

# Fully Precast Concrete Bridge System for Accelerated Construction

George Morcous

Professor, University of Nebraska-Lincoln, gmorcous2@unl.edu

Fouad Jaber

Assistant Bridge State Engineer, Nebraska Department of Transportation, Fouad.Jaber@nebraska.gov

Mark Ahlman

Bridge Engineer, Nebraska Department of Transportation, Mark.Ahlman@nebraska.gov

This paper presents the design concept, construction procedure, and implementation of a fully precast concrete bridge system developed for accelerated bridge construction. The system comprises precast concrete abutments, wing walls, grade beams, I-girders, deck panels with rail, and approach slabs. This system was first implemented to the construction of Belden-Laurel bridge in Nebraska during the summer of 2018. The project is a replacement of an existing bridge on the U.S. Highway 20 (US-20) located in Cedar County and connecting the villages of Belden and Laurel, NE. It is a part of the replacement of 6.87 miles of roadway due to its poor condition based on recent inspection records. The existing three span steel bridge over Middle Logan Creek was removed and replaced with a simple span concrete bridge that is fully made of prefabricated components. The bridge has an average daily traffic of 1780 with 25% truck traffic as of 2018. The demolition of the existing bridge started in May 2018 and the new bridge was open to traffic in July 2018 using accelerated bridge construction techniques. The construction of the new bridge involved the use of Ultra-High Performance Concrete (UHPC) and Self-Consolidated Concrete (SCC) to connect bridge components. The new system was designed to relax the tight tolerances of precast construction to facilitate rapid and economic construction. The project was completed successfully on budget and schedule. Lessons learned for this experience will be also presented.

*Keywords:* precast concrete, UHPC, deck-to-girder connection, precast rail