Florida Department of Transportation Research

Environmental Suitability of Weathering Steel Structures in Florida – Materials Selection, Phase 2

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Current Situation

Weathering steel (WS) is a steel alloy which was first formulated in the 1930s so that rust that normally forms on steel does not flake off, but adheres to the steel, thus forming a protective oxide layer. WS does not need painting and can require less maintenance than other types of steel. Once the oxide layer has completely formed, it has been estimated to provide corrosion protection for more than 100 years. If WS could be used in Florida bridges, substantial cost savings could be realized. Repainting Florida bridges alone costs over $30 million a year.

Research Objectives

Florida Atlantic University researchers tested WS to support development of Florida Department of Transportation (FDOT) guidelines for the appropriate use of WS for bridges and other structures.

Weathering steel develops an even coat of oxide that resists corrosion and does not need painting.

Project Activities

The research team brought more than 25 years of experience with WS to this project, supplementing this with additional literature review. To realize the potential benefits, the interaction of specific WS formulations with local environmental conditions, such as humidity, rain, and local air and water pollutants, must be understood.

The researchers chose 30 sites where monitoring stations could be located in southeast Florida, from Key Biscayne to Ft. Pierce. Historical environmental data for the sites were collected from public sources. The monitoring stations collected similar data during the project period using sensors for wind speed and direction, humidity, temperature, rainfall, and wetness.

Deposits from existing structures in the area were examined for chloride and sulfur content in order to determine corrosion levels. Second, at monitoring stations, samples of conventional carbon steel, aluminum, and WS were exposed to the elements for periods of time from 200 days to over 900 days. Samples were in the form of plates, bolts, and wire. After the exposure period, corroded material was removed from the sample and preserved for further analysis. The samples were cleaned in a three-stage process and then weighed to determine weight loss.

The researchers found that sites farther from the coast (chloride exposure) or from ports (sulfur exposure) showed less corrosion. Even close to the ocean, shielding by foliage or structures lowered corrosion rates. In general, chloride showed a higher influence on corrosion than sulfur. Time of wetness did not appear to strongly influence corrosion; however, salt deposits can retain moisture and distort time of wetness measurements. These findings support wider use of WS in Florida.

Project Benefits

The results of this project may increase the opportunities to use weathering steel in transportation structures, which offers significant cost savings due to lower maintenance and longer service life.

For more information, please see www.fdot.gov/research/.