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Duplex Stainless Steels as a Structural Material for Long Life Bridge Construction

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Abstract

Structural duplex stainless steel (DSS) is being increasingly used in non-aesthetic and even non-visible structural elements in bridges to reduce the cost of in-service maintenance compared to use of carbon steel. Until recently, use of stainless steel in the built environment has been driven by architects seeking to develop aesthetically satisfying structures. There is now an emerging trend towards utilising the high corrosion resistance of DSS to reduce total life cycle costs. To validate the assumption that structural DSS are a durable solution, an in-service inspection of DSS in selected European bridges has been undertaken. This assessment has concluded that recently introduced EN 1993-1-4 Annex A 2015 is an appropriate selection tool for structural applications, although in some cases it was found to be somewhat conservative. Having confirmed DSS as a durable material, a case study of the use of DSS in the Söderström bridges in Stockholm is presented. To reduce life cycle costs, this project makes extensive non-visible use of a new DSS grade, EN 1.4662.

Keywords: Duplex Stainless Steels; EN 1.4662; Life Cycle Cost; Durability; Fabrication

1. Introduction

Stainless steels have been used for over 80 years in the built environment, predominantly as building cladding where the materials' corrosion resistance giving longevity of aesthetic appearance and durability in performance are well-known attributes. In more recent years, developments in steelmaking technology have led to the development of the family of duplex stainless steels (DSS) that retain high resistance to corrosion, but have the added benefit of high strength combined with good weldability [1]. DSS have a lower nickel content compared to standard austenitic grades such as 316L/1.4404 which helps to reduce the material's cost. This combination of characteristics has led to the increased use of DSS as a structural material for bridge applications. In this paper, the corrosion performance of DSS in selected bridge structures is studied and the rationale for selecting a high value, high performance material is considered. DSS has been often specified in bridge structures primarily due to a combination of highly aesthetic considerations and a need for long life of appearance and structural integrity. However, in the last few years,

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