

ABSTRACT

EXPERIMENTAL EVALUATION OF NON-COMPOSITE SHALLOW PRESS-BRAKE-FORMED STEEL TUB GIRDERS

The Short Span Steel Bridge Alliance (SSSBA) is a group of bridge industry leaders (including steel manufacturers, fabricators, service centers, coaters, researchers, and representatives of related associations and government organizations) who have joined together to provide educational information on the design and construction of short-span steel bridges in installations up to 140 feet in length (Michaelson, 2014). From within the SSSBA technical working group, a shallow press-brake-formed steel tub girder was developed. This new technology consists of cold-bending standard mill plate width and thicknesses to form a trapezoidal box girder. By eliminating the need to cut and weld plates together, the system proves to be an economical and rapid construction option. The steel plate can either be weathering steel or galvanized steel, each an economical option.

The originally-proposed system consisted of a reinforced concrete deck cast on the girder in the fabrication shop, forming a composite modular unit once cured. The composite unit would then be shipped to the construction site to be installed. However, the option of implementing a cast-in-place deck must be explored. A critical design stage for these girders occurs during pouring of the concrete deck, when the non-composite steel section must support the construction load, including the wet concrete. During this period, the top flanges are in compression and the system is susceptible to torsional buckling and deflection phenomena. Therefore, for a cast-in-place deck option, the non-composite stability and behavior of tub girders needs to be further evaluated.

The scope of this project was to develop a complete understanding of the stability and behavior of non-composite press-brake-formed tub girders for short span bridge applications. This was performed in four stages. A complete literature review focusing on previous studies relating to non-composite trapezoidal steel tub girder behavior was conducted. Destructive flexural testing was then performed on two non-composite specimens to assess the ultimate capacity of the system. Next, nonlinear finite element models were developed and benchmarked against experimental data. Results of the experimental and FEA modeling are used to determine bracing requirements for the non-composite press-brake-formed tub girders to improve their torsional response.

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