



# A LONGER LIFE FOR VIADUCTS

**A**s part of the rebuilding plan for a number of viaducts along the A14 Bologna-Bari-Taranto motorway, (which runs from central to southern Italy and is managed by Autostrade per Italia), work was also carried out on the San Savino and Ilde viaducts. The following article describes the work carried out.

## THE SAN SAVINO VIADUCT

The viaduct is located at km 429+617 along the A14 Bologna-Bari-Taranto motorway, in the stretch between the Italian cities of Pescara and Vasto, and was built at the end of the 1960's by the C.M.C construction company from Ravenna. It is in the territory administered by the Casalbordino City Council in the province of Chieti, which in the

seismic classification table is considered to be a N° 3 zone.

The overall length of the structure is 313 metres, it is 19.1 metres wide and includes the north and south-bound carriageways (8.7 metres wide), two lateral kerbs (0.5 metres wide) and a New-Jersey single-row concrete central strip.

The viaduct is made from pre-compressed reinforced concrete in seven spans. The single scaffold frame is made of three pre-compressed reinforced concrete beams at a pitch of 3.25 metres which are joined together with five cross-beams, with one at each end, which supports a 21 cm-thick floor slab.

The supports, which sit on continuous concrete bearing elements, are of the

swivel and/or pendulum steel type.

The piles on which the beams of the support frame sit are made from two double H boxed trunks, with a shelf-type pulvino for each trunk, and are 3.6 metres wide and 9.5 metres long. There is also a load-bearing boxed structure in reinforced concrete which is positioned above the pulvino. All the foundations (piles and shoulders) sit on piles with a diameter of 1.2 metres. Drainage channels for run-off water are positioned along the external overhangs of the support structure.

## Deterioration Found on the Viaduct and Recommended Solutions

When a technical survey of the San Savino viaduct was carried out, capillary cracks were found on the edge





*Photo 1.  
An image of the San Savino viaduct before repair work.*

*Photos 2 and 3.  
The bearing elements of the viaduct had problems of localised detached concrete, with the reinforcement rods exposed in some areas.*

*Photo 4.  
MAPEGROUT EASY FLOW GF mortar was used to rebuild areas where the concrete had been removed.*

*Photo 5.  
ELASTOCOLOR PRIMER and ELASTOCOLOR PAINT were used for the final protective coating.*

beams, and the internal beams of bay N° 6 of the south-bound carriageway showed signs of deterioration of the concrete.

The concrete used to make the piles had signs of localised scouring and was partially deteriorated.

The concrete cover was worn away by the rusty steel reinforcement, especially all around the corners and the bearing elements. After analysing the problems highlighted on the San Savino viaduct, repair operations were then carried out.

The first phase was to demolish the deteriorated surfaces by hydro-blasting, until all the deteriorated and carbonated concrete had been removed, including concrete in danger of becoming detached.

This operation completely exposed the reinforcement rods. Those which were particularly eroded or corroded were replaced.

The concrete was then rebuilt using MAPEGROUT EASY FLOW GF one-component sulphate-resistant, thixotropic, inorganic fibre-reinforced mortar.

This product has been developed and perfected in Mapei's own Research & Development laboratories to repair the deteriorated concrete structures of viaducts, hydraulic works, facing walls on dams and depuration tanks.

Thanks to its special thixotropic consistency, MAPEGROUT EASY FLOW GF may be applied on vertical surfaces by hand or with a rendering machine, including in thick layers without the use of formwork.

The product was mainly sprayed onto the structures of the viaduct, while in certain areas it was applied by hand, in layers of from 2 to 8 cm, according to the level of deterioration.

The final protective layer was made using ELASTOCOLOR PRIMER, a fixing primer with high-penetration properties used particularly for impregnating concrete surfaces repaired with products from the MAPEGROUT range. The primer penetrates deep down into absorbent surfaces, to guarantee excellent insulation and a good bond for successive painting cycles. ELASTOCOLOR PAINT protective and decorative elastic paint based on acrylic resins was applied on the surface, which once dry forms a waterproof film which remains permeable to vapour.





Photo 1.  
An image of the Ilde viaduct before repair work.

Photos 2 and 3.  
Beams, piles and bearing elements of the viaduct had problems of localised detached concrete, with the reinforcement rods exposed in some areas. MAPEGROUT EASY FLOW GF mortar was used to rebuild areas where the concrete had been removed.

### THE ILDE VIADUCT

The Ilde viaduct, which is located at km 447+469 along the A14 Bologna-Bari-Taranto motorway on the stretch between the Italian cities of Pescara and Termoli, was also in need of repair.

The viaduct in question was inaugurated in 1972. It is in the area administered by the Vasto City Council in the province of Chieti, and is classified as a N° 3 seismic zone.

The viaduct has a straight part and a part which curves to the right, and has two lanes for each carriageway.

Its total length is 473 metres distributed over 14 bays at a span which varies from 33.18 to 34 metres, and is 19.1 metres wide overall.

Each support frame is formed by three beams in precompressed reinforced concrete at a pitch of 3.14 metres with running cables which are simply laid in place, and by four cross beams. The beams have an "I" section with an upper and lower root, and an increased section in the support areas. The piles vary in height (the highest one is 24.5 metres), and have a rectangular box section strengthened on the longest side.

#### Deterioration Found on the Viaduct and Recommended Solutions

A number of areas in danger of concrete becoming detached from the root of some of the beams were found during the survey, which in some cases exposed the reinforcement rods.

The ends of the beams were dete-

riorated, and the reinforcement rods were exposed and oxidised.

The concrete used to make the piles had signs of localised scouring and was partially deteriorated, with parts of the concrete on the corners worn away exposing rusty steel reinforcement rods on the surfaces of the piles. With the repair work to the Ilde viaduct and to the San Savino viaduct carried out to the piles, edges abutments, pulvinoes, floor slabs and the head-pieces of the beams risen at a certain height, tubular scaffolding fixed at ground level was used.

The internal transversal members were repaired using a suspended scaffolding system.

As with the San Savino viaduct, the first operation was to demolish the deteriorated areas by hydro-blasting in order to remove all the concrete which was deteriorated, carbonated or in danger of detachment from the areas highlighted during the survey. Missing or particularly corroded reinforcement rods were replaced.

The deteriorated concrete was then rebuilt using MAPEGROUT EASY FLOW GF pre-packed, sulphate-resistant, mortar for repairing concrete structures. As before, the product was applied by spray and by hand in smaller areas, in various layers at a thickness of from 2 to 8 cm.

Final protection was carried out by applying ELASTOCOLOR PRIMER high penetration primer followed by a coat of ELASTOCOLOR PAINT protective elastic paint.



Photo 4.  
ELASTOCOLOR PRIMER and ELASTOCOLOR PAINT were used for the final protective coat.

Photo 5.  
An image of the Ilde viaduct upon completion of the repair work.



4

**Mapei Products:** the products referred to in this article belong to the "Building Speciality Line" range. The technical data sheets are available at the web site: [www.mapei.com](http://www.mapei.com). Mapei mortars for the repair of concrete structures have been awarded the CE mark in compliance with Standard EN 1504-3. Mapei products for protecting concrete surfaces have been awarded the CE mark in compliance with Standard EN 1504-2.

**Elastocolor Paint (CE EN 1504-2):** protective and decorative elastic paint for concrete and renders based on acrylic resins in water dispersion.

**Elastocolor Primer:** solvent-based fixing primer with high penetration properties for porous substrates and curing agent for repair mortars.

**Mapegrout Easy Flow GF (CE EN 1504-3, R4):** one-component, shrinkage-compensated, sulphate-resistant, thixotropic, inorganic fibre-reinforced mortar, for repairing concrete structures where high ductility is required.



5

## TECHNICAL DATA

**San Savino viaduct** km 429+617 along the A14 Bologna-Bari-Taranto motorway, in Casalbordino (Province of Chieti, Italy) and

**Ilde viaduct** km 447+469 along the same A14 Bologna- Bari-Taranto motorway, in Vasto (Province of Chieti, Italy)

**Intervention by Mapei:** protection of reinforcement rods, rebuilding deteriorated concrete and final protective coat on the beams and piles

**Period of intervention:** 2006-2007

**Client:** Autostrade per l'Italia (concessionaire for all Italian toll motorways construction and management)

### The San Savino Viaduct

**Designer:** eng. Fulvio Di Taddeo

**Works Director:** Enrico Strani - SPEA

**Operations Management and Works**

**Coordination:** Fernando Pansera - SPEA

**Main Contractor:** SAES srl, Turin (Italy)

**Sub-contractor:** Martin srl, Trezzano sul Naviglio (Province of Milan, Italy)

**Mapei Coordinators:** Alessandro Barnabè and Vito Pedretti, Mapei SpA (Italy)

### The Ilde Viaduct

**Designer:** eng. Fulvio Di Taddeo

**Works Director:** Enrico Strani - SPEA

**Operations Management and Works**

**Coordination:** Fernando Pansera - SPEA

**Main Contractor:** Cedis srl, Isernia (Italy) – Domenico Zullo

**Sub-contractor:** Salvatore D'Aniello

**Mapei Coordinators:** Alessandro Barnabè and Vito Pedretti, Mapei SpA (Italy)