

AASHTO | American Association of State Highway and Transportation Officials

Guidelines for Corrosion Protection of Steel Bridges Using Duplex Coating Systems

First Edition

2026






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AASHTO

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ISBN: 978-1-56051-830-3 Pub Code: GCPS-1

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SECTION 1:

INTRODUCTION TO DUPLEX COATINGS—DEFINITION, LIMITATIONS, AND CASE HISTORIES

1.1—DEFINITION OF DUPLEX COATINGS

A duplex coating consists of a metallic first coat of hot-dip galvanizing (HDG) or thermal spray metal coating (TSC) that is protected with one of more coats of an organic coating. For the purposes of these Guidelines, "sealed metallizing" is not considered a duplex coating. Note that both galvanizing and metallizing are also used without the addition of the organic coating, but this is not a duplex coating. The use of the metallic coatings alone is outside the scope of these Guidelines.

Figure 1.1-1 provides a schematic of a duplex coating system. Layer C represents the steel substrate, Layer B represents the metallic coating, and Layer A represents an organic coating. The materials that have been commonly specified for the metallic layer (Layer B) on bridge structural steel are hot-dip galvanizing and thermal sprayed coating. TSC may include zinc, 85Zn/15Al, or aluminum. State specifications use different words for TSC including metallizing, thermal sprayed zinc (TSZ), thermal sprayed aluminum (TSA), wire arc spray, metallization, and metalizing. These Guidelines use the various terms somewhat interchangeably. The materials that have been commonly specified for the organic coating layer (Layer A) on bridge structural steel are liquid-applied bridge coatings including epoxies and polyurethanes as well as other chemistries.

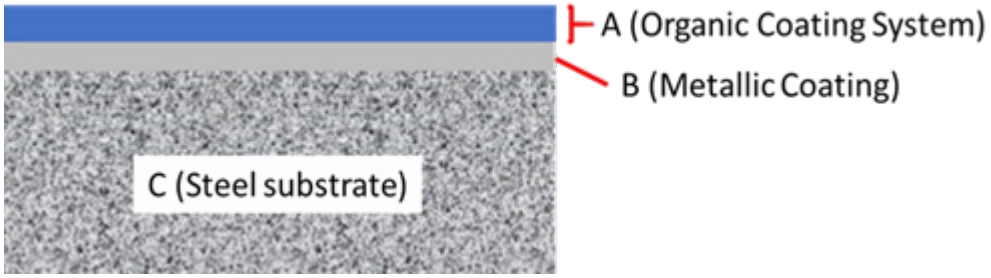


Figure 1.1-1—Schematic of a Duplex Coating System

1.1.1—Hot-Dip Galvanizing

Hot-dip galvanizing, referred to throughout these Guidelines as "galvanizing," is the application of a zinc coating to iron and steel by the hot-dipping process. The process involves preparing steel (fabricated or unfabricated) by dilute acid pickling or abrasive blast cleaning, and then dipping the part into hot molten zinc, usually at a temperature of about 840°F (449°C). Figure 1.1.1-1 shows a typical or normal alloying effect between the steel and the zinc, starting at the Gamma layer, which is 75 percent zinc/25 percent iron, up through the outermost layer, which is 100 percent zinc. It should be noted that when bridge steel is reactive[1] (due to its chemistry) this type of coating structure may not be formed.

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