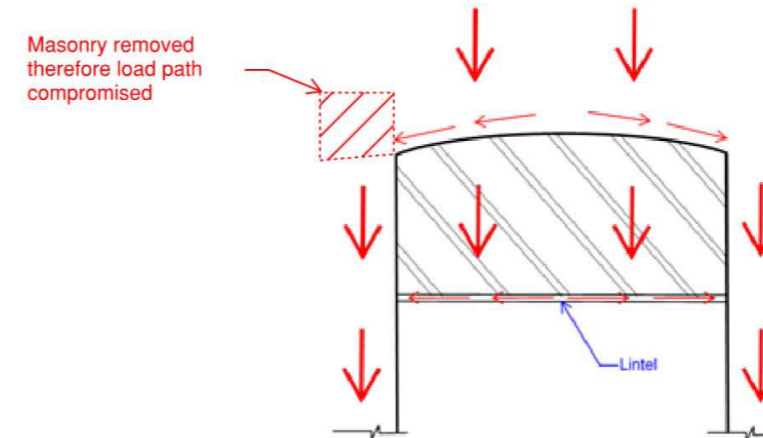


Figure 8: Load path for front elevation of infill panel.



Figure 9: Load path from concrete arch to masonry pier and iron column.

### 4.2 Archway 2

- Brickwork appears to have been removed at both ends, that would have been partially supporting the concrete arch above (Figure 11). At present, archway is only supported by brick packing onto plate girder beam.
- Beam is not continuous through masonry piers (as not encountered during drilling for clock), and beam bearing left onto brickwork unknown (Figure 10). However once area has been infilled (as recommended in section 5), beam will be carrying no significant load.
- Brick pier is not fully supported at ground level (Figure 7). Pier below plate girder beam is of more recent construction.

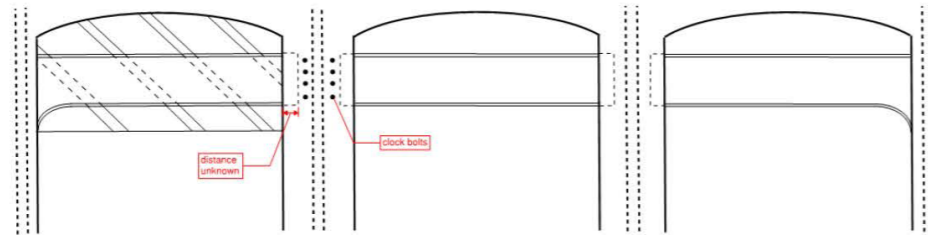


Figure 10: Schematic view of rear elevation of façade.



Figure 11: Masonry pier adjacent to central opening with brickwork removed around plate girder beam. Similar detail at other end.

### 4.3 Archway 3

- Pier below plate girder beam at north end is of more recent construction and investigations will be required to check that it is not hollow.
- Steel column at south end of opening has no fire protection (Figure 12).

## 5 Recommendations

All recommendations are in the sections below. For construction details and calculations please refer to the drawings at the end of this report. It is our understanding that Network Rail are in communication with English Heritage regarding the approval of these works.

### 5.1 Removal of infill panel

Prior to the removal of the infill panel, the concrete arch, visible on the rear elevation must have a suitable load path. Initially, this will involve the temporary support of the arch, either from the plate girder beam or from the floor slab (to be decided by contractor). Once these temporary works are in place, a concrete column shall be constructed up to the underside of the arch (see ENG-SKE-TSOS-001), whilst ensuring that the pouring of the column takes place in suitable increments to prevent blowout of the existing masonry structure. Ties shall also be required between the concrete and existing masonry to ensure the two act in tandem in resisting the vertical load from above. Once these works have been completed, the infill panel can be removed as demonstrated in the indicative construction sequence shown in ENG-SKE-TSOS-001. Care must be taken not to damage the front façade when removing the infill panel as this will have important heritage implications.

### 5.2 Other works

During the visual inspection, it was noted that in archway 2 the brickwork around the plate girder beam has been removed (Figure 11). This will affect the load path from the arch above into the masonry pier. To remedy this, a concrete infill shall be implemented (see ENG-SKE-TSOS-004 for details).

Individual bricks have been removed near the base of the piers of the central openings (Figure 7). This area is to be filled with a Sika®-Armorex® L2 High Flow cementitious grout or similar to avoid further damage to the masonry pier.

### 5.3 Fire protection requirements for beam and column elements

It is believed that the plate girder beam supported a steel roof behind the masonry façade which has now been removed. As the beam appears to have no role in the current structural performance of the façade, at present there is no fire requirement for the plate girder beams.

However, as the iron columns form part of the structural load path for the façade above, suitable fire provision will be required. As per the Arup fire strategy for King's Cross Station, for life safety 60 minutes fire resistance is required for insulation, integrity and load bearing capacity. The protection measure used (e.g. approved fire board) should be fixed back to the brickwork as per the manufacturer's guidance.

An alternative fire protection measure for the beams is the use of intumescent paint. However sandblasting would be required to ensure a clean surface to paint onto and due to the current presence of lead paint appropriate health and safety measures would need to be implemented prior to this method of fire protection.

A further alternative would be to clad the metal elements in brick or concrete.