

Electro-Chemical Treatments for Corroded Piers in Monte Carlo

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Summary

The rehabilitation of piers of Monte Carlo Star building was performed using Foreva Solution. It required two electrochemicals techniques in addition to traditional repair: a temporary electrochemical treatment for extracting the chlorides “Foreva Regebeton PA” and a permanent cathodic protection with impressed current “Foreva CP Mesh”. This paper will explain in detail the electrochemical principles of the treatment, the design of cathodic protection of the 17 piers, the way it is set up on site, the way it works, and the results that were obtained.

Keywords: Reinforced concrete, corrosion chlorides extraction, cathodic protection.

The building Monte Carlo Star in Monaco was built in 1973 above the Mediterranean sea. It rests on circular piers, 1.8 m diameter, anchored into the seabed rock. Since construction, these piers were exposed to mechanical and physico-chemical attacks associated to storms, marines spray, etc. In 2005, these piers were showing many advanced damages like cracks, spalling areas, traces of corrosion and oxidation products.

As part of the future Condamine port development, the integration of the piers into the future Monte Carlo Star Yatch Club implicated their repair.

The rehabilitation works of the 17 piers was performed using Foreva solutions. It required two electrochemicals techniques in addition to traditional repair: a temporary electrochemical treatment for extracting the chlorides “Foreva Regebeton PA” and a permanent cathodic protection with impressed current “Foreva CP Mesh”.

These two techniques rest on the same principle of rebar protection, they put the rebar into immunity position by modifying the electrochemical potential of steel. For cathodic protection, the introduction of cathodic current changes the steel/concrete interface in a cathode by reducing anodic reactions of corrosion steel. A maximum current density of 20mA/m² put steel in an electrochemical potential estate where pitting corrosion can not initiate.

Foreva Regebeton PA treatment is a passive treatment. Cathodic reactions result in both the chloride extraction and the alkalisation of concrete around rebar. In the long-term, it favours the creation of a compact and no porous oxide layer that protects the reinforcing steel.

Results were excellent. The initial “Foreva Regebeton PA” treatment was applied during 21 days and reduced dramatically the chloride ratio and homogenized the electrochemical state of the steel/concrete interface. Then in order to guarantee a sustainable protection of rebars a cathodic protection with impressed current was installed after repair works (replacement of corroded rebars and sprayed concrete).

The paper will explain in detail the electrochemical principles of the treatment, the way it is installed and the way it works, and the results that were obtained. It will be demonstrated that electrochemical treatments of corroded reinforced concrete are very efficient in repairing existing structures, with a reduced need for new materials and energy. These techniques fully correspond to the current research for methods and process that reduce the environmental impact of construction and extend the service life of structures.