CONCRETE ARCH BRIDGES

Carrollton Bridge (Carroll County Bridge No. 132), Carroll County, Indiana

Location and Description of Setting:

The Carrollton Bridge carries Carrollton Road over the Wabash River, approximately three miles north of Delphi, Carroll County, Indiana. The bridge is in a rural, agricultural setting. The bridge was the first permanent crossing of the Wabash River. It is also the site of a historic Wabash and Erie Canal lock.

Description of Bridge:

The Carrollton Bridge was designed by Daniel B. Luten and was constructed in 1927. It is a 615 foot reinforced concrete arch bridge comprised of six spans.

Figure 4. Carrollton Bridge

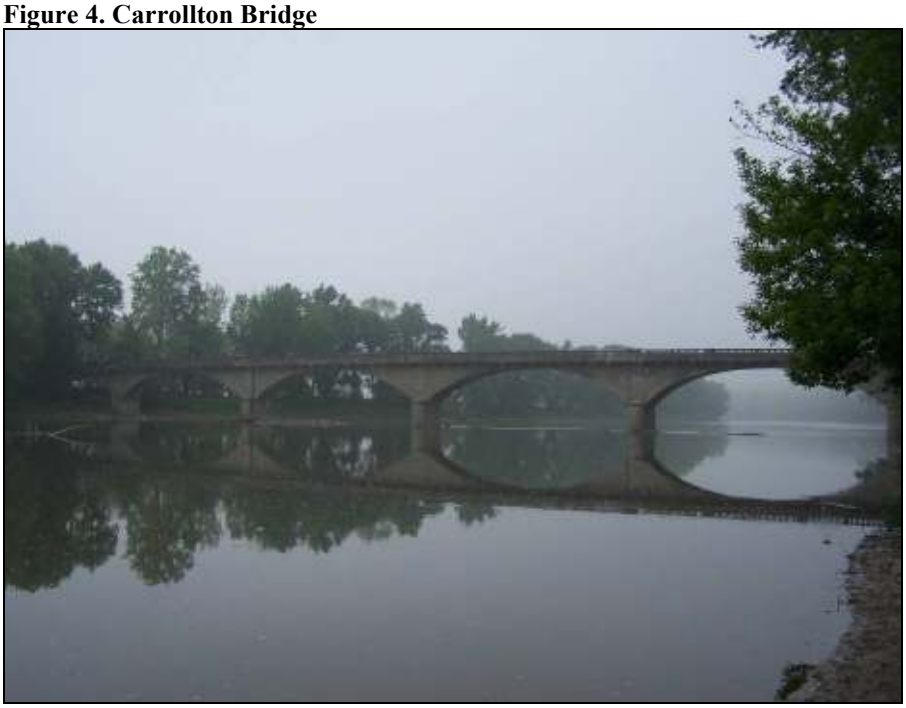
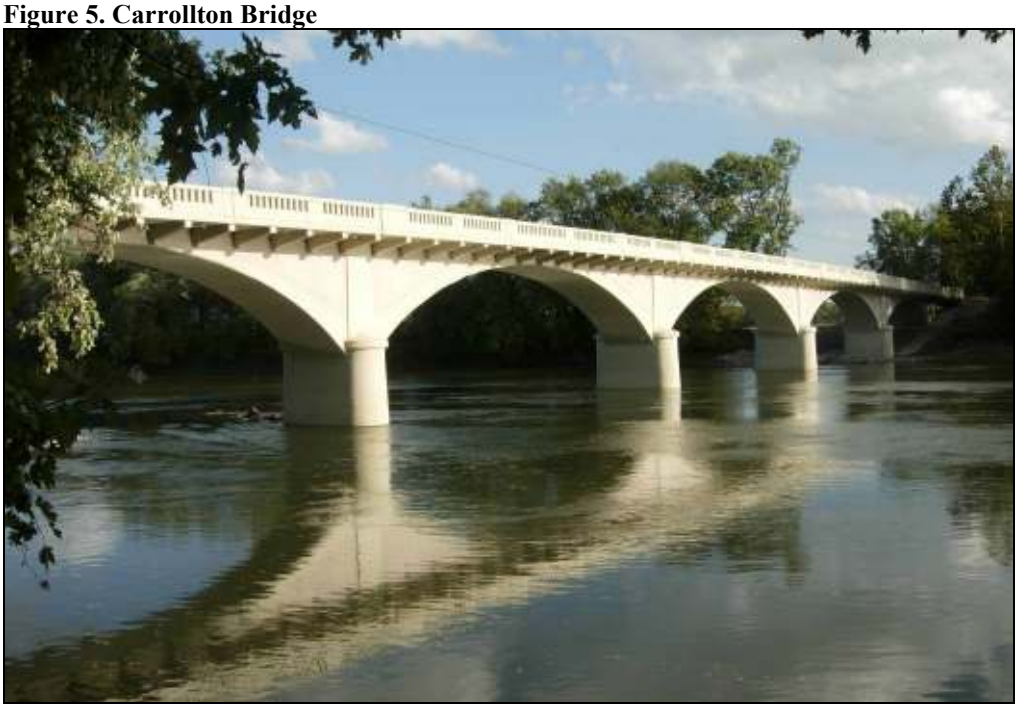


Figure 5. Carrollton Bridge



Rehabilitation Project Information

Date/Cost for Rehabilitation:

The project began in May of 2005 and the bridge was reopened to traffic in December of 2006. Final construction was completed in the summer of 2007. The construction cost was $1,916,750.

Project Designer:

Butler, Fairman, & Seufert, Inc.
Contractor: Wirtz and Yates, of Kentland, Indiana

Bridge Owner/Client:

Carroll County, Indiana

Source for Additional Information:

Stephanie Wagner
Bridge Rehabilitation Engineer
Indiana Department of Transportation—Central Office

Project Information

1. **Significant issues associated with project (e.g., bridge condition, reasoning behind decision to rehabilitate versus replacement, reasoning behind selected maintenance activity).**

   The Carrollton Bridge is a National Register-listed concrete arch bridge that was once considered too deteriorated and obsolete to be saved. Through the use of innovative engineering techniques, special materials, and experienced construction inspection engineers, the bridge was saved and rehabilitated. The exterior appearance of the bridge did not change significantly from the original form, although

the deck was widened by four feet and the arch strengthened for heavy loads. The use of relatively new materials and engineering techniques, such as self-consolidating concrete, steel-backed timber approach railings, composite deck brackets, and modified Texas Type "T-411" bridge railings, helped make the project a success.

Since the existing bridge is listed in the National Register, it was extremely important that the external appearance of the structure not change any more than absolutely necessary. Due to the extreme deterioration of the pier shafts from freeze/thaw action, complete encasement was required as part of the rehabilitation. Self-consolidating concrete was used in the encasement of the piers in order to reduce the thickness of the encasement and to provide a more uniform appearance for the concrete surface. The use of this material was a first for the Indiana DOT LaPorte District.

The new cantilever brackets that support the new concrete deck were two feet longer than the existing brackets, but the depth and width were kept the same so as to not significantly change the exterior appearance of this historic structure. The new concrete deck was made composite with the brackets to provide full-load capacity for the longer cantilever, and deck reinforcement was concentrated over the beams so it could contribute to the load capacity of the cantilevers.

Incorporating a new continuous deck composite with the brackets and spandrel walls has an additional benefit. It helps distribute the load over a larger area, increases the load capacity of the arch rings, and stiffens the bridge against heavy truck loads. It also creates a concrete roof over the arch fill, thereby eliminating the ingress of moisture into the substructure and reducing the concrete's deterioration due to freeze/thaw action.

The existing railing could not be replaced "in kind" and still meet current federal guidelines for crash tested bridge railing. Therefore, the Texas Type "T-411" railing was heavily modified to provide a similar appearance to the existing rail, but still providing the necessary strength and geometry to satisfy Federal Highway Administration (FHWA) crash standards. Thus, the railing emulated the look of the existing railing and meets crash test requirements.

2. **Project description, including purpose and need.**

The Carrollton Bridge provides a major river crossing for Carroll County residents, farmers, and commuters traveling to and from the city of Delphi. Very few structural repairs had been performed on this concrete arch bridge since its original construction in 1927. The bridge was considered functionally obsolete with a growing concern developing over the structural health of the bridge. Freeze/thaw damage was observed over much of the structure including the overhang brackets, pier stems, and arch rings. Concrete cracking and delaminations were resulting in section loss throughout the structure.

Growing concerns over load capacity and the lengthy detour that would be necessary if the bridge had to be closed prompted county officials to initiate a replacement project. Funding shortfalls within the county government and mounting objections from state and local historical agencies, however, resulted in the decision to rehabilitate, rather than replace, the Carrollton Bridge. The purpose of the rehabilitation project was to address both functional and structural deficiencies of the bridge without significantly affecting the historical properties of the bridge.

3. **Traffic levels, loading needs, and other related issues.**

The safety of the traveling public was greatly improved by increasing the width of the structure to 24 feet. The structure is no longer posted as a narrow bridge. The four feet of added bridge width also

reduces the driver/pedestrian conflicts that were frequent before the rehabilitation. Stoned shoulder sections at all four corners of the bridge and a public access location beneath the bridge's north span allow people to park safely and enjoy a panoramic view of the area.

In addition to the added travelway width provided on the bridge, crash tested bridge and approach railings were constructed. This is an enormous safety improvement over the inadequate bridge rail and non-existent approach railing of the existing structure. The blunt concrete bridge rail ends on the original structure were considered a major hazard for today's traffic volumes and speeds.

4. **Section 106 effects finding (no adverse, adverse). Major issues discussed with State Historic Preservation Officer, and how issues were resolved.**

A meeting at the project site was held immediately after the project Notice to Proceed in order to streamline the coordination with the State Historic Preservation Office and other interested parties. The meeting included representatives from SHPO, Indiana DOT, the Indiana Historic Spans group, Wabash & Erie Association, Carroll County, and other parties. After much discussion regarding the needs and concerns of each group, a general consensus was reached regarding the general scope of the project. As a result of this meeting, coordination that would normally take several months to complete was finalized in a matter of days. The Indiana DOT made an Adverse Effect finding on the project, and worked with all of the parties to prepare a Memorandum of Agreement on resolving this adverse effect.

Progress meetings were held with all of the parties throughout the project. These meetings were helpful in keeping everyone informed, setting schedules, and meeting deadlines.

Because the Wabash and Erie Canal once crossed the Wabash River at this bridge location (remnants of old locks have been found at the northwest corner of the bridge), an interpretive sign explaining the history and functioning of the canal locks was installed at the north end of the bridge. A second interpretive sign discusses the history and significance of the Carrollton Bridge.

5. **Lessons Learned.**

First, it is important to look for ways to modify current standard bridge elements so they appear to match the originals bridge elements. In the case of the Carrollton Bridge project, by modifying the shape of the windows in a current crash tested standard railing, no design exceptions were required. The new railing emulated the look of the original railing, and also met crash test requirements.

Second, careful detailing can ensure that the historical integrity of the bridge is not lost in rehabilitation and repair work. Extensive detailing of the bridge railing and overhang brackets ensured that the profile view of the bridge conformed to the consistent gradual curve of the original design. False work details for the overhang brackets used every third existing bracket to support the new brackets. This process helped retain the neat lines of the original bridge construction.