



# Project Summary

Texas Department of Transportation

## 5-4124-01: Bridge Strengthening Through the Use of Post-Installed Shear Connectors - Phase 1

### *Background*

This project was an implementation of research conducted previously under TxDOT research project 0-4124. Project 0-4124 developed a technique to increase the load capacity of existing bridge floor systems consisting of a non-composite concrete slab and steel girders. The strengthening technique involves post-installing shear connectors in the girders to develop composite action, which can lead to a substantial increase in load capacity. Project 0-4124 developed three different types of post-installed shear connectors, referred to as the Double-Nut Bolt (DBLNB), the High-Tension Friction-Grip Bolt (HTFGB), and the Adhesive Anchor (HASAA).

In this implementation study (phase 1), an existing non-composite bridge in the San Antonio District was retrofitted with these three types of post-installed shear connectors to increase the load rating of the bridge. The bridge, built in 1950, is located on FM 462 over Live Oak Creek in Medina County near the town of Hondo, Texas, and is referred to in this study as the Hondo Bridge.

### *What the Researchers Did*

A complete detailed design process to strengthen the Hondo Bridge using post-installed shear connectors was developed in this study, and can be used as a model for future strengthening projects. The Hondo Bridge consists of three identical simple spans and each span was retrofitted with a different type of post-installed shear connector, in order to gain experience with each type of connector. The design process resulted in a recommendation to install 28 shear connectors per girder for the DBLNB and HTFGB connectors, and 52 shear connectors per girder for the HASAA connector. A larger number of HASAA connectors were needed due to the lower fatigue strength of this connector. The shear connectors were then installed in the bridge by TxDOT personnel. A load rating was conducted for the bridge, both before and after installation of the shear connectors. Field live load tests were also conducted on the bridge, before and after the installation of the shear connectors, to assess the effectiveness of the connectors in developing composite action. Finite element studies of the bridge were conducted to assist in the design process and to improve understanding of the behavior of the bridge before and after strengthening.

#### *Research Performed by:*

Center for Transportation Research (CTR),  
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#### **Research Supervisor:**

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#### **Researchers:**

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**Project Completed:** Ongoing

## What They Found

The load rating conducted for the Hondo Bridge prior to retrofit showed an HS10.6 inventory level rating and an HS17.6 operating level rating. With the addition of the post-installed shear connectors, the load rating for the bridge increased to an HS17.4 inventory level and an HS29.1 operating level. Thus, both the inventory level and operating level load ratings increased 65 percent as a result of the installation of post-installed shear connectors. The live load tests conducted on the Hondo Bridge before and after the retrofit showed that significant composite action was developed in the retrofitted bridge girders, as expected.

The actual installation of the post-installed shear connectors on the Hondo Bridge proved considerably more difficult than anticipated prior to construction and based on the connector installation experiences in project 0-4124.

## What This Means

Post-installing shear connectors can significantly increase the load rating for an existing non-composite bridge girder. For the bridge considered in this study, the load rating was increased by 65 percent. Construction operations required to install the shear connectors proved to be difficult, so modifications in the installation procedures may be warranted in future projects. Nonetheless, the results of this project demonstrated that post-installing shear connectors can significantly increase the load rating of an existing bridge, and this technique should be considered as an option for strengthening existing bridges.



*Post-Installed Shear Connectors in Bridge Located Near Hondo, Texas.*

### *For More Information:*

5-4124-01-1 Implementation Project: Strengthening of a Bridge near Hondo, Texas using Post-Installed Shear Connectors

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