

Making a Statement

BY STEVE HAGUE

Designers blend clean, sweeping lines with creative use of steel to produce a signature span for Ohio's capital.

CIVIC LEADERS THESE DAYS ARE ALL TOO EAGER TO ATTACH THE LABEL "SIGNATURE BRIDGE" TO ANY NEW SPAN THAT ENHANCES THE LOCAL SKYLINE.

Other bridge designs, however, deserve the label because they are so bold and innovative that they quickly become synonymous with the city where they were built.

The new Main Street Bridge now under construction across the Scioto River in Columbus, Ohio is in this latter group. Given the opportunity to create a new structure, city leaders wanted a bridge that would support and add value to urban and regional development plans, create desirable public spaces, and ultimately make an unmistakable statement.

In fact, one state transportation official expects the Main Street Bridge to achieve the iconic status of the Brooklyn Bridge or the St. Louis Arch. The dramatic design represents several significant firsts:

- The inclined single-rib arch will be the first of its type in the United States and one of only a handful in the world.
- It will be the first inclined arch—designed or built—tied together with cables and struts.
- It will be the world's first single-inclined arch bridge that incorporates separate pedestrian and vehicular decks.

Meeting a Pressing Need

The Main Street Bridge will link downtown Columbus with the older community of Franklinton to the west. The previous Main Street Bridge, a 70-year-old concrete span that was on the National Register of Historic Places, had deteriorated to the point that the city was forced to close it in 2002. Because the multiple-span, open-spandrel concrete deck arch bridge was an important eastbound artery, Columbus needed an efficient and effective solution for commuters. So, ODOT and the City determined that building a new bridge would be more cost-effective than renovating the existing one.

The diverse group of stakeholders involved in the design process underscores

the project's significance to the city. That group includes state and federal transportation officials, city leaders, the Ohio historic preservation office, the Franklin County engineer, developers of a high-rise residential complex near the bridge, the Greater Columbus Arts Council, and the City's Historic Preservation Office. This group agreed on specific design criteria:

- Access for bikes and pedestrians in addition to vehicles.
- Aesthetic and architectural compatibility with the Broad Street Bridge, the primary artery into downtown Columbus, and with the Civic Center Historic District.
- An unobstructed view of the river and skyline for motorists and pedestrians.
- Structural life of 100 years.
- The ability to accommodate the transportation needs of an expected 400,000 new residents over the next two decades.
- A link to the Riverwalk project now under development.
- Accommodation for several area summer festivals.
- Low-maintenance service.

A Design that Works

All of these criteria culminated in what could be called a tall order for the design team. The team developed more than 50 preliminary concepts during a two-day charrette, which were narrowed down to six. At that time, S.N. Pollalis of the Harvard University Graduate School of Design was invited to join the team, and three new design concepts were presented to City officials. By public vote, the inclined arch concept developed by Pollalis was chosen as the preferred option.

A paramount design consideration was the use of clean, classical lines that evoke the city's neighboring arched bridges and art deco buildings. The final design is a single rib-tied steel arch inclined at a 10° angle from vertical. The arch emerges through the bridge deck, and steel hangers descend from the arch to support members

below the deck. Unlike traditional tied-arch bridges, stay cables are used for the tie.

The bridge features three vehicle lanes for eastbound traffic, a 5-ft sidewalk on the south side, a steel box girder roadway, a concrete pedestrian path, piers that complement the superstructure design, and a pedestrian deck that sweeps horizontally and vertically away from the roadway to provide an unobstructed view of the city's downtown.

The overall length of the three spans is approximately 660 ft. The main span is 400 ft long, and the spans on each end are 130 ft long. The three-lane vehicular deck is 35 ft wide, and the pedestrian walkway is 18 ft wide. The curved pedestrian bridge is connected to the arch by a series of cables and struts that support the structure.

Committed to Steel

The design team was committed to using steel, in large part because of budget constraints (overall cost is \$42 million); although the location and structure type determined materials to some degree, cost was the overriding decision point.

Designers originally selected concrete to achieve the pure, smooth lines the project required. They later decided they could attain the same look with steel, which would be lighter and easier to fabricate, and take less time to construct. The use of box girders under the roadway achieves the same clean look as concrete. Designers and engineers also recognized that steel would require a shorter erection time, which would reduce the length of time the temporary supports were exposed to flooding risk.

The creative use of steel solved several engineering challenges. For example, designers switched from concrete to steel boxes to support the road deck and enable it to span the river more safely. Using steel also lightened the bridge load and allowed the removal of composite concrete that originally was going to be put in the arch.

Nearly 3,000 tons of ASTM A709 Grade 50 steel will be used during construction. The general contractor ordered



The new Main Street Bridge in Columbus will be completed in 2009.

steel when the old Main Street Bridge was removed last fall, and fabrication was expected to take about one year. Because the bridge is being built in a heavily developed area, the logistics of shipping fabricated parts required careful planning.

As soon as foundation and substructure work is completed, contractors will build temporary towers along the roadway box girder to support construction of the vehicular steel box and the arch. After these are completed, workers will install floor beams to support the pedestrian deck on the north side and the permanent struts and hangers for the arch. Finally, the contractor will build the pedestrian and bridge decks before removing the towers.

A Strong Statement

Building a bridge that meets the needs of diverse stakeholders is always a challenge. Making an architectural statement that will define the city's skyline for the next century takes the challenge to an even higher level. The Main Street Bridge is on track to meet this challenge when it opens in 2009. MSC

Steve Hague is chief structural engineer for HNTB Corporation's Kansas City Bridge

Group and the firm's project manager for the Main Street Bridge.

Owner

Ohio Department of Transportation

Design

DLZ Ohio, Inc., Columbus

HNTB Ohio, Inc., Columbus

Project Architect

Dr. S.N. Pollalis, Harvard University
Graduate School of Design, Cambridge,
Mass.

General Contractor

Kokosing Construction Co., Inc.,
Fredericktown, Ohio

Erection Engineer

Janssen & Spaans, Indianapolis, Ind.
(AISC Member)

Steel Detailer

Tensor Engineering, Indian Harbour
Beach, Fla. (AISC Member)

Steel Fabricator

PDM Bridge LLC, Eau Claire, Wis.
(AISC Member)

Main Street Bridge by the Numbers

- 42 million – project budget in dollars
- 1937 – year original bridge was built
- 100 – years new bridge is designed to last
- 10 – degrees of angle from vertical of the rib-tied arch
- 5 – width in feet of sidewalk on south side
- 18 – width in feet of pedestrian deck
- 660 – overall length in feet of three spans
- 400 – length in feet of main span
- 130 – length in feet of end spans
- 35 – width in feet of vehicular deck
- 3,000 – tons of ASTM A709 Grade 50 steel that will be used