



## Composite Steel Beams Strength Evaluation Constituted of Steel Profiles Filled with Reinforced Concrete

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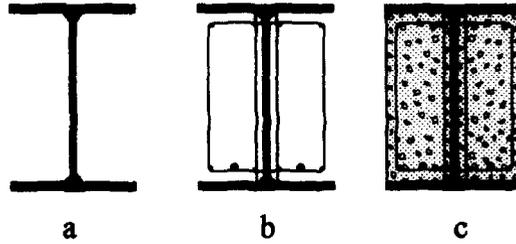
### Paper Number 302

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The study of composite structures of profiles filled with reinforced concrete began as a solution for structural elements submitted to fire situations. The first researches on the behaviour of composite structures of profiles of steel filled with reinforced concrete or structures of composite profiles of steel were developed in the University of Darmstadt, Germany, in the 70s and 80s. A structural system was developed formed by profiles of steel with the area among the flanges filled with reinforced concrete. They obtained a structural element that parts of the section of steel and bars were involved in the concrete protecting against the direct action of the fire. The interaction between the profile of steel and the reinforced concrete is guaranteed through stirrups or connectors welded to the web of the profile. This structural system presents higher strength and stiffness in relation to conventional composite systems when submitted to high temperatures (fire situations). Some advantages of the structures of composite profiles of steel compared to the usual composite systems are: higher load capacity due to participation of the reinforced concrete, possibility of higher reduction of the section of the profiles of steel, higher stiffness in the structural system.

The structures of composite profiles of steel investigated in this work are constituted by metallic profiles filled with reinforced concrete, using welded I-shapes (Figure 1a). The stirrups were welded to the web, and flanges of the steel profile guarantee the interaction between the profile of steel and the reinforced concrete (Figure 1b). The cross section of the tested beam is presented in Figure 1c.

This work presents some results of an experimental study of the behaviour of beam-composite formed by welded I-shaped steel filled with reinforced concrete. A beam was tested with two simple supports, single span of 5.7 m in length, with emphasis on the evaluation of the strength. The influence of the main parameters in the strength of the beam is presented, as well as values



**Fig. 1.** (a) Welded I-shape; (b) welded I-shape with bars and stirrups; (c) welded I-shape with reinforced concrete.

for loads, displacements, deformations, slippage and stress in the more critical steps of the experimental test. The experimental results were used in the evaluation of the design strength of the analysed structural element. © 1998 Elsevier Science Ltd. All rights reserved

#### KEYWORDS

Steel structures, steel construction, beams, composite structures, composite beams, fire protection, experimental analysis, experimental results, welded I-shape, design.