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Duplex stainless steel in infrastructure: applications, challenges and opportunities

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Abstract

Duplex stainless steels have unique properties which can be exploited in a wide variety of applications in the construction industry. The high strength of duplex stainless steel (30% higher than the widely used carbon steel grade S355) leads to specific applications in weight sensitive structures, for example structural members on the topsides of offshore platforms and bridge girders. These applications are usually situated in corrosive environments where durability, combined with long service life, are important and maintenance closures are very costly. Structural applications of duplex stainless steel in the energy and transportation sectors are reviewed. Based on an assessment of the complete supply chain (encompassing design, procurement and fabrication), obstacles to the wider use of structural duplex stainless steel are identified with some recommendations about how they may be overcome. The future burden caused by the use of materials that are not inherently durable in the service environment has led to a growing appreciation that the use of more durable materials in infrastructure applications is the key to maximum availability and low life cycle cost. A huge programme of infrastructure development is needed to meet future demand in both developed and developing economies, which includes the construction of airports, bridges, railways, roads, tunnels and power plants. New opportunities for duplex stainless steel in the creation of resilient, cost-efficient and fit-for purpose energy and transport networks are discussed.

Keywords: Duplex stainless steel; bridges; corrosion; Eurocode; fabrication;

1. Introduction

The condition of a country's infrastructure has a significant impact on the national economy and people's health and welfare. Around the world there is evidence that infrastructure such as buildings, airports, water treatment, water management, flood protection, roads, railways and bridges are failing to keep up with current and expanding needs. This is particularly true in countries undergoing high rates of urbanization in the world's fastest-growing economic regions.

The 2017 US Infrastructure Report Card, prepared by ASCE, designated 9.1% of the nation's bridges as structurally deficient in 2016. On average there were 188 million trips across a structurally deficient bridge each day [1]. With about half of the US population living in coastal areas, and evidence of increasing use of de-icing salts, it is not surprising that a large proportion of the maintenance costs of

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