



Market Application Focus

Parking

Concrete Repair and Protection

Chloride Induced Corrosion

Project: 6th Street Parking Garage, Louisville, KY
Owner: Parking Authority of River City
Contractor: Schnell Contractors, Inc.
Year: 2004
Engineer: HNTB
Assessment: Material Service Life Company
Monitoring: C-Probe Technologies, Ltd.

The Problem

The 6th Street parking garage, located in Louisville, Kentucky, was built in 1987. A south bay was added in 1990. The garage has nine levels and is constructed with cast-in-place, post-tensioned concrete.



A thorough structural analysis showed the root cause of the spalling to be the result of high chloride content at the level of reinforcing. Many areas that were previously repaired remained intact, but adjacent and various other spalls had also developed. The future appeared to be an ongoing battle against corrosion, especially knowing that high chloride levels were already present in the concrete but had not yet penetrated to the steel reinforcement depth. Material Service Life Company was retained to provide advanced durability materials analysis to assist in the development of an efficient restoration plan. Testing included: chloride ion content, carbonation depth, concrete cover, predicted chloride profiles, and review of restoration options. The concrete at areas that were typically wet or near drainage paths displayed signs of scaling from salts and freeze-thaw conditions. The concrete over the beams showed the highest frequency of corrosion damage. The mild steel used for negative reinforcement had low cover on the ends of the rebars, and this caused early corrosion damage in these more aggressive conditions. Future prediction models were presented allowing the owner to choose the repair strategy investment with an estimated benefit in terms of service life.

The Sika Solution

The owner wanted a long term repair strategy to restore the existing damage, treat existing unseen corrosion and protect from future damage. Sika Armatec 110 EpoCem, an epoxy / cement bonding agent, was applied to the exposed reinforcing steel. Sikatop 122 Plus, a 2-component, polymer modified repair mortar was used at approximately 4,000 square feet of horizontal deck patching at an average depth of 3". The substrate was then shot-blast to a CSP-3 profile to provide a clean sound substrate. Two coats of Sika FerroGard 903, an amino-alcohol, surface-applied, corrosion inhibitor, was applied to over 105,000 square feet (1,045 gallons) using a spray bar applicator. Prior to membrane placement, 6,000 linear feet of Sikaflex 2C NS polyurethane sealant was used to seal cracks, expansion joints and to provide a cant bead at vertical transitions for the cove base. A silane sealer was used to treat the 1990 South addition areas because there was



Case Study



very little spalled concrete damage and the chloride levels were low. A total of 126,000 square feet of deck membrane was applied at varying thicknesses to handle different degrees of traffic conditions. Approximately 28,000 sf of heavily deteriorated areas required leveling using Sikadur 22 Lo-Mod, a low modulus epoxy broadcast system.

Six corrosion rate monitoring probes (1 per level on 6 levels) were used to monitor corrosion activity before and after repairs. Corrosion rates were reduced in all areas and currently remain low.

Sika Products

Anti-Corrosion Primer and Bonding Agent

Sika Armatec® 110 EpoCem® - protects rebar in areas of inadequate cover.

Single Component-Concrete Mix

Sikacrete® 211 - a single-component portland cement based concrete which contains factory blended aggregate. This product is available in 80 lb. bags and 2000 lb. supersacks.

Hard Wearing Epoxy Overlay

Sikadur® 22 Lo-Mod - epoxy resin that provide a hard wearing, slip resistant wearing surface. This overlay system seals the concrete and provides waterproofing protection.

Structural Strengthening Systems CFRP

Sika CarboDur® - a proven system of external strengthening using epoxy-bonded Carbon Fiber Reinforced Plastic (CFRP) laminate strips. Stronger than steel, yet lightweight and non-corrosive, this system can solve unique strengthening problems in a variety of concrete structures.

High Performance Repair Mortars

SikaTop® Plus Mortars - two component polymer modified materials containing Sika FerroGard® 901 corrosion inhibiting admixture.

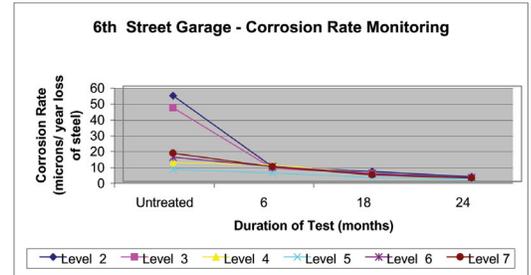
Sikacem® mortars are machine applied by dry/wet process shotcrete techniques for repair applications.

Corrosion Inhibitors

Sika FerroGard® 903 as a dual action corrosion inhibitor, will reduce corrosion currents by penetrating through the concrete and forming a protective coating on the embedded steel bars.

Anti-Carbonation Coatings

Sikagard® 550W Elastocolor and 670W - protect concrete facades from the damaging effects of carbon dioxide (carbonation), water and pollutants. Either crack-bridging (550W) or rigid (670W), both are high-performance protection coatings, available in a variety of decorative colors.



6th Street Parking Garage Completed

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