

Analysis of a cross-section of a steel-concrete composite beam

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Abstract

Steel-concrete composite bridges with encased continuous shear connectors are constructions in which the basic mechanical advantages of both materials are effectively used. The cross-section of a steel-concrete composite short-span road bridges is usually of rectangular shape. This paper presents an analysis of such cross-section in order to adjust the ratio and amount of material to make it more environmentally friendly and economic and therefore sustainable. It compares the analytical as well as experimental resistance and displacement of a rectangular and lightened beam cross-section with regards to the amount of materials used.

Keywords: steel-concrete composite, composite bridge, steel-concrete, shear connector

1 Introduction

Research of composite steel-concrete bridges has been ongoing since the 80s of the last century. Most of the research focus has been on the development of continuous shear connectors and overall improvement of the longitudinal shear connection. Different types, such as perforated strips [1], dowels [2], truss [3], trapezoids [4] and Y-shaped [5] connectors have been proposed.

The typical cross-section of the short-span steel-concrete composite bridge is in a shape of a rectangle, or, for longer spans, the T-shape cross-section can be used. In Europe, the PrecoBeam beams (see Figure 1) have been a popular steel-concrete composite solution for short to middle span bridges [6].

When constructing short-span bridges, the rectangle shape does seem as the simplest solution. However, if the prefabrication is considered, other solutions could be considered. Such solutions could bring a significant decrease in

mass and weight as well as cost reductions, which would make it more sustainable.

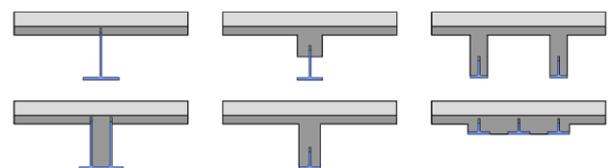


Figure 1 PrecoBeam steel-concrete composite cross-sections [6]

This paper deals with the following research questions:

- Could the cross-section of the steel-concrete composite beams be reduced in order to save material?
- Would the reduction in material influence the beam resistance?

Several laboratory tests (four-point flexural tests), material property tests have been performed, as well as theoretical analysis considering the effect on the position of the plastic neutral axis and the flexural resistance of the beam were investigated in order to answer these questions.