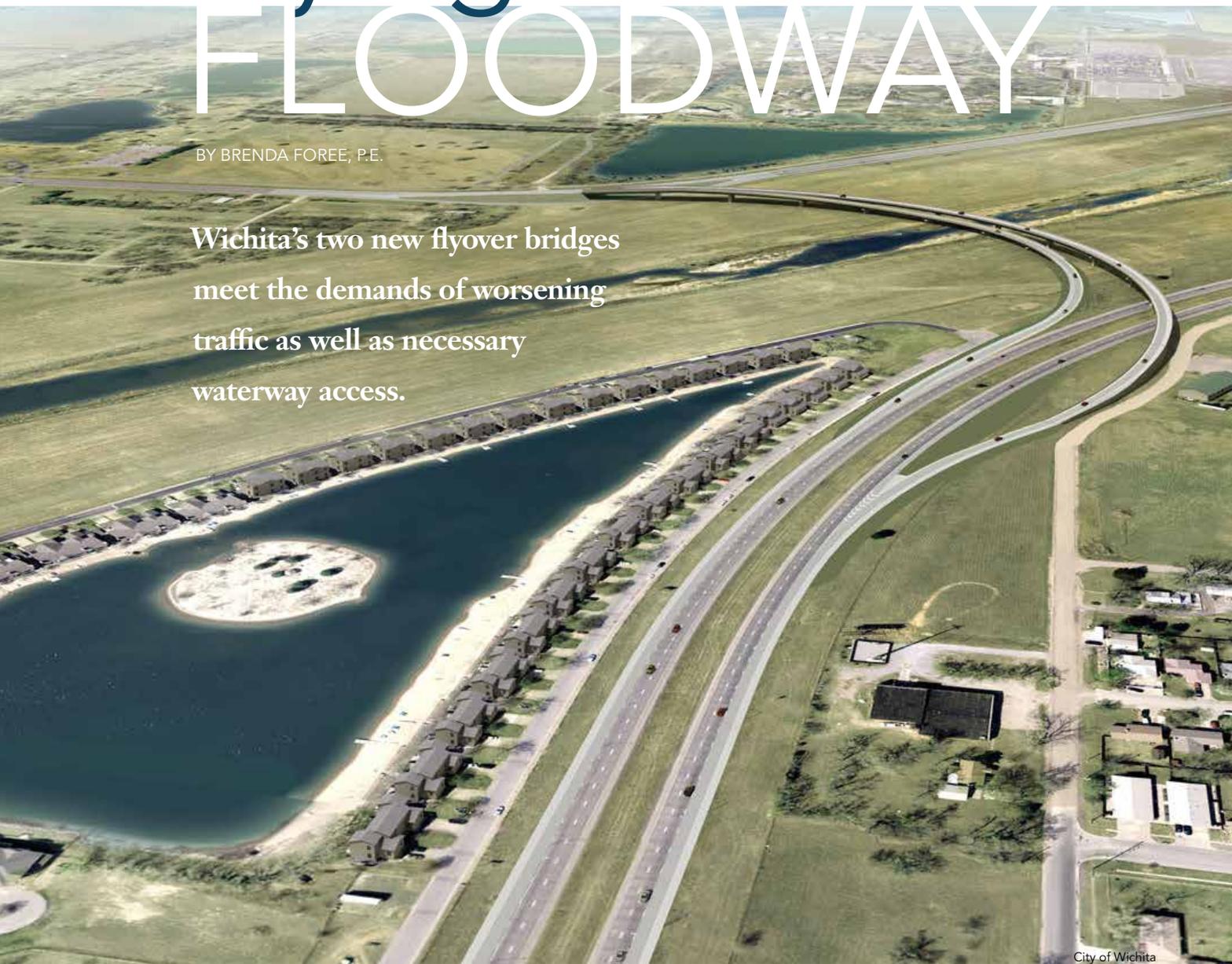


Flying Over the FLOODWAY

BY BRENDA FOREE, P.E.

Wichita's two new flyover bridges meet the demands of worsening traffic as well as necessary waterway access.



▲ The two flyover bridges opened this past November in Wichita.



Brenda Foree
(bforee@hntb.com)
is a project manager with HNTB Corporation.

TWO NEW FLYOVER BRIDGES, which sweep gracefully over a Wichita, Kan., floodway, provide a welcome relief for commuters from decades of traffic congestion—while also preserving critical flood protection for the community.

The structural steel plate girder bridges—2,273 ft long and 1,690-ft long, respectively—are part of a new partial interchange with 13th Street and Interstate 235 in this city of nearly 400,000. The bridges were integral to the design of a suitable alternative for meeting traffic demands in a highly constrained area and to achieving the city's aesthetic objectives.

Before the opening of the \$24 million interchange this past November (five days ahead of schedule) Wichita commuters were routinely suffering bottlenecks accessing the limited crossings over a large flood protection channel that separates the city from newer development to the northwest.



Courtesy of HNTB

- ▲ One of the bridge assemblies in the field, which starts at pier 6 and ends at pier 8. The assembly is nearly 534 ft long, with a maximum elevation of over 24 ft and a maximum sweep offset of nearly 39 ft.

For more than two decades, the City of Wichita had sought solutions to relieve this worsening traffic congestion at the I-235 interchange with Zoo Boulevard, which provides access across the Wichita-Valley Center Floodway, known locally as the “Big Ditch.” The Floodway is a manmade channel on the west side of Wichita that was constructed in the 1950s to protect a large portion of the city from flooding by intercepting and diverting flow from the Arkansas River and other Sedgwick County watercourses.

To address the safety issue of traffic accessing Zoo Boulevard backing up onto I-235 during peak hours, the bridge across the Floodway at the I-235/Zoo Boulevard interchange was reconstructed in 2000 with additional left-turn lanes. Bottlenecks remained, however, and given the proximity to the Floodway, a pedestrian/pipeline bridge and railroad tracks would not allow any other major improvements to that interchange. The city thus turned to other options.

Traffic studies indicated that a new crossing over the Floodway would help alleviate congestion in the area. A new partial access interchange at 13th Street and I-235, between Central Avenue and Zoo Boulevard, and over the Floodway was determined to be the most appropriate solution for congestion relief, given the constraints of the area. The Kansas Department of Transportation (KDOT) and the Federal Highway Administration (FHWA) approved this break in access for I-235 after a study demonstrated that the proposed improvements would improve safety and operations on I-235 and improve local access.

Even with this new option, the City still had to contend with several challenges. The design team had to carefully locate the flyover bridges over 1,000 ft of floodway and around its levees, as well as around



Courtesy of HNTB



HNTB

- ▲ The bridges use 2,875 tons of structural steel.
- ▼ The exterior steel girders employ two different-colored elements constructed from HSS6x3x⁵/₁₆ to visually subdivide the girder mass.



HNTB



- ▲ Both bridges are 32 ft, 6 in. wide, with four plate girders spaced at 8 ft, 8 in. The girders have 84-in.-deep webs, 2-in.-thick flanges and lengths ranging from 100 ft to 110 ft (the average girder weight is 15 tons to 20 tons).

I-235, other roadways, a lakeside residential development and a county park.

The Right Pace

The 45-mile-per-hour design speed was a major factor in setting the bridge's geometric features, such as longitudinal grades, super-elevation rates and curve radii. Steel plate girders were chosen as the preferred structure type early in the preliminary design process due to the bridges' horizontal curvature and span lengths up to 225 ft.

Flyover NB235-WB13 connects northbound I-235 to westbound 13th Street, while flyover EB13-SB235 connects eastbound 13th Street to southbound I-235. Flyover NB235-WB13 is a 12-span bridge on a 1,150-ft radius with a total bridge length of 2,273 ft. The south unit crosses I-235 with spans of 155 ft, 200 ft and 155 ft. The center unit passes over the east levee and Floodway channel with spans of 157 ft, 215 ft, 215 ft, 215 ft and 167 ft. The west unit spans the west levee and 13th Street to Windmill Road Ramp. West unit spans are 190 ft, 225 ft, 210 ft and 169 ft.

Flyover Ramp EB13-SB235 is a nine-span bridge on a 950-ft radius with a total bridge length of 1,690 ft. The west unit crosses over 13th Street to Windmill Road Ramp and the west levee with spans of 145 ft, 180 ft, 225 ft and 190 ft. The south unit passes over the Floodway channel and east levee with spans of 156 ft, 212 ft, 212 ft, 225 ft, and 145 ft.

Both bridges are 32 ft, 6 in. wide, with four plate girders spaced at 8 ft, 8 in., and the girders have 84-in.-deep webs, 2-in.-thick flanges and lengths ranging from 100 ft to 110 ft (the average girder weight is 15 tons to 20 tons). Weathering steel was chosen to minimize future maintenance requirements, and the project uses 2,875 tons of structural steel.

After fabricating the girders, each unit required a full vertical inspection. Essentially, the bridge had to be erected in the shop using falsework (mock piers and blocking points), including the installation of cross frames and diaphragms, to verify that the elevations, camber and horizontal sweep of the bridge would match in-field conditions. These assemblies reached up to 600 ft in overall length with an overall elevation difference of 30 ft, and were able

to get within ¼ in. over spans exceeding 500 ft. In order to verify all dimensions, a transit was used to verify horizontal offsets and camber. Before each assembly began, the outdoor assembly bay was surveyed and re-leveled in order to properly assemble the units.

Floodway and Levees

Construction had to accommodate the needs and requirements of the City of Wichita/Sedgwick County Flood Control Section, which is responsible for maintaining the Floodway in accordance with standards established by the U.S. Army Corps of Engineers (USACE). Construction could not restrict access to the levees for maintenance and emergency vehicles, but the bridges' vertical profile allowed for an access road to be constructed on top of the west levee and on the dry side of the east levee. Temporary bents for steel erection were allowed to be located on the levees since emergency access was available from Zoo Boulevard (north of the project) and Central Avenue (south of the project). Vertical bridge profiles were set to provide room for an access road on top of the levee at three crossings, and the access road was placed adjacent to the dry side of the levee at the fourth crossing.

Two mechanically stabilized earth (MSE) walls are located at the west end of the bridges, and one MSE wall is located at the south end of Flyover NB235-WB13. Additional project improvements included addition of acceleration/deceleration lanes to I-235 between Central Avenue and the flyover ramps, realignment of 13th Street/Windmill, arterial intersection improvements at two locations, roadway improvements to Hoover Road and Lakewind Street and revised access to the Sedgwick County Park.

Bridge piers were located a minimum of 20 ft from the toe of the east and west levees in order to avoid impacts to the integrity of the levee system. In addition, USACE required a geotechnical seepage analysis be completed for bridge piers adjacent to the dry side of the levees to demonstrate that the piers would have no substantive impact upon seepage potential through or beneath the existing levees.

The team performed a hydraulic analysis, which determined that the project would have only a minimal effect



HNTB

upon the capacity of the Floodway. The minor rise of the base flood profile attributed to the bridge piers was acceptable because the existing levees are sufficiently high to contain floods exceeding the 500-year event.

Bridge Aesthetics

The City of Wichita was committed to creating visually appealing bridges with clean, elegant lines, and the bridges' steel components helped to achieve this goal. Project designers worked with artist Greg Turner to develop an aesthetic concept that was approved by the Wichita Design Council. The two flyover bridges sweep across the Floodway in an ever-widening curve inspired by the flared pier design. Curved rustications in the pier face recall floodplain grasses bending in the breeze, and the exterior steel girders employ two different-colored elements constructed from HSS6×3×⁵/₁₆ to visually subdivide the girder mass. These elements extend from abutment to levee, to be seen from adjacent viewpoints, and represent the colors of the changing Kansas seasons.

Project retaining walls and abutment wingwalls have a ribbed finish and are tan in color. The retaining wall along Windmill Road has a stylized impression of a windmill, clouds and birds, and southbound Windmill Road runs parallel to the west end of Flyover NB235-WB13, giving a prolonged view of the artwork on the retaining wall. ■

Owner

Kansas Department of Transportation

General Contractor

Dondlinger and Sons Construction Company, Inc., Wichita

Structural Engineer

HNTB Corporation, Overland Park, Kan.



HNTB

▲ Weathering steel was chosen to minimize future maintenance requirements.