

# A BRIDGE TO THE FUTURE: SUSTAINABLE REPAIR ON THE TEES VIADUCT

**Andy Hatch of Fosroc** looks at the collaborative efforts to repair Tees Viaduct – a project that has proceeded without disruption to traffic and extended the design life to the 50-year-old structure.

**T**he annual electricity consumption of 39 homes, 23 years of commuting or travelling three times around the world. What have all these figures got in common? They have roughly the equivalent CO<sub>2</sub> emissions generated every day by the 100,000 cars driving the 1.2 miles of Tees Viaduct, which carries the A19 over the River Tees, railway marshalling yards, open land, access roads and the A1046 interchange – approximately 28.69 tonnes of CO<sub>2</sub>.

These figures aren't a shock tactic, they're a way of life. The UK daily average round commute is 26 miles. Rather depressingly, writing as a 37-year-old, the author can calculate a personal journey of the best part of 200,000 miles still ahead... luck withstanding. Those figures are merely a way of demonstrating, with real-world examples, why considering the environmental impact of infrastructure projects is so important.

## EMISSION STATISTICS

Greenhouse gas emissions are allocated into groups known as territorial emissions statistics (TES) sectors<sup>(1)</sup>. Emissions from domestic transport and industry (which includes manufacturing and construction) both ranked in the top three biggest emitting sectors in the UK in 2023, holding first and third respectively. So, it's little surprise that when it became clear maintenance was required on the Tees Viaduct, a sustainable solution was paramount.

Opening in 1975, the six-lane

superstructure, flowing north–south, is supported on 67 portal frame concrete piers. The viaduct has a longitudinal joint throughout its length and transverse joints above each bent. Far-from-ideal detailing, coupled with far-from-ideal weather conditions in north-east England, meant chloride-laden water leaked through the joints and started to cause serious deterioration to the reinforced concrete, soon after opening.

The operation and maintenance of the A19, including the Tees Viaduct, has been the responsibility of Autolink Concessionaries (A19), a consortium comprising Sir Robert McAlpine (SRM), Taylor Woodrow and Amey, for the past 28 years. With the 30-year design–build–finance–operate (DBFO) agreement with National Highways set to run to 2027.

## VIADUCT PIERS

Prior to Autolink's involvement, 15 piers had already been demolished and replaced, and the scheme awarded in 1996 outlined a further 52 piers to succumb to the same fate. However, it was clear the demolition and rebuild process on such a structure was highly complex from a health and safety perspective and would cause significant disruption to the travelling public, local communities and businesses. What may not





*(Photo: Jason Elberts.)*

have been as clear back in the late 1990s was the sustainability impact demolition and rebuild would also have.

### **NEW TECHNIQUES**

However, fast forward to the present day and this has become the key consideration in everything we do, especially in infrastructure where PAS 2080<sup>(2)</sup> has been the guiding Standard since 2016. Developed by the British Standards Institution (BSI), PAS 2080 focuses on three key areas – carbon management, collaboration, and measurement and reporting – to provide a framework to manage carbon emissions across the life cycle of the built environment, in particular

infrastructure projects.

Fortunately, the 30-year concession allowed time for new techniques and technology to be developed as there was always the strong probability that repair and protection techniques would be developed to avoid the need to demolish and replace. That 30-year period saw advancements in impressed current cathodic protection (ICCP) systems to negate the effects of chloride attack on steel by reversing the electrochemical process causing the corrosion. This works by applying continuous electrical current through the system, thus making the steel reinforcement electrically

### **MAIN IMAGE:**

Repair work was carried out on the 1.2-mile Tees Viaduct to extend its design life.

### **INSET LEFT:**

Proprietary products were used to repair the concrete and encapsulate the ICCP system.

*(Photo: Jason Elberts.)*



more negative than the surrounding concrete. The process prevents the steel from losing electrons, therefore halting the corrosion process. There were also advancements in concrete repair technology, as well as the advent of BS EN 1504<sup>(3)</sup>, resulting in far superior repair mortars that have quality control and testing standards to ensure the quoted properties are met.

When the time did come to act, it was recognised that large-scale infrastructure projects don't succeed in silos. This is why, when SRM appointed Concrete Repairs Limited (CRL) as the specialist subcontractor in October 2020, collaboration between all parties became paramount to ensure a robust and sustainable repair solution. AECOM and CRL collaborated to design and detail an ICCP system that incorporated Fosroc products to reinstate the spalled concrete and provide a spray overlay to encapsulate the ICCP system fully. This solution provided an 80-year design life and the experience and capabilities of the project team were instrumental in making it a reality.

### WIN FOR SUSTAINABILITY

This project has been a major win for sustainability. In fact, the numbers speak for themselves. When compared with demolition and reconstruction, there was a 98% reduction in CO<sub>2</sub> emissions for concrete elements, 99% for steel and 97% for timber. To further bolster the sustainability credentials, Fosroc introduced a carbon offset scheme in 2024, meaning every bag of hand-placed and flowable repair



(Photo: Jason Elberts.)

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mortar used on this project, and those materials used in the whole of the UK and Ireland, were certified as carbon neutral. Although by no means a final or standalone long-term solution, it's a step in the right direction while working towards reducing carbon at source.

One of the biggest groups of beneficiaries of the whole scheme probably don't even realise its presence. Apart from the odd dog walker frequenting Portrack Meadow, it's likely the occupants of those 100,000 vehicles had, and remain to have, no idea of the work happening beneath them, as there has been no disruption to traffic

flow throughout the entirety of the project. That's not to say it isn't important to give back to the community when undertaking such significant works. On the contrary, social value was high on the agenda and CRL and Fosroc were fortunate enough to volunteer at Nunthorpe Academy, Middlesbrough, to help deliver 'The Green Energy Challenge', which saw the Year 9s plan, develop and present a new business idea or concept to save energy.

### BENCHMARK

With that, I think Daren King, CRL's northern regional director, summed up this project best, "The Tees Viaduct refurbishment serves as a benchmark for future infrastructure projects. It's proof that when engineering ingenuity meets collaboration and sustainability, bridges to the future aren't just built – they're strengthened for generations to come." **C**

### References:

1. DEPARTMENT FOR ENERGY SECURITY AND NET ZERO. 2023 UK greenhouse gas emissions, provisional figures. HMSO, available at: <https://tinyurl.com/44f5k6zw>, March 2024.
2. BRITISH STANDARDS INSTITUTION, PAS 2080. Carbon management in buildings and infrastructure. BSI, London.
3. BRITISH STANDARDS INSTITUTION, BS EN 1504. Products and systems for the protection and repair of concrete structures. Definitions, requirements, quality control and evaluation of conformity. BSI, London, multiple parts.

### TOP LEFT:

The repair solution has provided for an 80-year design life.

### INSET MIDDLE:

Fosroc worked with AECOM and CRL.

### TOP RIGHT:

The repaired A19 Tees Viaduct.