THAT CHANNEL ON CICERO'S RIVER

HIGH PERFORMANCE AND CUTTING-EDGE PRODUCTS USED TO RESTORE AND WATERPROOF CONCRETE

The source of the River Fibreno, known also as "Cicero's River", are the crystal-clear waters of a lake bearing the same name in the Lago Posta Fibreno Nature Reserve, in the province of Frosinone (Central Italy).

Shortly before leaving the area of Posta Fibreno, the river is joined by a large stream called Rio Carpello, its main tributary in terms of volume of water.

It then flows through the town of Broccostella and, after receiving the waters from a stream called Rio, it reaches Carnello, a village within the confines of Sora, where a natural waterfall is intercepted by a power station and used to generate hydro-electric energy.

The feeder channel for the power station, which was built in the 1950's, has been completely restored using numerous Mapei products and systems specifically developed to repair and waterproof concrete.

This intervention was carried out in 2017 to stop the progressive deterioration of the concrete that had been used along almost 1,500 m of the channel.

The intervention also provided the opportunity to solve the problem of water infiltrations and to give a new lease of life to a structure that is now waterproof and resistant to aggressive sulphates.

The preliminary operations included preparing the substrates by removing all the damaged and loose concrete, with particular care taken in the preparation of the surfaces around the reinforcement rods.

The next step was to treat all the reinforcement rods left exposed by brush-applying two coats of MAPEFER 1K one-component, corrosion-inhibiting cementitious mortar to form a layer at least 2 mm thick.

ANCHORING THE TURBINE AND TREATING THE WALLS AND BASE OF THE CHANNEL

After this important preliminary phase, which also included anchoring the new turbine for the power station in place with MAPEFILL MF 610, an expansive grout specific for anchoring heavy equipment, the walls and base of the channel were treated with a structural mortar specifically designed for application by spray.

The channel of the hydro-electric power station near Sora (Central Italy) was lately renovated using several Mapei products for concrete repair and waterproofing.

In the areas where the thickness to be integrated was more than 3 cm, new reinforcement was added and fastened in place with L-shaped connectors, which were anchored to the existing concrete substrate with MAPEFIX VE SF chemical styrene-free vinylester anchor, specific for structural loads and construction bars.

Taking into consideration the layout of the existing joints in the channel, the concrete was integrated by spray-applying MAPEGROUT EASY FLOW one-component, fibre-reinforced, compensated-shrinkage, sulphate-resistant, thixotropic structural mortar with a worm-screw feed rendering machine. MAPEGROUT EASY FLOW, which also contains corrosion inhibitors, was mixed with MAPECURE SRA, a curing admixture with the ability to reduce hydraulic shrinkage and the formation of micro-cracks, at a rate of 0.25% by weight of the mortar.

MAPEFOAM closed cell polyethylene foam was placed along the bottom of the expansion and contraction joints and, after coating the sides of the joints with PRIMER A, the joints were sealed with MAPEFLEX PU45 FT one-component, thixotropic polyurethane sealant and adhesive and with MAPEFLEX BLACKFILL one-component, flexible bitumen sealant.

IN THE SPOTLIGHT

MAPEGROUT EASY FLOW

It is a one-component sulphate-resistant, fibre-reinforced, shrinkage-compensated, thixotropic mortar especially suitable for repairing concrete structures by using a spray rendering machine.

It is used for the repair of highway viaduct pillars, hydraulic works, road and railway tunnels, and precast concrete structures. It is especially suitable when easy pumping is required even over long distances and under constant high heads.

TRANSVERSAL BEAMS AND UNDERSIDE OF THE BRIDGE

After removing all the damaged and loose concrete from the transversal beams and the underside of the bridge and then carefully saturating the substrate, these areas were also restored with MAPEGROUT EASY FLOW admixed with MAPECURE SRA.

In the areas where the thickness to be replaced was 2 cm or less, the concrete was repaired with MAPEGROUT LM2K two-component, thixotropic, fibre-reinforced, cementitious mortar with a low-modulus of of elasticity and added organic corrosion inhibitor, applied in a single layer at a thickness of from 3 to 20 mm.

It is worth pointing out that MAPEGROUT LM2K bonds perfectly to both old concrete, as long as it has been wetted beforehand with water, and to steel reinforcement, particularly when treated with MAPEFER 1K, as it was the case in this project.

All the surfaces were then smoothed with MAPEFINISH, a two-component cementitious mortar specifically formulated for finishing off the surface of concrete which, once hardened, forms a compact, tough layer resistant to water and atmospheric agents.

PHOTO 1. Reinforcement rods were treated with MAPEFER 1K cementitious mortar.
PHOTOS 2 and 3. Damaged concrete areas were repaired with MAPEGROUT EASY FLOW, fibre-reinforced, thixotropic structural mortar, admixed with MAPECURE SRA.

RESTORING THE STRUCTURAL JOINTS IN THE CHANNEL

Once the damaged areas on the base and the sides of the channel and those around the edges of the joints had been restored, all the loose material was removed from these surfaces.
MAPEFOAM was then placed along the bottom of the joints to gauge the correct thickness. The sides of the concrete joints were treated with PRIMER M, a one-component, solvent-free primer for polyurethane sealants, and filled with MAPEFLEX PU 45 FT sealant.
Once MAPEFLEX PU 45 FT was fully cured, MAPEBAND FLEX ROLL flexible waterproofing tape was applied over the joints to ensure a higher degree of impermeability. Once all these operations had been carried out, MAPEBAND TPE tape, specific for flexible sealing and waterproofing of expansion joints subject to movements, was bonded in place with ADESILEX PG4 two-component, thixotropic epoxy adhesive. To guarantee a longer service life for the entire waterproofing system, it was then protected with metal flashing wide enough to cover the MAPEBAND TPE tape, which was anchored in place on one side of the joint and, on the other side, fastened through slots to allow for any movements in the structure.

TECHNICAL DATA
Feeder channel of the Carnello hydro-electric power station, Sora (Italy)
Year of construction: 1955
Year of the Mapei intervention: 2017
Intervention by Mapei: supplying products for anchoring turbines and repairing and waterproofing concrete surfaces
Client: C.E.I. - Compagnia Elettrica Italiana Srl (Italian Electric Company)
Design: C.E.I. Compagnia Elettrica Italiana Srl
Works direction: Arnaldo Angelini, Vincenzo Vespasiani
Main contractor: Di Palma Mario Srl
Contractor for joint repairs: L.P. Costruzioni Srl
Mapei coordinators: Fabrizio Caravello and Federico Laino, Mapei SpA (Italy)

MAPEI PRODUCTS
Repairing reinforcement rods and anchoring: Mapefer 1K, Mapefill MF 610, Mapefix VE SF
Concrete repair: Mapegrout Thixotropic, Mapegrout Easy Flow, Mapecure SRA, Mapegrout LM2K
Sealing and waterproofing joints: Mapefoam, Mapeflex PU 45 FT, Mapeflex Blackfill, Adesilex PG 4, Mapeband Flexroll, Mapeband TPE, Primer A
Smoothing concrete surfaces: Mapefinish

For further information on products visit www.mapei.com