

The National Trust

Castlefield Viaduct

Record of Structural Review Form

REP/282210/C001

Draft 1 | 27 July 2021

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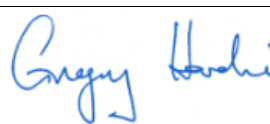
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1 Record of Structural Review Form

1.	Structure Details	
	Structure Name	Castlefield Viaduct
	Structure Number	MAJ/289
	Structure Key (if used)	-
	Date Commissioned	1890
	Obstacles Crossed	Bridgewater Canal
	Bridge Carries	Former railway, now redundant track bed
	Brief Description of Structure	
	Castlefield Viaduct was built in 1892, with 56 arches supporting a wrought iron lattice viaduct spanning 330m. The structure lies just south-west of the city centre. While the site lies between the Bridgewater Street car park and Egerton Street, the viaduct itself does extend further to the west, where it meets the Metrolink corridor. The main beams are comprised of 8 No. steel lattice girders along the length of the structure. The deck plate rests on 6 No. girders running parallel with the rails, spanning 13'4" between the transversely spanning "fish-belly" beams. These "fish-belly" beams span the width of the viaduct, transferring the load to the lattice girders. The lattice girders range in spans up to 175' transferring the loads on to cast-iron cylinder piers filled with masonry. The top of the cast-iron cylinders are braced in pairs with a lattice truss. The piers are 10'6" at the top, flaring to 13'6" at the submerged base, acting as the foundation. The overhead bracing was replaced in the 1950s whilst the viaduct was closed and became disused in 1969, with the rails being removed. Structural repairs were undertaken in 2014 following Jacobs' Assessment of Structural Members between 2009-2012	
	Elements to be Reviewed (where not the whole structure)	
	Whole structure (superstructure and substructure).	
	Reason for Structural Review	The review is required ahead of the development of the Castlefield Viaduct into an elevated urban park, whilst preserving the Grade II listed structure. The structure would primarily be used as a walkway, whilst also providing horticultural space, as well as the construction of a weatherproof community space. This conversion of use from a railway and redundant trackbed results in a change of loading. The review is required to assess whether the structure can support the new loading, whilst the capacity is reduced due to ageing such as corrosion.

2.	Existing Assessment Details or Design Records			
	Inspection for Assessment date		Recorded Condition	
	While there is not an Inspection for Assessment on record, the recent 2020 Detailed Examination combined with the detailed historic records available are considered to be sufficient at this stage. A Detailed Examination was carried out by Balfour Beatty on 07/09/2020.		<i>"The bridge was in fair to poor condition throughout with numerous areas of minor section loss throughout the trusses and soffits."</i>	
	AIP for Assessment	Not available	Status	N/A
	Assessment Date	An assessment of the main structural elements was undertaken by Jacobs in September 2010	Report Number	N/A
	Current Assessed/Design Capacity (include Reserve Factors)			
	Typically, a minimum 30kN/m ² Live Load capacity in the key structural elements (lattice girders, rail bearers and transverse beams) Limited capacity for point loads on the deck plate (4kN)			
	HA/ALL	N/A	SV/STGP/SO	N/A
	Critical Elements	The connection of the transverse girders to the bottom chord of the main longitudinally spanning lattice girders was highlighted in the assessment as a potential weak point due to condition (Jacobs, 2010)		
	Parapet	Currently a key-clamp type maintenance handrail is provided of unknown height above ground level. As part of the works a 1.15m minimum height pedestrian parapet/rail should be provided.		
	Pier Impact	There is negligible risk to the piers from impact. The space under the viaduct is used as a low speed access road and parking area, however high-speed vehicle collisions are extremely unlikely. The piers themselves are large diameter and fully filled with concrete/masonry.		
	Certification	No certifications		
	Calculations	Refer to Jacobs' Assessment 2010.		
	As built drawings	There are a series of original drawings for the Cheshire Lines Committee. 64032 - General Arrangement Drawing Sheet 1 64033 – General Arrangement Drawing Sheet 2 64034 – Sections – Bracing, Girders and Truss 64035 – General Arrangement Drawing Sheet 3 64036 - Details of Cylinders (piers) 64037 – Details of Bottom Portion of Cylinders (piers) 64038 – Details of Bases of Cylinders (piers) 64039 – Details of Cylinders showing Top Lengths & Cap Mouldings 64040 – Details of Cylinder Ties and Band Plates to Viaduct 64063 - Two Main Girders – Span No.6 64064 – General Plan of Major Girders Cross & Rail Bearer Girders Flooring 64065 – Main Girder – No.6 –Span No.7		

		64066 – Main Girder – No.5 –Span No.7 64067 – Main Girders – Nos.3 & 4 – Span No.8 64068 – Detail of Cross Girders and Rail Bearers on Rail Abutments – Span No.8 64069 – Bridge over Collier Street 64070 – General Plan shewing Main Girders – Floor Bracing & C
	Comments on Assessment or Design	
	No Inspection for Assessment was undertaken as comprehensive as-builts were available as well as up to date inspection records as noted above.	

3.	Evaluation	
	Inspection Date	The viaduct has most recently been subject to an examination by Balfour Beatty 07/09/2020. An Assessment was undertaken by Jacobs on 02/09/2010.
	Change In Condition	The main area of importance is noting any considerable change between the Jacobs report in 2010, the subsequent repairs in 2014 and the most recent Examination by Balfour Beatty in 2020. Cross-referencing the reports, shows that there are no obvious areas where corrosion has accelerated rapidly, however due to the age of the structure significant corrosion has occurred historically and this may be limiting the capacity of the structure.
	Change In Standards	Whilst the viaduct was constructed to the appropriate standards of the 1890s, any assessment will be made according to modern standards.
	Change In Loading	The original loading was rail transport, with the proposed change to an urban park.
	Required capacity	Pedestrian live loading. Community centre and planters' dead loads as dictated by the architectural layout.
	Vulnerable details	The structure has longitudinal rail-bearer girders which would previously have carried railway traffic loads out to the other main structural elements. A deck plate is provided between the rails which has considerably less capacity as would only have been intended to receive maintenance personnel loads.
	Hidden critical elements	N/A
	Interim measures	N/A
	Condition	The bridge was in fair to poor condition overall with numerous minor areas of loss of section throughout the trusses and soffits. Flooding to lower boom sections and ballast build up to sections of new guttering system. Loose vertical strut to palisade fencing to end of deck. (Balfour Beatty, 2020).
	Conclusion	The original loading requirements are significantly different to the proposed loading requirements, both in size and distribution. For most elements, the proposed loads are likely to be significantly smaller than the original design loads. However, the deck plate itself could have been designed for a smaller maintenance load than the proposed development.
4.	Recommendation	
	The preliminary Jacobs assessment has identified a significant theoretical capacity in most of the main structural elements. The condition of the viaduct is likely to reduce this theoretical capacity somewhat. Further assessment is likely to be required to understand the impact of the corroded condition on the theoretical capacity.	

To ensure the calculated capacities from the Jacobs' report are achieved, the following defects would require repairs, as noted by Balfour Beatty in their detailed examination:

- Repair broken stave to palisade fencing at East end of structure
- Remove loose rust debris to isolated piers trusses, West abutment and span 8 ballast wall
- Replace drainage bracket to pier 4S and guttering brackets to soffit of span 2
- Install drainage pipes to flooded bottom booms of spans 6S, 8N and 8S and re-examine elements
- Remove all ballast from recently installed guttering system to span 5
- Repair major losses of section to top boom of S truss of span 2 - Annually monitor widespread fractures to piers
- Clean shelf areas, remove sapling and replace heavily corroded bearings to W abutment
- Stitch repair fracture to pier 1S column - P2 £15k. Remove root growth and vegetation to pier 3S, pier 4S and make good
- Repair minor losses of section throughout piers particularly at tops
- Ditto to trusses generally and replace odd connections
- Remove all areas of corrosion to connections between main and transverse girders at decks 2-8, repair/repaint

2 Acceptance

THE ABOVE IS SUBMITTED FOR ACCEPTANCE

Signed.....

Name:

Engineering Qualifications:

Name of Organisation:

Date:

THE ABOVE IS REJECTED/ACCEPTED SUBJECT TO THE AMENDMENTS
AND CONDITIONS SHOWN BELOW

Signed.....

Name:

Engineering Qualifications:

TAA:

Date: