



## **PIC-CR22-6.95 Scioto Darby Road over Big Darby Creek – Project Narrative**

The structure carrying Scioto-Darby Road (County Road 22) over Big Darby Creek in Pickaway County, Ohio, known locally as the “Gantz Bridge”, was over 100 years old when the County Engineer initiated a project to replace it. The two-span, 255 foot long truss bridge was structurally deficient and functionally obsolete. The bridge’s location over Big Darby Creek – a highly protected State and National Scenic River – required diligence in project development to achieve the County’s goal of a cost effective, low maintenance replacement structure while meeting the complex environmental and permit requirements. The new 362 foot long, 3-span bridge with 0.53 miles of realigned roadway did just that.

**Complexity** - The project involved numerous design, environmental, and construction complexities. Even by maximizing the bridge length, substructures at the piers were in close proximity to the Ordinary High Water Mark (OHWM) of Big Darby Creek (BDC). Numerous iterations in the size and arrangement of drilled shaft foundations were required to ensure that the shoring for the footings would avoid stream impacts. This was balanced with providing reasonably sized 54 inch diameter shafts to avert costly special equipment required to socket 15 feet into very hard bedrock. Abutments were founded on H-piles to rock that considered downdrag forces and required 30 days of embankment settling time.

The new structure location 150 feet downstream of the existing bridge, where the stream narrows, allowed for a clear-span bridge utilizing the County’s desired structure type. Concrete I-beams were selected over steel girders based on reduced maintenance and 15% lower life-cycle costs. Also, increased environmental regulation along BDC will make painting steel more difficult and expensive. To achieve a center span length to clear OHWM, non-standard prestressed concrete I-beams with wider flanges were utilized with pre-approval from ODOT. These beams were being utilized in adjacent states but and would later become Ohio standard. They allowed for 20% more prestressing strands, utilized 8000 psi high-strength concrete, and additional reinforcing to achieve a center span length of 147 feet.

Detailed design was required early in the project to ensure the beams could be fabricated and economically erected without use of a causeway. Contractors confirmed that two of the largest cranes available in Ohio, 550-ton capacity each, could complete the task, ensuring an economical and constructible path forward.

At the request of US Fish and Wildlife Service (USFWS) and the Ohio State University (OSU), advanced hydraulic analysis evaluated high-flow stream velocities in five foot transects during high-flow events to ensure shear stresses didn’t adversely affect mussels that burrow themselves into the stream substrate. Unregulated dikes were also modeled to ensure flooding potential to adjacent properties was negated.

After construction of the drilled shafts, much of the concrete was testing at strengths as low as 2987 psi versus the 4500 psi specified. When discovered, the footings and pier columns were completed and beam erection was near, so urgent resolution was required. Korda revisited the design and utilized finite element analysis to determine the in-place concrete exceeded absolute minimum requirements by only 1.4%, but could remain in place.

**New Application of Existing Techniques/Originality/Innovation** - One unique approach was early engagement of the multitude of environmental and permitting agencies. Instead of seeking formal approval later in the development of the project, we had multiple group meetings with these agencies, both in-office and on-site, and even before the project scope was developed, to get early input and project buy-in. Impacted resources included not only BDC, but eight additional small streams, five wetlands, and significant



endangered bat species habitat. Agencies included USFWS, Ohio Department of Natural Resources (ODNR) Scenic Rivers, National Park Service Scenic Rivers, Ohio EPA Stormwater and Waterway Permit divisions, U.S. Army Corps of Engineers, The Nature Conservancy, and the OSU Department of Ecology. This engagement provided ongoing coordination, candid feedback on alternatives, and streamlined project development to give the County confidence to bid and award the project before final permits were secured.

A similarly simple but non-conventional approach was the selected alternative - moving the bridge on a new alignment 150 feet downstream of the existing. Many agencies were initially skeptical of the concept since a new alignment would seemingly have greater environmental impacts, but its merits were ultimately proven beneficial and resulted in a very cost-effective project. The primary goal of the agencies was minimizing stream impacts, with the only permitted in-stream work to remove the existing bridge pier. On existing alignment, a single-span bridge length of at least 255 feet would have been required, a cost-prohibitive alternative requiring maintenance and inspection beyond the County's expertise. Moreover, the bridge needed widened by 13 feet to meet current design requirements and the structure depth would need to be almost eight feet deeper than the existing truss. The significant embankment required would have resulted in greater impacts to environmental resources and private property than the new alignment, with fewer safety benefits.

**Social/Economic Considerations** - The existing bridge was closed to traffic in 2014 due to structural deterioration. The County set a goal of opening the new bridge by winter of 2016 to save the public significant time, money, and frustration resulting from the lengthy 11 mile detour. The design and environmental process was expedited, and the new bridge was opened to traffic in December of 2016 after just five months of construction. Final aesthetics, concrete sealing and staining, and landscaping was completed in the spring of 2017.

The project also provided a sense of pride to the local community. The Gantz family, the namesake of the original bridge, still reside in the corridor and were invested in the successful completion of the project. The roadway realignment resulted in the lengthening of all driveways, which was a benefit to these owners seeking quiet privacy in this rural setting. The community involvement and pride was evidenced by many residents, and even environmental agencies, being present at the grand opening event.

**Safety** – The existing 17'-3" wide bridge necessitated one-way traffic, which posed a safety issue since sight distance was impaired on the approaches due to vertical and horizontal alignment deficiencies. Travel speeds of just 15 mph were feasible through the roadway corridor. Agricultural equipment and loaded crop trucks, both frequent in the area, were often unable to generate enough speed to traverse a section of sharply curved roadway at the bottom of an 11.4% grade. By widening the bridge to 30 feet, improving the roadway alignment and profile to achieve speeds of over 40 mph, and removing the 13'-6" vertical clearance limitation of the old bridge, safety is significantly increased and commercial and agricultural users now have a safe bridge and roadway that accommodates their equipment.

**Aesthetics and Sustainable Features** - Beyond the regulatory items described above, the new bridge provides aesthetic benefits and a sense of community. Fluted piers, stained parapets with natural stone formwork, and aesthetic bridge railing match that of another recently constructed long-span bridge in Pickaway County. Besides creating a common County identity via these long-span structures, the aesthetics compliment the scenic BDC corridor for those fishing, hunting, canoeing, kayaking, and recreating near the



bridge. The low parapet and open railing also opens the viewshed of the scenic BDC corridor to motorists traversing over the bridge.

To obtain environmental and permit approval, the project provided numerous sustainable features. Off-site mitigation was required for impacts to Indiana Bat and Northern Long Ear Bat habitat, as well as for riparian zone and groundwater recharge requirements from the Ohio EPA Stormwater General Permit for BDC. Securing the required 15 acre mitigation parcel adjacent to BDC required extensive searching, coordination with environmental agencies, and calculation to ensure mitigation requirements were met. After over a year of searching, a parcel seven miles downstream with outstanding qualities was identified, purchased, and permitted to allow final approval of the USACE and OEPA Section 404/401 waterway permits while also providing mitigation for wetlands, bat habitat, and stormwater. This exceptional mitigation parcel, bisected by BDC with a second overflow stream through the parcel, protects and sustains the critical habitat within the BDC corridor and provides access for wildlife viewing and hunting and/or fishing opportunities. Stormwater BMPs were also provided on-site using the abandoned roadway corridor, which was planted with native trees and grasses, reducing maintenance while improving water quality and wildlife opportunities.

**Meeting and Exceeding Owner's/Client's Needs** - A fundamental goal of the project was engrained into every project consideration: providing a cost-effective, low-maintenance project. Utilizing concrete I-beams reduced costs by 15% over the lifespan of the project. Utilization of the old right of way as environmental mitigation reduced new right of way acquisition and off-site mitigation costs. Avoiding extra-ordinary structure types and sizes minimized design and construction costs, and avoids specialized maintenance and inspection requirements that would be outside the capability of County forces. The awarded construction bid was \$4,079,000, within 3% of the early preliminary engineering cost estimates, and 8% below the advertised estimate. Final construction costs came to \$3,990,000.