ABSTRACT

DEVELOPMENT AND FEASIBILITY ASSESSMENT OF SHALLOW PRESS-BRAKE-FORMED STEEL TUB GIRDERS FOR SHORT-SPAN BRIDGE APPLICATIONS

The Short Span Steel Bridge Alliance (SSSBA) is a group of bridge and culvert 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. From within the SSSBA technical working group, a modular, 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. The steel plate can either be weathering steel or galvanized steel, each an economical option. Once the plate has been press-brake-formed, shear studs are then welded to the top flanges. A reinforced concrete deck is then cast on the girder in the fabrication shop and allowed to cure, becoming a composite modular unit. The composite tub girder is then shipped to the bridge site, allowing for accelerated construction and reduced traffic interruptions.

The scope of this project was to refine the development of the proposed system. This was performed in five stages. A rational methodology, based on conservative estimates of the system's nominal capacity, was developed to design and proportion the steel tub girder and modular unit. Destructive flexural testing was then performed on representative specimens to assess the ultimate capacity of the system in its composite and noncomposite states. Next, two separate analytical tools utilizing nonlinear finite element methods and strain-compatibility procedures were developed and benchmarked against experimental data. These analytical tools were then employed to perform behavioral studies on the proposed system, resulting in the derivation of expressions which better predict the nominal capacity than those present in AASHTO LRFD Specifications. Finally, feasibility assessments were performed, comparing the economy of the proposed system against traditional short-span bridge solutions. Results of this project demonstrate that the proposed system is an economically competitive alternative for the short-span bridge market.

TABLE OF CONTENTS