CorrosionCOPS

When it's Rust Call US!

Causes of Corrosion in Concrete:

Reinforcement in new concrete is generally protected from corrosion due to the high alkaline nature of the concrete itself. The high pH of the concrete (usually greater than 12.5) causes a passive oxide film to form on the steel.

Environmental factors can affect this protective oxide film and induce the formation of corrosion cells. Once corrosion starts, some parts of the reinforcement become anodic, discharging iron ions (current) into the electric cell. Steel areas that receive this current are the cathodic areas of the corrosion cell. This is where hydroxide ions are formed. Iron and hydroxide ions react to form iron hydroxide, FeOH, which further oxidizes to form rust. Once started, the rate of corrosion is affected by the concrete's electrical resistivity, moisture content, and the rate at which oxygen migrates through the concrete to the steel. As rust formation continues, it can take up to four times the volume originally occupied by the embedded reinforcement, causing cracking and spalling of the concrete.

Chlorides:

Chloride ions can penetrate the passive oxide film on the reinforcement. They combine with iron ions to form a soluble iron chloride complex that carries the iron into the concrete for later oxidation (rust). Once chlorides reach a level of about 0.15% (water soluble chloride by mass of cement) in the concrete, corrosion starts. Concrete can be exposed to chlorides from several different sources, including chloride containing set accelerators, deicing salts, seawater, and airborne salts.

Carbonation:

Carbonation is the process by which carbon dioxide in the air reacts with hydroxides in the concrete such as calcium hydroxide, to form carbonates. This reaction significantly lowers the pH. When the pH of concrete surrounding embedded reinforcing steel drops below 12, the protective oxide layer is lost, and the corrosion process begins.

Acid Rain/Industrial Pollutants:

Acids attack concrete by dissolving the cement paste and calcareous aggregates. They also reduce the pH of the concrete, allowing the corrosion process to begin. Pollutants such as sulfate attack the concrete by reacting with hydrated compounds in the hardened cement paste. These reactions can lead to disintegration of the concrete, making embedded reinforcement more susceptible to corrosive attack.

Note: Once a concrete structure is built, it's impossible to coat the reinforcing steel with fusion-bonded epoxy to protect it from corrosion. Cathodic protection is ineffective unless the steel reinforcement is electrically continuous. Cortec ®MCI®, however, can be easily added to new concrete or used for rehabilitation and will not delay construction or increase construction costs other than the small cost of the material. Unlike standard inorganic inhibitors, Cortec® MCIs do not have to come in contact with the reinforcing steel upon application because they can migrate to the steel and protect it. When specified in new construction, Cortec's MCI® line of concrete admixtures offers reinforcing steel superior corrosion protection against carbonation and chloride attack.

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