39th IABSE Symposium – *Engineering the Future*
September 21-23 2017, Vancouver, Canada

Experience of duplex stainless steels as construction materials in bridges: Results of seven inspections

Sukanya Hägg Mameng, Claes Tigerstrand, Tobias Larsson

Outokumpu Stainless AB, Avesta, Sweden

Graham Gedge, Jonathan McCray

ARUP, London, UK

Contact: sukanya.mameng@outokumpu.com

Abstract

Duplex stainless steel (DSS) usage in bridge construction has increased significantly in the last twenty years because of the material's exceptional mechanical properties, good corrosion resistance, negligible need of maintenance and thereby low life cycle costs. Three suitable DSS grades used in bridge structures are EN 1.4462, 1.4362 and 1.4162. It is important to choose a DSS grade which is appropriate for the intended service environment, not least because the price of the material generally increases with the corrosion resistance. This work presents the results from various bridge inspections where DSS has been used for the main structure in environments which were retrospectively classified in accordance with EN 1993-1-4 Annex A. The results illustrate successful application of DSS structures and could also be used to provide data for future design standard revision, for example EN 1993-1-4, Annex A, relating to material selection.

Keywords: duplex stainless steel (DSS); corrosion resistance; long term durability; bridge; inspection; EN 1993-1-4.

1 Introduction

The structural use of duplex stainless steels (DSS) in bridge construction has increased significantly in the last twenty years. DSS are ideal for bridges because of their exceptional mechanical properties, good corrosion resistance, negligible need of maintenance and thereby low life cycle costs. The two-phase microstructure of DSS combines the positive characteristics of austenitic and ferritic stainless steels. These characteristics result in a high corrosion resistance and high strength. The use of stainless steel for structural applications is now recognized in design codes such as EN 1993-1-4 Annex A (Eurocode 3) and AISI Steel Design Guide 27 [1, 2]. Three duplex stainless steel grades suitable for use in bridges are EN 1.4462 (UNS S32205), 1.4362 (UNS S32304) and 1.4162 (UNS S32101). In recent years the lean DSS 1.4162 has often been selected in preference to DSS 1.4462 and 1.4362 since it has exceptional mechanical properties, reasonable corrosion resistance and a lower cost [1, 4]. It is important to select the DSS grade which is appropriate for the intended service environment since the price of the material generally increases with the corrosion resistance.

The design standard EN 1993-1-4 Annex A [1] sets out a methodology for selecting an appropriate grade of stainless steel for the service environment, using five Corrosion Resistance Classes (CRC I to V). The CRC are assessed in terms of three components: risk of exposure to chlorides from salt water or deicing salts (distance from the sea and roads), risk of exposure to sulfur dioxide and cleaning regime including natural washing by rain (which has a cleaning effect). The standard suggests the appropriate grades for the CRC classes. Different parts of the same structure may have different exposure conditions, for example one part may be fully exposed to rain and another

https://doi.org/10.2749/vancouver.2017.1691
Distributed by structurae