Reduced stress method for Class 4 steel section

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Summary

Design of steel cross sections with thin plates has to take in account the effect of local instability that reduce the ultimate resistance.

Eurocode 3 classifies these cross-sections as Class 4 cross-sections and in part 1-5 it shows two procedures to take in account local buckling effects in the ULS resistence evaluation:

- Effective cross section method
- Reduced stress method

Scope of this paper is to show the application of the Reduced stress method to a real case (main roof of High Velocity railway station in Florence, Italy) and some considerations about the relationship with Effective cross section's method.

Keywords: Effective cross section method, Reduced stress method, Eurocode 3, Class 4 steel cross-section.

1. Introduction

Eurocode [1], defines 4 classes of cross-sections according their capacity to develop plastic moment resistance. For class 4 cross-section design resistance R_d is limited by local buckling resistance and it is lower than calculated one adopting full-plastic or elastic distribution stresses.

To determine correctly design resistance R_d of class 4 cross-section Eurocode shows 2 methods [2]:

1) Effective cross section's method;
2) Reduced stress method.

These methods are analyzed and compared with observations on their application field and their correlations. It is possible find that in same cases Reduced stress method are more conservative than effective cross-section one.

Finally it is briefly showed an application of Reduced stress method in a real case: the design of High Velocity Railway Station roof in Florence (Italy) [3].

2. Method description, observations and comparation

Eurocode [1] defines 4 classes of cross-sections according their capacity to develop plastic moment resistance (this capacity is limitated by local buckling phenomenon).
According this classification Class 4 cross-sections are those in which local buckling occur before the attainment of yeld stress in one or more parts of cross-section.

The classification of a cross-section depends on:

a) the width to thickness ratio of the parts subjected to compression;
b) the tipology of component plates of cross-section (internal or outstand compression plates);

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