

Bridging Traditions: Merging Cast-in-Place Concrete with Modular Construction

by Aubri Benson, InQuik Inc.

Designers and constructors seek both efficiency and durability in today's concrete bridges. While some projects are suitable for cast-in-place construction methods, constrained sites often require prefabricated solutions.

In Eau Claire County, Wis., an innovative project merged cast-in-place and modular construction by using a new method for enhanced efficiency. In August 2023, the county used the InQuik Bridge System to replace a functionally obsolete plate arch culvert on County Road V. Because the system is composed of preassembled, pre-engineered components that combine reinforcing steel and stay-in-place formwork, it allows a conventionally reinforced concrete structure to be installed with limited labor resources and equipment.

The InQuik system is modular, and therefore any project that uses the system must use a combination of various "standard" modules. Generally, the deck panels are 8 ft wide. However, 18-in.-wide "extension spacers" can be added between deck panels if needed. Currently, the system is available for spans of 21, 30, 40, 45, 53, and 61 ft with nominal depths of 14.5, 27.5, and 40 in. These standard spans and associated sections have been designed in accordance with the American Association of State Highway and Transportation Officials' *AASHTO LRFD Bridge Design Specifications*¹ for HL-93 loading. Research and development for longer spans and other optimized designs are ongoing.

The Eau Claire County project used a standard InQuik section with a span of 30 ft and a section depth of 27.5 in. The bridge cross section

used three standard 8-ft-wide modules with two 18-in.-wide spacers for a total width of 27 ft. The bridge incorporated 4-ft-high abutments with an integral connection to the deck units. The abutments featured 45-degree wingwalls that cantilevered off the abutments and required no independent foundations.

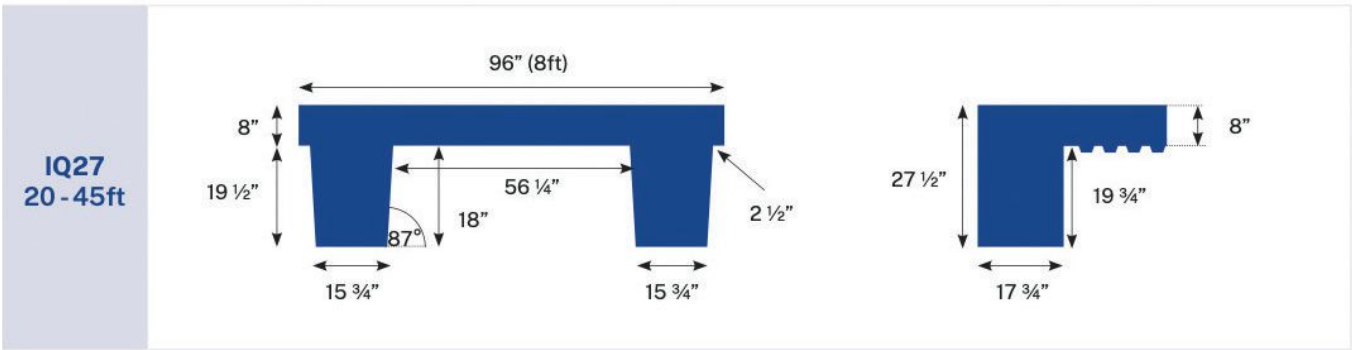
A thorough quality-control and quality-assurance program is implemented and documented at the factory to ensure that reinforcement within a module is properly placed. Before concrete placement on the jobsite, the reinforcement can be checked by an on-site inspector for consistency with the design documents. Once the concrete is placed, nondestructive testing for voids can be performed using a sounding hammer. If a defect is detected, the formwork can be removed for remediation.

For the Eau Claire County project, upon the system's arrival on site, a county road maintenance crew lifted the components into place with an excavator and completed some minimal on-site reinforcing work. With pick weights around 5 tons, the county was able to use their own excavator and operator instead of a crane. The prefabricated abutments, with preplaced reinforcing steel inside prefabricated formwork just like the decks, were ready for concrete within an hour of their arrival on site, eliminating the need for a cofferdam or dewatering, which may have been required with conventional construction. The county sourced ready-mixed concrete from a local supplier and placed the concrete themselves.

Because the system is designed to be self-supporting, the need for additional formwork supports or bracing is eliminated. This aspect of the

Eau Claire County Highway Department crews set the final module of the InQuik accelerated bridge construction system for a bridge replacement on County Road V. Photo: InQuik Inc.





The InQuik system is available for spans of 21, 30, 40, 45, 53, and 61 ft with nominal depths of 14.5, 27.5, and 40 in. Figure: InQuik Inc.

system simplifies on-site work, eliminating the need to work below the span and keeping employees and equipment out of the waterway.

For the installation of the structure in Eau Claire County, the schedule was as follows: one day to set abutment modules, one day to place concrete for the abutments, one day to place deck modules, one day to install lap bar and integration bar (to complete the integral connection between the deck and abutment), and one day to place deck concrete. Owing to weather conditions, utility conflicts, subcontractor schedule conflicts, and so forth, the total road closure time was approximately six weeks. However, the InQuik-specific construction processes were completed using about a week’s worth of on-site labor with a small (usually four-person) crew.

Use of prefabricated components for this project accelerated the construction such that the duration was measured in weeks rather than the months often required with a conventionally constructed reinforced concrete bridge.

According to Jon Johnson, Eau Claire County’s highway commissioner, this methodology reduced bridge construction costs significantly, as compared to the engineer’s estimate.

Travis Pickering, the Eau Claire County engineer, says that once he learned about InQuik, he “saw how innovative it was, and that it could be a real game changer. You can install faster and save some money, especially [considering] budgets that keep getting tighter, and rising costs.”

Additionally, Pickering notes that the system “goes in faster, [which is] something that’s going to have a positive impact on the community as well.”

Eau Claire County is planning a second InQuik bridge for construction in 2024. Further east, Marathon County, Wis., is planning to use this system to replace a deteriorated structure in their system.

Reference

1. American Association of State Highway and Transportation Officials (AASHTO). 2020. *AASHTO LRFD Bridge Design Specifications*. 9th ed. Washington, DC: AASHTO.

Aubri Benson is a marketing associate for InQuik Inc. in Denver, Colo.