



Florida Department of Transportation Research Experimental Investigation of the Effect of Surface Markings on the Mechanical Integrity of Weathering Bridge Steels BDV31-977-02

High-strength low-alloy steel (HSLA) weathering steels are the conventional choice for fracture-critical members in bridge construction. HSLA weathering steels offer superior corrosion resistance, important in Florida's humid and coastal environments. They also offer high strength-to-weight ratio, ductility, and toughness. For specific applications, HSLA steels differ from carbon steel because of special processing and because they contain a low amount of alloy materials. "Weathering" means that, once in service, the steel develops a rust-like crust, which protects the steel.

Special processing for HSLA steels also means that each piece of steel must be marked for reference in subsequent production steps or to inform the customer about important properties of the steel. Currently, this steel must be marked manually, usually by die stamping or other means, which slows production and is subject to human error both in writing and reading; in addition, marks can be lost altogether during manufacturing processes, such as sand blasting.

In this project, University of Florida researchers examined three automatable approaches to marking: mechanical milling; plasma marking; and laser marking. Their investigation focused on durability of marks and impact of marking on the microstructure of the steel, which can compromise required strength and durability.

The researchers used a 50W weathering steel for their tests; the number designates a minimum yield strength. 50W does not designate a specific steel product, rather it can be applied to any steel which conforms to certain standards. This means that there can be considerable variation in composition and processing of 50W steel from one manufacturer to another. For this project, 50W steel was acquired from a single, well-established Florida supplier. The researchers worked closely with a Florida commercial steel fabricator, who executed the marking, sand blasting and



Weathering steel has a distinctive look, and with proper design considerations, makes an excellent low maintenance choice for bridge construction.

weathering of experimental samples according to researcher specifications.

The treated samples were subjected to a series of test and evaluations. Examination of the sample surface and microstructure around the notches revealed that the mechanical milling notch was insufficient due to lack of visibility, while the laser left a fine line that was visible but created little damage to the underlying material microstructure. The plasma scribe left the deepest mark and resulted in a heat affected zone (HAZ). This left an effective notch of 12 mils for the plasma scribe. The fatigue life of the marked material was not measurably different from the fatigue life of the unmarked material.

These tests identified effective marking techniques and indicated that marking did not compromise the steel's mechanical qualities. Further tests with more samples will help to refine these findings and make them available to commercial processors, thus clearing a significant bottleneck in production and assuring greater integrity in the bridge construction processes.

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For more information, visit <http://www.dot.state.fl.us/research-center>