Bridge Rehabilitation with Thermal Spray Zinc Coatings

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Abstract

Rapid overconsumption of natural resources is a primary driver of climate change. Reinforced concrete and steel, the two primary construction materials for bridges, have a heavy environmental footprint and can fail prematurely from corrosion. Extending the lives of existing bridge structures reduces mining and processing activity needed to produce new construction materials. Thermal spray zinc (TSZ) coatings have proven to be very durable for protecting and extending the lives of both reinforced concrete and steel bridges. Corroding reinforcing steel in concrete structures can be protected using TSZ external anodes. The anodes easily adhere to the contours of the bridge and colour match with the concrete. Steel bridges can be protected with TSZ coatings alone or as painted 'Duplex' TSZ coatings. TSZ coatings can be applied in the factory or in the field, making them ideal for the rehabilitation of existing bridge structures showing signs of corrosion.

Keywords: Corrosion, rehabilitation, thermal spray zinc, external anodes, cathodic protection, metallic zinc, duplex zinc coatings, zinc

1 Introduction

Reinforced concrete and steel are two widely used construction materials. Concrete is a mixture of cement, aggregate and water with good compressive strength. It is reinforced with steel bars to provide better tensile strength. Steel is an iron-carbon alloy, strengthened with the addition of other elements. In 2020 global cement production was 4.2Bmt [1], while crude steel production was 1.9Bmt [2].

The production processes for the main component of each material, cement and iron, both have a high carbon footprint. In 2020, CO_2 emissions for cement were reported as 988kg per tonne of cement [1]. For steel, CO_2 emissions were reported as 1,890kg per tonne of steel [2].

Based on the high volume of production of both materials, the manufacture of cement and steel are major contributors to greenhouse gases that contribute to climate change. In 2020 global CO_2 emissions for cement production were 4.1Bmt, and 3.6Bmt for steel. Further emissions will arise from production of other components, transportation, and installation, all adding to the carbon footprint. Extending the life of existing structures will be an important way to reduce CO_2 emissions from the production of new construction materials.

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