EVALUATION OF MODULAR PRESS-BRAKE-FORMED TUB GIRDERS WITH UHPC JOINTS

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 reducing traffic interruptions.

The use of prefabricated bridge elements and systems has led to the recognition that durable connections are the key components in this type of construction. An ultra-high performance concrete (UHPC), which is a steel fiber reinforced, portland cement-based product with advantageous fresh and hardened properties is used for creating robust connections between the prefabricated components. The use of the UHPC as a joint media is becoming more popular during bridge construction. However, the majority of the prefabricated bridge elements and systems are of traditional structural shapes. Therefore, structural performance of the UHPC joint connecting prefabricated composite tub girders needs to be evaluated.

The scope of this project was to test a bridge model system comprised of two composite modular press-brake-formed tub girders connected with an UHPC joint. This was accomplished by, constructing two modular units and joining them with an UHPC joint. The system was then fatigue loaded simulating 75-year traffic conditions in a rural environment. A Service II limit state moment was induced into the system at predetermined numbers of cycles in order to monitor performance of the specimen. Data obtained from strain gages installed on the webs and bottom flanges was used to determine the actual moments induced into the system, as well as the load distribution factors. Experimental results were used to evaluate reliability of the longitudinal UHPC joint in a composite tub girder system.
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