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Box Culvert Creates Efficiencies for Bridge Repair

In October 2020, Iowa opened a newly rehabilitated bridge on Highway 3 in Plymouth County. Installing twin precast concrete box culverts under the existing bridge instead of a full bridge replacement enabled busy Highway 3 to remain open throughout the repairs. Box culverts were the perfect solution.

Highway 3 is the longest state highway in Iowa. As it carries steady traffic from east to west, closing it for maintenance or infrastructure replacement would create a real challenge for Iowa travelers. So, when the Iowa Department of Transportation (IDOT) determined a bridge on Highway 3 in Plymouth County was past its lifespan, rather than replace the bridge, they chose to repair the aging structure with a precast concrete box culvert. The box culvert could be quickly and efficiently installed without significant disruption to traffic.

Installation

Prior to culvert installation, it was necessary to grade the area and move dirt to provide proper culvert bedding. In this particular installation, the ground under the bridge was too wet and muddy to support the box culvert, so material was brought in to aid drainage and stabilize the foundation. The contractor, Peterson Contractors Inc. (PCI), Reinbeck, Iowa, put in roughly 4 feet of a railroad ballast (4-inch large stones) topped with approximately 1 inch of Class A stone to ensure a stable base.

The project design called for PCI to use two 12- by 12-foot box culverts installed side by side with 3/1 sloped end sections. Each culvert measured 117 feet long, consisting of 13 x 4-foot sections and 13 x 5-foot sections. A total of four end sections measured 35 feet each.

An interesting twist to this project was that the twin culverts had to be installed under the existing bridge. Normally the road is closed, the bridge is removed, the culverts are installed, and the road reopens. In this case, Iowa DOT wanted to keep the traffic flowing on the highway without disruption, so the bridge was kept intact during the new culvert's construction.

PCI installed one section at a time. The biggest challenge was to carefully slide the precast concrete culvert sections into place without destroying the grade. Using a 110-ton Link-Belt crawler crane and a 345B Caterpillar excavator, each culvert piece was slowly walked into place and carefully pulled together. Even with the added caution, the slide required PCI to continually adjust the grade throughout the installation.

After the box was installed, the guardrails were removed and any spaces between the box culvert and existing bridge were filled. Next, holes were drilled in the existing bridge deck, and a flowable grout was pumped through to fill the void between the top of the box culvert and the bottom of the bridge. When complete, a new asphalt overlay was placed on the bridge, and grading was completed around the outside of the culvert ends.

Precast Box Culvert Advantages

Iowa DOT's decision to install the twin precast concrete box culverts under the bridge instead of a full bridge replacement enabled busy Highway 3 to remain open throughout the repairs. Not only did Iowa DOT avoid traffic disruption from long road closures, but they saved time and money with the efficiency of the precast solution. With construction starting in mid-August 2020, the precast box culvert was installed in three days in September. The total project was complete by mid-October 2020.

Project Profile

Location
Plymouth County, IA

Installation Completed
September 2020

Project Completed
Mid-October 2020

Project Owner
Iowa Department of Transportation

General Contractor
Peterson Contractors Inc., Reinbeck, IA

ACPA Producer
Hancock Concrete Products, Lake View, IA

» Box Culvert, Highway, DOT, Installation, Bridges, Repair