Repairs

Concrete Repair

M6 J16-19 Smart Motorways Bridge Repairs

Client
Highways England

Principal Contractor
Carillion Kier JV

Engineer
Jacobs

Specialist Supply Chain Partner
Tarmac

As a strategic route connecting people, communities and businesses, the M6 is one of the busiest motorways in the UK.

The £233 million M6 J16-19 Smart Motorway upgrade programme aims to conquer traffic congestion and reduce delays between Crewe and Knutsford, by introducing new signalling technology, variable speed limits and converting the hard shoulder to a traffic lane.

Carillion and Kier, working as a joint venture on behalf of Highways England, approached Freyssinet in conjunction with other strategic supply chain partners to work with them on the scheme. A repair solution was sought for the structure that wouldn't require any further intervention for a minimum of five years post-construction.

The Challenge

The motorway environment is a tough one, especially for the concrete piers, bridges and soffits (constructed in the mid-1960s) that are subject to erosion from road salts and carbon dioxide. As part of the Smart Motorways project, Carillion/Kier were tasked with repairing these structures and so collaborated with Freyssinet and other supply chain partners to find the best solution.

Due to the extensive deterioration of the structures, including significant chloride contamination, traditional methods of concrete repair would have meant either expensive temporary support to the structures or a time-consuming staged repair process. These options are expensive and jeopardised the Project Programme, which would increase the duration of the roadworks and disruption caused.

Given the complexities and logistics of the problem, as well as a very compressed timescale, an innovative and specialised solution was required.

Our Solution

Through conversations with the project team, it became evident that a different solution altogether was needed and an encasement and encapsulation approach utilising a flowing concrete would be the best option.

This meant the team could avoid the need for propping or phasing, as they would simply be removing loose and already de-bonded, and therefore non-structural concrete.

To overcome the challenge of the remaining chloride contaminated concrete, an Impressed Current Cathodic Protection (ICCP) system, which included unique technology developed by CCSL, was designed to be incorporated within the encasement and encapsulation. This included a full monitoring system.

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The concrete design also had to be compatible with the ICCP system in terms of resistivity, and sufficiently fluid when placed to completely encapsulate all elements without damage to them.

To check that the concrete encapsulation would provide the density, strength, resistivity and bond required, numerous trial panels were constructed and the mix altered accordingly. There was an added complication that both the self-compacting concrete solution and the ICCP system deviated from the existing HE standard procedures. However, because it was obvious that this was the right direction to go in, Tarmac worked with Freyssinet and the Principal Contractor to provide the relevant evidence needed to enable Highways England to approve a departure from their usual practices.

Results & Benefits

The collaboration of all parties, including Highways England, Carillion Kier JV, Tarmac, Freyssinet and the design team enabled this innovative, cost saving, time saving solution to successfully solve a commonly recurring problem on the network.

The solution will be delivered in less than half the time more traditional approaches would have taken, with a consequent reduction in disruption to the travelling public.

The ICCP system was installed by Freyssinet to the first of the structures and the first pour of Tarmac Topflow was carried out in October 2016. All parties involved have been incredibly happy with the result.

The quality of the concrete is aesthetically better than a conventional mix and has exceeded the original specification.

Costs have been considerably reduced and planning on the project has been much improved. The number of project hours has been reduced by 300 over the length of the M6 project, which has resulted in massive savings.

There are also many health and safety benefits, including reduced hand arm vibration, manual handling, traffic management and reduced noise on site.

Access on site has not been a problem due to the nature of the product and there has been a good product fit with the ICCP system, which will provide fully verifiable protection to both the old and new parts of the structures for more than 50 years to come.

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