# Boston Manor

**Prime Minister, David Cameron commented:**

***"I want to pass on my personal thanks to all those who worked so hard to repair the M4 Bridge and get it open again in time for the Olympics. You showed real determination to get the job done in time, working through the night to do so. I was delighted to get the news very early this morning."***

**IMAGE:** Boston Manor Viaduct

## Unified Team Delivers Olympic Critical Strengthening Solution

**The 1km long Boston Manor viaduct carries the M4 motorway into London and when cracks putting the structure at risk of failure were found in spring 2012, a weight limit was immediately imposed. The project team had fewer than three months to devise and implement a repair solution in time for the Olympic Games traffic.**

The original viaduct construction used obsolete welding techniques so the scope of the project was unknown from the start. Investigations into the welding ran in parallel with design solutions. With some solutions being designed while others were being implemented, the fully collaborative team had to adapt the programme, continually increase resources and devise new solutions.

The successful strengthening of Boston Manor Viaduct to such a critical schedule shows what can be achieved when customer, professional team contractor, designers and suppliers teams work together coherently. The project was shortlisted as a finalist for the Integration and Collaborative Working category in the 2013 Construction Excellence Awards.

## Defining the Scope from First Principals

The viaduct includes 17 steel spans, is owned by the Highways Agency and managed by Connect Plus. All the structural steel sections are fabricated using electro-slag welding which has since been discontinued.

When the cracks in the welds were first found, the owner and manager assembled a project team to devise and implement a solution in time to carry traffic for the games but without a full investigation the extent of the problem was unknown. As inspection and testing progressed, more and more cracks were revealed and the scale and complexity of the repair and strengthening project increased greatly.

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**TOP:** Innovative engineering solutions

**BOTTOM:** Works in progress

With the bridge being the only one on the UK’s strategic road network to use the welding technique, fracture and welding experts were consulted to engineer solutions to remove the immediate risk of brittle fracture of the primary structural members.

The defects needed to be repaired safely without increasing stress and a trial section was fabricated to highlight any issues with the main type of repair to be carried out. The “mock-up” repair proved to be highly successful, both as a visual tool to demonstrate to the team the installation sequencing and methods, and to enable the workforce to practice techniques prior to working on the actual structure.

## Flexible Solutions to Maximize Asset Opportunities

With investigation work continuing, and solutions being designed while others were implemented, this project asked far more of those involved than a typical project. Traditional technical approvals were run in parallel to site works, creating a production line process from identification, design and implementation. Fabrication works proceeded ahead of approvals to ensure materials were available on site to progress installation at the earliest opportunity.

Programme constraints meant the site was committed to working 24 hours a day, 7 days a week, with the work progressing on 20 simultaneous fronts at one stage. With the exact cause of the cracks being unknown it was imperative that the solution maximised the opportunity to remove intact weld samples for future analysis to assess the long-term risk.

## Success of Collaborative Planning

Through adopting the Lean technique of collaborative planning, the project team successfully delivered emergency repairs to 111 weld cracks in just 16 weeks.

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> ***"Through reducing the gaps between activities, the overall time to complete a full splice plate repair, from discovery of need to completion, reduced from over 25 days to 9 days."***

The very public project, affecting thousands of road users every day; was carried out under the scrutiny of the government, British public and visitors from around the world. It was essential that all parties involved acted as one team and trust established as early as possible. Access to the isolated repair sites also affected local businesses, shops and residents – presenting yet further challenges with access, interfaces and programme management.

Lean collaborative planning was set-up in three stages to simplify the project process, eliminate waste and drive team performance:

- Senior personnel from all organisations mapped their interdependencies, providing each other with a clear view of their dependence on others

- Site meetings with critical suppliers enabled a first collaborative programme to be populated for each weld repair

- Short-interval review meetings were then set-up to optimise the interlinked works, allow shift handovers and allow for daily reporting to the Government

This generated transparency of information that allowed for efficient pooling of resources to address the individual challenges, identify inefficiencies and drive improvement.

Through reducing the gaps between activities, the overall time to complete a full splice plate repair, from discovery of need to completion, reduced from over 25 days to 9 days.

## Team Success

In addition to the pure resilience demonstrated by the entire team, key to the success was the tremendous respect the project team had for each other and their support for the goal of the project. The stabilisation of Boston Manor Viaduct shows what can be achieved when teams work together coherently, safeguarding the structure and minimising the risk of costly and disruptive closures occurring in the future.