

Iowa Bridge Aesthetics: Connections with History and Environment

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The Iowa Department of Transportation (Iowa DOT) has incorporated aesthetic design principles into its standard practice of bridge design on selected projects since 1997. This article explores the local and regional influences, collaborations, creative processes, and ideas that shaped the aesthetic form of three examples.

Prairie Jewels

Dual precast, prestressed concrete beam structures carry Interstate 80 (I-80) over a local highway serving as the main southern access to Grinnell, Iowa, and its renowned college campus. Grinnell is also home to Merchants National Bank, a celebrated Louis Sullivan “jewel box” bank building that exemplifies the early 20th-century Chicago School architecture and Sullivan’s lavish terra-cotta ornamentation. Built in 1914, the bank is one of eight jewel box structures designed by Sullivan and a National Historic Landmark (Fig. 1). Sullivan was a mentor to Frank Lloyd Wright, and his work was a primary inspiration for the Prairie School architectural style championed by his protégé.

Grinnell has a community gateway plan for entry corridor improvements including trails, a future visitor center near the I-80 interchange, and an aesthetic emphasizing the jewel box bank design, which is already evident in several city infrastructure projects. Iowa DOT met with city officials during the early stage of detailed design for the new interchange bridges and worked with their consultant, RDG Planning & Design, to discuss how these new structures might complement that design theme.



Figure 1. The Louis Sullivan “jewel box” bank building, characterized by its early 20th-century Chicago School architecture and Sullivan’s lavish terra-cotta ornamentation, is a key inspiration in the Grinnell, Iowa, community gateway plan. Photo: Grinnell Area Chamber of Commerce.

Iowa DOT had previously done some Prairie School-style work elsewhere in Iowa, but new studies specific to Grinnell’s vision resulted in several substructure treatment options celebrating this style. Project stakeholders were invited to choose their preferred option, thus involving local partners in the decision-making process.

Designers made extensive use of thin brick veneer for a building-like feel and authenticity, reflecting the city’s historic architecture exemplified by the bank. Iowa DOT’s bridge designers favor this material over painted concrete for its sustainable, permanent color and its strong character.

Terra-cotta tile, which is the main ornamental feature of Sullivan’s jewel box bank, had been used as a signature material for several recent city amenity projects, and the bridge designers identified opportunities within the substructure design to accommodate this locally iconic ornamentation. The designers carefully considered the risks associated with bridge decoration and performed thorough design studies to integrate terra-cotta tile elements so that they appear to be integral to the structure’s architecture rather than merely applied.

A construction partnering agreement was established with the City of Grinnell to provide terra-cotta



Figure 2. Interstate 80 interchange at Grinnell, Iowa. Thin brick veneer and copings were used to bring historically significant framework and architectural elements to the piers of the structures. Rendering and Photos: Iowa Department of Transportation

ornamental tiles to the project. The city's planning and design consultant has an embedded art studio working group that designed and fabricated the tiles. Iowa DOT's plan included an install-only bid item for the tiles to be furnished to the contractor by the city when needed during construction. This arrangement allowed the city to use a flexible, just-in-time procurement process for tile design and fabrication. These "prairie jewels" are a gleaming example of a state agency and a local partner coming together to create a solution that is greater than the sum of its parts (Fig. 2). City-installed underdeck bridge lighting will showcase the terra-cotta pieces and light the trail beneath the bridges.

Fossil Bridge

Dual precast, prestressed concrete beam bridges carry U.S. Route 61 (U.S. 61)

and a multiuse trail over Flint Creek at a site north of Burlington (Fig. 3). At Starr's Cave Nature Center just one mile downstream from the site, visitors are encouraged to explore area rock outcroppings for embedded fossils. In geological circles, the "Burlington" is a limestone formation that stretches from Iowa to northwest Arkansas and from Illinois to western Kansas. This limestone is mostly composed of fossilized remains, primarily crinoids or "sea lilies" that lived at the bottom of an inland ocean in the Midwest.

For the U.S. 61 bridge over Flint Creek, the use of textured formliner in the pier concrete evokes watery depths, indicating that this area was beneath a shallow sea 350 million years ago. A laser-cut weathering steel plate railing similarly conjures water, and casts shadows onto the trail surface

in patterns that give the impression of being submerged.

An amateur fossil collector, Charles Wachsmuth, put this region on the world map of crinoid fossil study in the mid-19th century. His collections from Burlington are housed at Harvard University's Museum of Comparative Zoology and the Smithsonian Museum of Natural History.

With help from Iowa State University and Dr. Forest Gahn of Brigham Young University, a Burlington native and geologist, Iowa DOT obtained three-dimensional (3-D) scans of two of Wachsmuth's fossils: one each from Harvard and the Smithsonian. These scans were 3-D printed at 2.5-times scale and provided to the contractor to create molds for concrete replicas of the fossils. The replicas became part of

Figure 3. Rendered view of the U.S. Route 61 bridges over Flint Creek, north of Burlington, Iowa, as seen from the trail's approach. The oscillating wave pattern gives the impression of submersion as pedestrians and cyclists follow the trail below the structure. The monolith construction used textured formliners that were printed at 2.5-times scale from scans of actual fossils. Figure: Iowa Department of Transportation.



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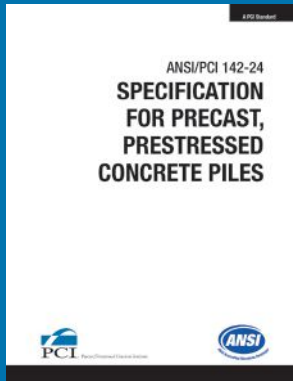
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abutment monuments at each end of the trail on the southbound bridge, where they act as "found objects" for keen observers and visually recall the interpretive outdoor displays at the nearby nature center.

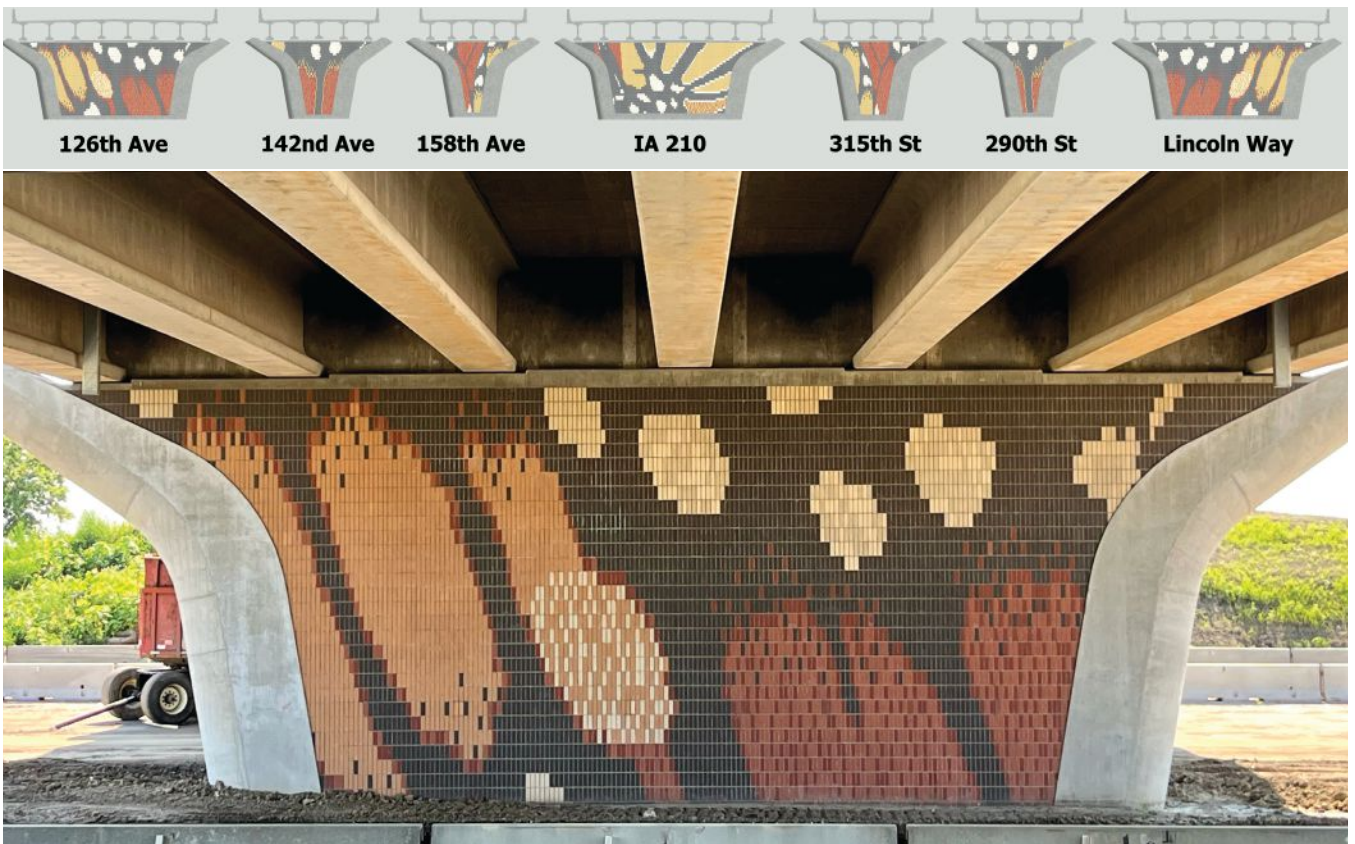
These new bridges celebrate the area's rich geological history and significance. The Wachsmuth fossil scans were provided at no cost to Iowa DOT and incorporating them into construction went smoothly. The simple features intrigue trail users, strongly connect the bridges to their context, and effectively bring back two of a world-renowned

collector's important specimens for permanent display near the place of their discovery.

Monarch Highway

The project to replace seven overhead bridges along a 16-mile stretch of Interstate 35 (I-35) between Ankeny and Ames, Iowa, used precast, prestressed concrete beams and cast-in-place concrete construction for a durable and aesthetic solution. The project planning was complicated because there were multiple stakeholders. Fortunately, the entire highway corridor had already been given a clear identity. I-35 travels through Minnesota, Iowa, Missouri, Kansas, Oklahoma, and Texas, and in 2016, these six states along with the Federal Highway Administration signed a Memorandum of Understanding pledging to collaborate on best practices in right-of-way and other land management in support of pollinators and to increase public awareness of pollinator's role in local ecosystems.¹ The I-35 route was named the Monarch

Figure 4. Seven precast, prestressed concrete beam replacement overhead bridges along a 16-mile stretch of Interstate 35, which is part of the Monarch Highway, presented an opportunity to celebrate the butterfly species. Each central supporting pier of the seven bridges contains a unique illustrative closeup view of the monarch butterfly's wing pattern constructed with thin brick veneer. Photo and Figure: Iowa Department of Transportation.



Highway to celebrate the iconic butterfly species and its annual two-way migration, a critical part of which occurs along and surrounding this route.

Designers of the seven precast, prestressed concrete beam structures sculpted a new pier shape for the corridor, both to make the bridges cohesive in their architecture and to reflect the monarch theme. A modified T-shaped pier with integrated winglike features and a reverse-curve bullnose section create a dramatic signature (**Fig. 4**). A shallow recess in the central portion of each pier has integral thin brick veneer for a splash of sustainable color.

The integral veneer brickwork on the new overhead bridges reinforces the theme. Each central supporting pier of the seven bridges will contain a unique illustrative closeup view of the monarch butterfly's wing pattern. The bricks portray individual wing scales. To create this effect, a design process of underlaying the brick grid pattern with a butterfly specimen photograph was used. The multiple brick colors portray the monarch's pigmentation in a sustainable way.

On a past project, the creation of pictorial images using thin bricks had been explored but was abandoned because the surface area was insufficient. The piers of these I-35

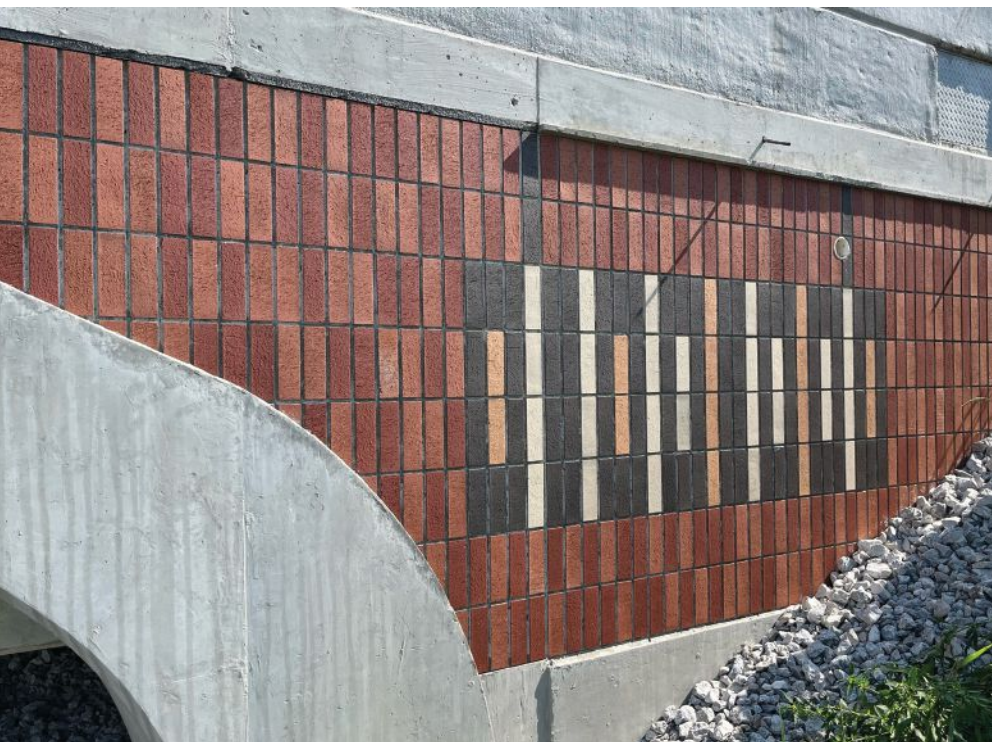
bridges presented a better opportunity to use the bricks as "pixels" to create images. Soldier coursing, where bricks are placed vertically with the narrow face exposed, was chosen for its versatility.

Bricks on the abutments illustrate a monarch caterpillar as well as binary code—black bricks are arranged to form a combination of ones and zeros that represent a single letter. The letters on the seven bridges together will spell out "Monarch Highway" on the west and east ends of the bridges for both northbound and southbound I-35 traffic using this "binary caterpillar" font (**Fig 5**).

Contractors have been meticulous in their application of the multicolor brick patterns during construction, devising a system of color-coding the brick gaskets on the forms before loading the bricks. This method makes the brick-insertion process efficient and relatively straightforward.

The current annual average daily traffic along this corridor exceeds 45,000

Figure 5. View of abutment with a binary code "caterpillar." The inlaid thin brick is in sharp contrast to the surrounding concrete structure. The binary code "01001000" in this photo represents capital letter "H." Photo: Iowa Department of Transportation.



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vehicles. At a vehicle occupancy rate of 1.65, roughly 74,000 people per day pass through this section of I-35. That number is expected to double in less than 20 years. To those passing motorists, the Monarch Highway bridges will act as a unique reminder of Iowa's commitment to support pollinators and the critical role those creatures play in agriculture.

Iowa Aspirations

Attaching culturally accessible meanings or ideas to a bridge can bring greater public connection and appreciation of all the benefits bridges provide. Alongside economics and longevity performance, visual quality in the built environment is an important consideration of the process that the Iowa DOT Bridges and Structures Bureau routinely uses to assess the impacts that its bridges have on the communities they serve.

Reference

1. Federal Highway Administration, Iowa Department of Transportation (DOT), Kansas DOT, Minnesota DOT, Missouri DOT, Oklahoma DOT, and Texas DOT. 2016. *Memorandum of Understanding, Agreement in Support of a Monarch Highway*. https://downloads.transportation.org/Monarch_Highway_MOU_052616.pdf. 