Florida Department of Transportation Research

Development of Improved Bridge Design Provisions for Barge Impact Loading

BD545-29

In 1991, the American Association of State Highway and Transportation Officials (AASHTO) issued its first bridge design specifications for resisting bridge/vessel impacts. In creating the specifications, AASHTO drew upon previous static and dynamic impact studies that had been performed using reduced scale model barges. However, these studies did not include the dynamic vessel-bridge-soil interactions that occur during actual impacts.

The dynamic model is based on extensive real life barge impact tests.

Between 2000 and 2008, University of Florida researchers conducted a series of projects to determine how dynamic loading affects bridges when they are hit by vessels, particularly barges. Barge traffic is common around marine bridges. The researchers carried out 15 full-scale barge/bridge impact tests at the former St. George Island Causeway Bridge, on the Florida Panhandle, which was awaiting demolition following replacement. (See previous projects BC354-23, BC354-56, BC354-76, and BD545-05.)

In the most recently completed study (BD545-29), the researchers created a one-pier, two-span dynamic bridge impact model based on the data gathered during the previous projects. Then they modeled several types of bridge impacts (head-on, angled, various pier shapes) from barges with different bow widths.

The model demonstrated that the width of the barge bow does not significantly affect the amount of bridge impact loading. However, earlier studies had shown that barge bows absorb some of the impact energy and experience crushing. By incorporating this data into the model, the researchers could demonstrate how the bow crushing behavior affects bridge impact loading and, in turn, how bow crushing behavior strongly depends on the size and shape of the impacted bridge structure. Model impacts on broad, flat-faced pier foundations, which are common on Florida bridges, produced the highest impact loads. The models predicted that bridges with rounded piers and footings would experience lower impact load levels.

The study shows that dynamic modeling can provide bridge loading predictions more accurately than traditional static modeling. The adoption of dynamic modeling for assessing potential bridge impact resistance has the potential to increase bridge safety and service life, as well as provide construction and maintenance cost savings.

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http://www.dot.state.fl.us/research-center/