

Design Team Case Study

Denmark Street Middlesbrough

End Client	Network Rail
Design Stages	Concept to as-built
Design Timeframe	2021 - 2022
BIM	BIM Stage 2
Specialist Software	Autodesk Revit for modelling and drawings, AXIS VM for structural analysis, LimitState GEO 3.4 for the geotechnical analysis



Project Overview

Denmark Street Underbridge was a life expired 19th century structure. AmcoGiffen undertook design and construction work to renew the deck supporting the DSN2 lines in Middlesbrough, Teesside. The bridge required renewal under the London North Eastern Control Period 6 framework.

Before works began, the existing sandstone abutments were exhibiting signs of severe disproportionate settlement and the geological conditions are extremely poor at the structure location. Underpinning works were required to address this issue prior to reconstruction of the bridge deck. The new deck structure has a minimum service life of 120 years and maintains existing headroom to the footway.

The existing track formation was a direct fix, with rails clipped to the longitudinal timber bearers. The renewed deck carries ballasted track formation which allows for greater flexibility in the permanent way design and serviceability.

The bridge deck was replaced within a 72-hour blockade in conjunction with a similar renewal at Boundary Road, located 275m away.

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Scope of Works

Prior to beginning works, the AmcoGiffen Design Team were required to complete a detailed feasibility study for deck renewal options, further scope of works included:



DESIGN SOFTWARE

GRIP 2 to GRIP 8



DETAILED DESIGN WORK

Provided outline design of the new deck and preliminary substructure underpinning



COLLABORATION FOR DESIGN

Supplied detailed design of the deck renewals, and pile design by Keller Group



SITE SUPPORT

Contributed site support during fabrication and delivery



TEMPORARY WORKS

Temporary works design was completed and applied

Innovation Applied

- Bridge design details and form similar to Boundary Road to provide commonality across both structures
- A flat deck profile creating a clear wide rail 'corridor' for track alignment
- 10ft deck edge detailed to allow for connection of a future renewed deck below the neighbouring freight lines
- Pali Radice piles augured through existing abutments

Benefits Provided

- Renewed structure to the DSN2 lines
- Removal of intermediate longitudinal members restricting track alignment
- Safe cress walking routes over the structure
- Ballasted track over the structure
- Abutment underpinning/stabilisation works
- Inspectable and renewable bearings
- Deck attachment in the 10ft for any future renewal of the Freight line deck

Challenges Overcome

- Compliant deck deflection limits with a shallow form of construction
- Deck installations within 72-hour blockade
- All elements of the deck transported via standard-size trailers and assembled on site
- Use of heavy plant and Self-Propelled Motor Transporter over shallow buried services