

## The UK's First Network Arch Railway Bridge

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### 1. Introduction

River Irwell Bridge will be the first network arch in the UK to carry railway traffic. It is intended to be the signature structure for the Ordsall Chord, a section of new railway in central Manchester that provides a link between the two main stations, Manchester Piccadilly and Manchester Victoria. The prominent location of the bridge means that the appearance of the structure is of high importance whilst the functional requirements; inspectability, maintenance, robustness and erection methodology, must also be satisfied.



Fig. 1: River Irwell Bridge Visualisation

### 2. Content

The bridge carries 2 ballasted tracks 89m over the River Irwell and comprises a pair of weathering steel inclined hexagonal shaped arch ribs (rise to span ratio 0.152) which continuously vary in depth and width along their length. The 46 hangers in each network are set out at approximately equally spaced nodes along the arch axis and consecutively vary in angle whilst all hanger intersection points align radially to a single focal point. Open section tie beams were required by the Route Access Manager to facilitate inspection and maintenance. Fabricated cross girders with shear key end plate connections were requested by Network Rail. The connections are located so that the tie soffit appearance is kept “clean”.

The accidental loss of 4 hangers in “series” was the governing robustness requirement. Over 600 scenarios were investigated with 4 hangers lost simultaneously with a dynamic amplification.

The steelwork ladder deck is erected piecemeal from two sets of temporary piers in the river whilst maintaining a navigable channel. The braced arches are to be lifted onto the deck in one operation followed by the installation and stressing of the hangers. The deck slab is constructed in stages before the secondary phase pre-stressing of the hanger network.

The twist of the tie beam sections during erection are controlled by a sequence of jacking operations between the tie beam top flanges in order to facilitate installation of the cross girder connections and the hangers. Spherical bearings are provided at hanger ends to improve rotational tolerances.

### 3. Conclusions

The River Irwell Bridge is a good example of a structure where form function, durability and constructability are simultaneously addressed.