



## Use of Duplex Stainless Steel Plate for Durable Bridge Construction

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### Summary

The paper considers the use of alternative materials for bridge construction to provide owners with long term durable structures requiring minimum maintenance. The materials considered are a family of stainless steels referred to as duplex stainless steels. The paper considers the history of development of duplex steels and reports on the latest generation of steels with lean alloy contents that provide good levels of corrosion resistance without the excessive cost premium often associated with stainless steels. The paper includes examples of recent uses of these steels on bridge structures and outlines where further research is required to provide the greater confidence needed to encourage owners and designers to adopt the steels more widely

### 1. Introduction

Construction of bridges for major infrastructure projects, whether road or rail, increasingly demands that such structures be inherently more durable to reduce future maintenance costs and disruption to the travelling public. It is possible with conventional construction materials, such as reinforced concrete and structural steel, to provide design solutions that are more durable than those constructed in the past. However, neither material can, realistically be regarded as maintenance free or inherently durable in many service environments. Alternative materials are therefore being increasingly investigated by designers and owners. These materials include aluminium, fibre composite reinforced concrete and weathering steels. Relatively few designers have considered the possibility of using stainless steels for bridge construction.

This paper will consider the use of stainless steels, with particular reference to duplex steels that are now being used for bridge applications, particularly in Europe and the Far East. The paper provides an introduction to:

- Stainless steels relevant for bridge fabrication
- The factors influencing the base cost of stainless steels
- Recent developments in steel technology that has extended the range of available materials and product forms

The paper then considers factors that are limiting the use of stainless steels for bridge fabrication, how these might be addressed and where additional research is required to improve the competitiveness of stainless steels as a bridge construction material.

The paper includes examples of the recent use of stainless steels for structural applications on bridges where the particular properties of these materials have been used to advantage.

### 2. Introduction to stainless steel

Stainless steels are a family of ferrous materials that are grouped according to their microstructure as austenitic, martensitic, ferritic or duplex. All stainless steels contain a minimum of 10.5% chromium as a primary alloying element. The most commonly used group in construction are the austenitic steels and for structural applications there is increasing interest in the duplex (austenitic/ferritic) steels. Alloy designations, composition and properties are given in Table 1.