

**DESIGN and BEHAVIOR of COMPOSITE STEEL-  
CONCRETE FLEXURAL MEMBERS with a FOCUS on  
SHEAR CONNECTORS**

By

Ubejd Mujagic

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Approved by:

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W. Samuel Easterling, Chairman

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Thomas E. Cousins

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Thomas M. Murray

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Carin L. Roberts-Wollmann

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Kamal B. Rojiani

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Virginia Polytechnic Institute and State University  
Blacksburg, Virginia

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(ABSTRACT)

This study consists of three self-standing parts, each dealing with a different aspect of design of composite steel-concrete flexural members.

The first part deals with a new type of shear connection in composite joists. Composite steel-concrete flexural members have increasingly become popular in design and construction of floor systems, structural frames, and bridges. A particularly popular system features composite trusses (joists) that can span large lengths and provide empty web space for installation of typical utility conduits. One of the prominent problems with respect to composite joists has been the installation of welded shear connection due to demanding welding requirements and the need for significant welding equipment at the job site. This part of the study presents a new type of shear connection developed at Virginia Tech – standoff screws. Results of experimental and analytical research are presented, as well as the development of a recommended design methodology.

The second part deals with reliability of composite beams. Constant research advances in the field of composite steel-concrete beam design have resulted in numerous enhancements and changes to the American design practice, embodied in the composite construction provisions of the AISC Specification (AISC 1999). Results of a comprehensive reliability study of composite beams are presented. The study considers specification

changes since the original reliability study by Galambos et al. (1976), considers a larger database of experimental data, and analyses recent proposals for changes in design of shear connection. Comparison of three different design methods is presented based on a study of 15,064 composite beam cases. A method to consider effect of degree of shear connection on strength reduction factor is proposed.

Finally, while basic analysis theories between the two are similar, requirements for determining the strength of composite beams in Eurocode 4 (CEN 1992) and 1999 AISC Specification (AISC 1999) differ in many respects. This is particularly true when considering the design of shear connections. This part of the dissertation explores those differences through a comparative step-by-step discussion of major design aspects, and accompanying numerical example. Several shortcomings of 1999 AISC Specification are identified and adjustments proposed.