AMCO·GIFFEN

# Design Team Case Study

## South Tyne Viaduct Strengthening and Refurbishment

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| **End Client** | Network Rail |
| **Design Stages** | Approval in principle to as-built |
| **Design Timeframe** | 2021 |
| **BIM** | BIM Stage 1 |
| **Specialist Software** | 2D AutoCAD |

## Bridge Construction

South Tyne Viaduct carries two tracks over the River South Tyne, over 5 spans and is located between Haydon Bridge and Bardon Mill Stations in Northumberland.

Each of the five spans is of similar deck type construction, consisting of four riveted steel plate girders positioned directly below the rails, and a steel plate supporting the ballasted tracks. The main girders are connected transversely by half-depth steel diaphragm plates. The cantilevered Cess areas on each elevation are supported by steel cantilever brackets with a steel edge beam running along the external face.

Each deck is supported by substructures comprising stone block abutments, wingwalls and four intermediate stone block piers.

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## Project Overview

AmcoGiffen were commissioned to provide approval in principle and then detailed design to refurbish the bridge.

### DECK JOINTS

The existing deck joints between each span had failed, allowing water to seep through the joints and corrode the steelwork. In response, steelwork repairs to deck end joints were designed and detailed. This included the renewal of deck end angles, cover plates and the application of a loose-laid waterproofing membrane.

### DIAPHRAGMS REPAIR

63 No. diaphragms were identified as understrength or distorted. Repairs and strengthening of these diaphragms were designed by our team, this included the application of back-to-back angles to understrength diaphragms in addition to renewing the web of deformed diaphragms.

### CORROSION REPAIRS

A number of localised areas of severe corrosion had been recorded. Localised steelwork overplating to end plates and steelwork overplating to bottom flanges adjacent to the bearings were designed and installed.

### BALLAST REPLACEMENTS

Ballast loss had been recorded over the existing ballast retention system. The existing ballast retention system was improved by designing GRP boards of 150mm height across the length of the structure.

### BEARING PADS

All 40 No. of the bearing pads below each main girder end had rotated, necessitating their replacement. This was achieved by cutting out a localised area of existing bedstone and seating the girders on a new natural rubber bearing. The bearing was located in a stainless-steel cradle, formed from plates and angles and surrounded by a cast in situ grout. To facilitate these works, the ends of the girders had to be propped, we designed a trimmer girder that could be erected and dismantled into small pieces, allowing deck ends to be repaired sequentially.

## Innovations Applied

Our design, fabrication and delivery teams implemented an innovative approach to jacking the bridge, utilising fabricated sections which were assembled to form a trimmer beam. This beam was then jacked from a series of bottle jacks, enabling the bearings to be replaced. The trimmer beam was then dismantled to transfer it onto the girder. This process was repeated until all bearings were repaired. The tracks remained operational throughout this process.

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