

Executive Summary, Technology Transfer and Research Readiness Level Assessment

Long-Term Performance Evaluation of NUDECK in Kearney East Bypass

Research Objectives

Inspected, monitored, and evaluated the performance of the Kearney East Bypass bridge project for at least 3-year period, possibly 5-year period, after completion. During this period, the bridge deck is in service and exposed (no-overlay), which was an ideal condition to conduct detailed inspection for transverse joints, post-tensioning anchor zones, and deck-girder connections.

Wireless gauges were also installed to continuously monitor girder and deck deformations to confirm their behavior as composited sections.

This long-term monitoring provided vital information about the performance of the 2nd generation of NUDECK system.

Research Benefits

Since this is the first implementation of the 2nd generation of NUDECK system, the study resulted in significant data about the performance of this new development. This data will not only be useful for bridge designers to better understand the structural behavior of the system, but also to bridge managers to predict its service life and estimate lifecycle cost of precast decks compared to cast-in-place decks. The data will allow decision makers to select the most cost-effective option for new construction and redecking projects.

Background

The Kearney East Bypass is the first bridge project that uses the 2nd generation of precast concrete deck system (NUDECK) and the only bridge in Nebraska with precast concrete deck panels on precast/prestressed concrete I-girders. The 2nd generation of NUDECK has several developments over the 1st generation that was implemented in Skyline Bridge in 2004 on steel I-girders. These developments include increasing the width of precast concrete deck panels from 8 ft to 12 ft, using covered individual pockets at 4 ft spacing instead of continuous open channel, eliminating deck overlay, and placing post-tensioning strands underneath the deck panels. The bridge will be constructed during the 2014-2015 construction seasons.

Conclusion

Due to the unique features of the new PC deck system, this research project was initiated to monitor short-term performance using live load test and long-term performance under traffic loads to evaluate the system performance. Both CIP concrete deck and PC deck bridges were instrumented and tested during the summer of 2016 to compare the performance of their superstructures. Also, finite element analysis (FEA) was conducted to predict the performance of the new PC deck system. The results of both analytical and experimental investigations indicated that the PC deck system performs as predicted and very comparable to the conventional CIP concrete deck.

Principal Investigators

George Morcoux (P.I.) and Marc Maguire (Co P.I.)
University of Nebraska

Lead TAC Member

Fouad Jaber, PE, Assistant State Bridge Engineer



Kearney East Bypass

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Interested in finding out more?

Final report is available at:
[NDOT Research Website](#)

NDOT Recommendations Based Off of Research Project

The Principal Investigator provided a presentation to AASHTO as part of the technology transfer for the performance evaluation of NUDECK in Kearney East Bypass project. The result of this connection is a continuation of a precast deck, the performance of short-term evaluation using live load test and long-term performance under traffic loads performed very well.

The Lead TAC Member, Fouad Jaber, worked with AASHTO Sub-committee (T-10) subcommittee on Concrete Structures Section 5 in LRFD to change the following;

- Those changes allowed the Department to provide faster, more durable and economical construction.

The University of Nebraska was awarded funding from private industries to build on this NDOT research.

Technology Transfer

Journal Publications

- Tawadrous, R. and Morcou, G. (2018) "Interface Shear Resistance of Clustered Shear Connectors for Precast Concrete Bridge Deck Systems", Journal of Engineering Structures, Elsevier, 160, 195-211.
- Morcou, G., Hatami, A., and Jaber, F. (2018) "A New Precast Concrete Deck System for Accelerated Bridge Construction", Journal of Advances in Civil Engineering Materials, ASTM International, 7(3).
- Tawadrous, R., Morcou, G., and Maguire, M. (2019) "Performance Evaluation of a New Precast Concrete Bridge Deck System", ASCE Bridge Engineering Journal, 24(6).
- Tawadrous, R. and Morcou, G. (2019) "Design of Shear Pocket Connection in Full-Depth Precast Concrete Deck Systems", Journal of Engineering Structures, Elsevier, V179, 367-386.

Conference Publications

- Tawadrous, R. and Morcou, G. (2018) "Interface Shear Resistance of Clustered Shear Connectors for Precast Concrete Bridge Deck Systems" 2018 PCI Annual Convention and National Bridge Conference, Denver, CO, February.
- Tawadrous, R., Morcou, G., and Maguire, M. (2018) "Performance Evaluation of a New Precast Concrete Deck System", 97th TRB Annual Meeting, Washington, DC.

Invited Speeches

- "Simplified Shear Pocket for Full-Depth Precast Concrete Deck Systems", Presentation in a technical session, 2020 TRB Annual Meeting, Washington, DC. Jan. 2020.
- "Fully Precast Concrete Bridge System for Accelerated Construction", Presentation at 2019 Mid-Continent Transportation Research Symposium, Ames, IA, August 2019.

Research Readiness Level (RRL) Assessment

Level 5: Standard Practice

Research/Technology fully implemented and understood. No follow-up is necessary.

RRL 5

This brief summarizes Project SPR-P1 (15) M026

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RESEARCH BRIEF **Nebraska Department of Transportation Research Program**