

The benefit/cost analysis  
was performed in 1997



JTRP/INDOT RESEARCH PROGRAM

# Research Pays Off

## Precast Stay-In-Place Concrete Panel Shear Strength

Precast concrete bridge deck panels are used extensively in the U.S. They lower the cost of construction projects by making bridge deck construction faster and easier. They also help satisfy structural requirements. Cast in Place (CIP) concrete is used with the precast panels to produce the final bridge deck. The panels serve as stay-in-place forms and aid in the load carrying capacity for superimposed loads. To ensure connection of the precast panel and the CIP concrete, shear connectors are used. After the panels have been laid, a layer of concrete is poured to complete the bridge deck. To ensure adequate shear strength exists between the panel and the cast in place concrete, shear connectors are

used. A typical 4' x 8' panel contains 20 shear connectors.

Previous specifications required that 20 shear connectors were used in precast deck panels. This may be an unnecessarily high number of connectors. By reducing the number of connectors in each panel, there would be savings. The savings would be in material and labor.

The purpose of this research was to find the number of needed shear connectors. Using a roughened precast panel surface always provides good composite action with the poured concrete, possibly making shear connectors unnecessary. Were the connectors really needed?

## Research Findings and Implementation

With the broom finished surface of the precast panels, no shear connectors are necessary, as long as the nominal average horizontal shear stress at the interface is less than 115 psi (Ramirez). 4 shear connectors/lifting hooks, one near each corner, are still needed for handling purposes, eliminating an average of 16

connectors per panel.

The INDOT bridge standard C-5 for precast panels was revised October 1994 and were effective January 1995 to implement the research findings. As of 1997 the new specifications affected five bridge decks amounting to 17,000 square feet.

## Benefits

Cost for material and labor installing the connectors in a panel is approximately \$0.894 per connector. For the five jobs completed with the new specifications, the savings, in fabrication, material and labor were \$10,000 or about \$2,000 for each bridge deck.

*Cost of Research*  
**\$127,000**

## Estimated Economic Value Over 20 Years At 5% Discount Rate

<b>Number of Bridge Decks per Year</b>	<b>Savings Per Deck</b>	<b>Annual Savings</b>	<b>Discounted Savings (20 years)</b>	<b>Benefit/Cost Ratio</b>
40	\$2,000	\$80,000	\$1,000,000	7.87

## Assumptions

- That INDOT will construct 40 precast bridge decks per year.
- That the cost per connector saved is \$0.894.

## References

- Herrin, S., 1996, notes
- Nukala, P. K., Ramirez, J. A., Lee, R. H., and Cohen, M. D. "Stay-in-Place Deck Forms – Horizontal Shear Strength of Bridge Deck Panels," Joint Highway Research Project FHWA/IN/JHRP-94/11 Final Report August 1995
- Ramirez, J. A., 1996,. Conversation and notes.