Florida Department of Transportation Research

FDOT Procedures for Welding, Testing, and Fabricating Weathering Stainless Steel for Bridge Applications

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Current Situation

Although rust is the prime enemy of steel, weathering steel is a special alloy designed to rust. After a few weeks, the rust stabilizes to form a protective coating. While weathering steel is more costly than standard steel, it does not require painting, thus reducing a significant maintenance cost. Weathering steel has been used for decades, and its design requirements are well established. For example, the welds, which represent a slightly different alloy, must be compatible with the weathering steel and also develop a protective coating. Yet, weathering steel faces a challenge in humid or coastal settings like Florida, where the rusting process might not stabilize; it may continue to corrode and damage the steel. Weathering stainless steel (WSS) is a higher grade of steel that is more resistant to corrosion and is a viable option in many Florida settings. However, to employ WSS in Florida, the Florida Department of Transportation (FDOT) requires specifications to assure that structures will be properly designed and built and that promised maintenance savings are realized.

Jacksonville's Alsop Bridge is one of hundreds of steel bridges in Florida that require regular painting, requiring hundreds of work hours and thousands of gallons of paint.

Research Objectives

Wood Environment & Infrastructure Solutions, Inc., developed a comprehensive specification for the use of WSS in Florida bridge structures.

Project Activities

The WSS of interest to FDOT for use in Florida is designated ASTM A709 50CR. It does not contain the alloying elements of higher grade, more corrosion-resistant stainless steel, but is more cost effective. While WSS is more expensive than standard steel, the cost difference can be recovered within a few maintenance cycles where painting is not required.

To create these specifications, the researchers identified documents from national and state sources, including relevant standards and specifications as well as evaluations of existing WSS bridges and other research materials. Each of these documents has its own focus, and none of them provides a complete specification. For example, the AASHTO/AWS D1.5 Bridge Welding Code does not address the use of A709 50CR steel. The Structural Welding Code AWS D1.6 addresses welding of stainless steels, but not for bridge applications. The researchers structured their WSS specification in the format of the Bridge Welding Code, supplementing with additional information as necessary to cover all the design and fabrication issues required.

The researchers divided the specification into seven sections: materials, design, welding, bolting, fabrication, repairs, and inspections. Every aspect of the specification is the result of research and testing. The materials section provides an example of the level of detail in the specification. It covers the type of WSS and the exact bolts, nuts, and washers that must be used. Only one lubricant is allowed for use on bolts, with the caveat that "Extensive testing is required to qualify other types of lubricants." Filler materials, weld cleaning, and permissible abrasives are all covered by this section of the specification.

Project Benefits

The specification produced in this project is the first step toward using WSS in Florida bridges, which can yield significant maintenance savings.

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