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Influence of the thickness of intumescent paint in the position of steels (fire safety)

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Abstract

Purpose – The purpose of this paper is to analyze a new structural design applied in industrial frames using two type of steels (S275 and fire resistant (FR)) with different mechanical resistance against fire. To do it, the authors have taken into account variables such as intrinsic metallic design, span length, intumescent paint thickness, and fire time exposure, which offers information about new scenarios of design in industry.
Design/methodology/approach – The key methodology followed has taken into account a modeling program that uses the following variables: 25 and 35 m of span, 45 and 60 fire exposure times, and seven different intumescent paint thickness. An optimum structural design has been evaluated by discretization of each scenario with the particular type of steel, S275 and FR. The obtained approach could be a good guideline for future designs.
Findings – The results and analysis have shown a very good and valid idea of a new structural typology using optimum intumescent paint thickness into the final design of the industrial frame considering that it has two different types of steel. It is in realty a handicap since usually mechanical engineers employ structural steel without paying attention to this new feature.
Practical implications – Cheaper structural designs could be obtained using the two different types of steel considering the proper positioning into the full building.
Originality/value – The validity of design of two types of steel plus intumescent paint in building construction has been shown, and this study will encourage designers to use it, in particular in buildings with high fire risk.

Keywords Coating, Steel structures, Temperature effects, High strength steel, Optimization models, Structural safety

Paper type Research paper

1. Introduction

Nowadays, various alternative treatments are employed to protect the useful life of metallic structures exposed to significant risk of fire. The most widely applied treatment, well-established in both theoretical and practical studies over many years, is to coat fire-resistant (FR) steel with intumescent paint. Nevertheless, the theoretical data are not always consistent with practical experience following a real fire, since a lot of variables come into play in a real fire scenario.

Intumescent paints can improve the fire-resistance performance of metallic structures (Chico *et al.*, 2005), although they also increase the overall cost of the final design, because

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