The bridge underwent a refurbishment and concrete repair intervention that made use of MAPEGROUT EASY FLOW GF, MAPEGROUT HI-FLOW B2, and MAPEGROUT LM2K.

A13 Bologna-Padua motorway (Italy)

Bridge over the River Po along the A13 Motorway

THIS BRIDGE BUILT AROUND 50 YEARS AGO WAS THE FOCUS OF IMPORTANT STRENGTHENING AND REPAIR WORK

Built in the 1960s and 1970s, the A13 Bologna-Padua motorway connects North-East of Italy to the important transit hub around Bologna in Central Italy. The A13 motorway is located along the Baltic-Adriatic Corridor and runs through the regions of Emilia Romagna and Veneto. Maintenance work started two years ago on the bridge crossing the River Po between Occhiobello and Ferrara Nord. The renovation and maintenance works were scheduled to start at the beginning of spring 2020 but, because of the pandemic, it was put back to April of the same year with a programme of works lasting around one year.

Areas of intervention: piles and deck

The Po Bridge is 1,800 m long and is located at point km 47+528 along the A13 Bologna-Padua motorway. It is made up of two separate carriageways, one heading north and the other heading south. Each carriageway is made up of 42 constrained spans sitting on piles and abutments. The spans are in various lengths of 32 m, 54 m and 67.20 m. Before carrying out the consolidation and strengthening work, the spans and piles were carefully surveyed to check their actual condition. The data collected from the bridge were put together and handed over to the client, a team of designers and the main contractor commissioned to carry out the work so they could put together a programme of works and decide on how to repair the areas in poor condition.

The data and site surveys, as well as the structural analyses, indicated that piles 21, 22, 23, 24, 25 and 26 were in need of repair works. The works were carried out by the company Divisione Cantieri Stradali under the guidance of Mario Iorio.

The first step was to prepare the substrate by mechanically removing all the areas in poor condition and then hydro-blasting the entire surface to remove all the crumbling and detached areas. The reinforcing rods were then cleaned and treated with MAPEFER 1K one-component, anti-corrosion cementitious mortar. MAPEGROUT EASY FLOW GF fibre-reinforced, thixotropic cementitious mortar was applied with a rendering machine to repair concrete in the areas where a higher level of ductility was required. For the areas where particular thicknesses or forms needed to be reintegrated and that required the use of pre-dosed, free-flowing concrete, on the other hand, MAPEGROUT HI-FLOW B2 shrinkage-compensated, fibre-reinforced micro concrete was applied, as well as MAPEGROUT LM2K thixotropic cementitious mortar in layers from 3 to 20 mm thick. Chemical anchors were cre-

After strengthening the deck, the concrete surfaces were finished with MAPECOAT E23 epoxy primer and MAPECOAT PU 33 polyurethane resin-based, flexible coating.

ated using MAPEFIX EP 385 pure epoxy resin-based product for structural loads. Once all the work had been completed, MAPELASTIC GUARD elastic cementitious mortar was applied to provide concrete surfaces with long-lasting protection from aggressive atmospheric agents.

Repairs on the bridge deck

For the repairs on the bridge deck in correspondence with piles 22, 24, 25 and 26 along the south-bound carriageway and pile 24 along the north-bound carriageway, after mechanically removing all the deteriorated areas and hydro-blasting the surface to remove the crumbling and detached areas, the concrete on the bridge deck was repaired with MAPEGROUT LM2K and MAPEGROUT EASY FLOW GF. A complete product cycle was applied to protect the deck, involving MAPECOAT E23 epoxy primer followed by a coat of MAPECOAT PU33 polyurethane resin-based, flexible coating.

In 2020, for a previous tender, Mapei also supplied FRP strengthening materials which were applied on deck 23 south of the bridge. This also enabled samples of FRP materials to be taken from the site, which then underwent testing in the laboratory in order to accept the material, as per the requirements of MIMS (Ministry for Infrastructures and Sustainable Mobility) guidelines. Particular attention was also paid when verifying the safety data sheets for each single application of the materials used on site, in line with both the prescriptions of Italian Legislative Decree 81/08 and the requirements of the client, Autostrade per l'Italia SpA.

Find out more
MAPEGROUT EASY FLOW GF

TECHNICAL DATA
Bridge on the River Po along A13 Bologna/ Padua motorway, Italy
Period of construction: 1970s
Period of the intervention: 2021-2022
Intervention by Mapei: supplying products for structural strengthening, and concrete repair
Design: Massimo Acanfora
Owner: Autostrade per l'Italia SpA
Project manager: Giuseppe Turco (ASPI Bologna)
Static tester: Prof. Andrea Prota
Works director: Ernesto Maione
Operational direction: Pasquale Staropoli, Ciro Valerio
Executional safety coordinator: Gaetano Mascetta
Technical-administrative testing: Alessandro Zamboni, Piero Indelli
Site direction: Gennaro Sorrentino, Andrea Carraretto
Main contractor: Divisione Cantieri Stradali, Mario Iorio
Contractor: Divisione Cantieri Stradali
Mapei coordinators: Giulio Morandini, Gianpiero Peluso, Davide Demicheli, Corrado Castiglioni, Mapei SpA (Italy)

MAPEI PRODUCTS
Concrete repair and strengthening:
Mapefer 1K, Mapefix EP385, Mapegrout Hi-Flow B2, Mapegrout Easy Flow GF, Mapegrout LM2K
Waterproofing and coating surfaces: Mapelastic Guard, Mapecoat E23, Mapecoat PU33

For further info on products: mapei.com

by **Giuseppe Turco**

Hydrometric variations and damp: the challenges of the project

A "LIGHTWEIGHT" SITE IN COMPLETE SAFETY THANKS TO FIBRE-REINFORCED MORTARS BY MAPEI

What type of investigations and checks did you carry out on the spans and piles of the bridge?
When we decided to intervene on the bridge, we contacted several external companies to verify the condition of the structure. Every three months, we carry out regular inspections to check the condition of all the infrastructures we are responsible for, as required according to current norms and standards. Then we contacted the engineering company, Strutture e Servizi Srl, which came up with a programme of inspections and tests to assess the work that needed to be carried out in more detail. We then drafted a project that was tendered out to a construction company which, in turn, chose Mapei as supplier of the products required to repair the concrete on the bridge.

What problems did the bridge have?
The bridge was built in the 1960's and was opened to vehicle traffic in the 1970's. During its 50 years of service various works were carried out to guarantee it remained in good health. This is a strategic structure, not only for Northeast Italy, but also for the rest of the country because it connects the region of Emilia Romagna to Veneto and then to Northern Europe. The programme of works was based on the critical areas identified in the concrete, mainly due to the level and flow rates of the river. Localised repair work was required along with repairs to the cortex of the concrete of both the piles and the spans on the riverbank side of the bridge.
The bridge had problems due to its age, but even more so because of the aggressive action of the river itself. In fact, the level and flow of the river can vary dramatically, which means the areas that are wet and then dry are particularly impacted: in just a few days the level of the Po River can rise quickly and then drop again just as quickly. What is more, the bridge is in a particularly damp area.

Safety and durability: the objectives of the intervention. How much did it help to be able to rely on cutting-edge, consolidated products such as those proposed by Mapei?
Using Mapei products helped us achieve the objectives of this intervention: to repair the concrete exactly where needed and to protect it. The result was highly appreciated by the owner, Autostrade per l'Italia. Before starting work, we studied the product data sheets and standards very carefully and we are convinced that the Mapei solutions have been fundamental for the structure.

How was life on site affected by being able to choose and introduce new materials, such as fibre-reinforced materials?
This was a very important choice for the intervention, considering the heights involved and the conditions we had to work in. Because of the wide variations in the level and flow of the river we couldn't erect scaffolding. To be able to count on products such as Mapei fibre-reinforced mortars was an enormous help to us.
We managed to carry out the work quickly while working in complete safety and without having to worry about having to demobilise the site because the level of the river was rising. We used portable platforms positioned under the bridge and choosing Mapei products combined to perfection with our idea of having a "lightweight" site, to work safely and to keep to the schedule.

The infrastructure is located in a strategic zone connecting the regions of Emilia-Romagna and Veneto. How did you overcome the problem of closing the road to traffic to carry out the work?
The viaduct has two traffic lanes running in each direction, so timing was very important. By carrying out the work from under the bridge we managed to interfere with the flow of traffic as little as possible.
The work was carried out without closing the road to traffic, particularly when working on the piles using semi-pontoons, or barges, with mobile lifting arms.
When working on the spans, on the other hand, we used suspended scaffolding with access from both the left bank and the right bank of the river.

Site Project Manager, Autostrade per l'Italia SpA