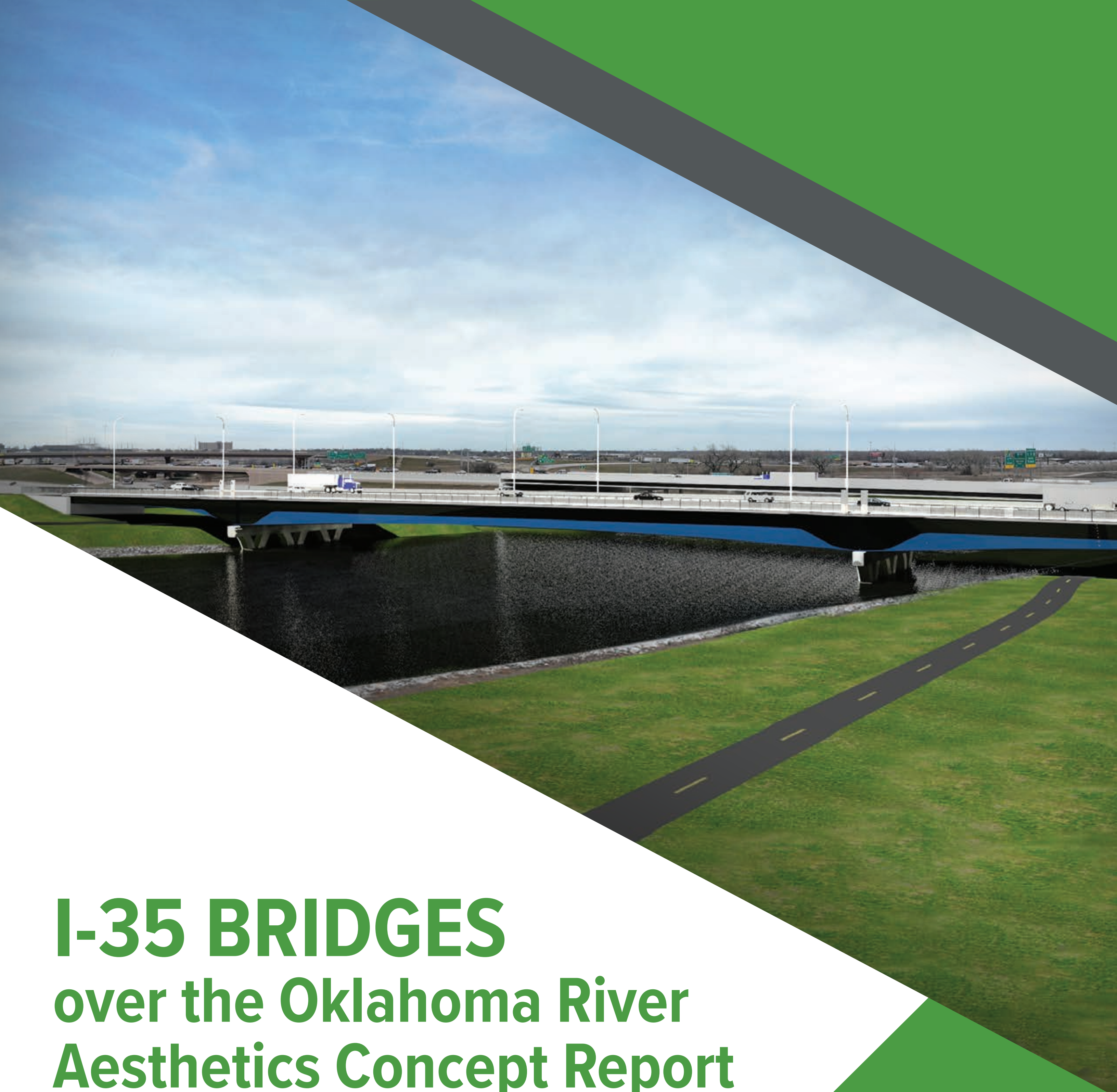


I-35 BRIDGES
over the Oklahoma River
Aesthetics Concept Report

Prepared for Poe & Associates

February 28, 2023

benesch

INTRODUCTION

The I-35 river bridge replacement project is a marquis project in Oklahoma City that will have tremendous community benefits. This project includes the construction of two new I-35 mainline bridges and a new I-35 NB ramp bridge, all spanning the Oklahoma River. These roadway bridge reconstructions are part of a larger corridor/interchange improvement that will help accommodate growing traffic demands by providing additional capacity and employing modern safety features. As part of the river bridge replacement project, a new multimodal path is proposed along the west side of the I-35 SB bridge. A path crossing the Oklahoma River at the I-35 location would complete a critical missing component of Oklahoma City's active transportation network and connect the north and south river trail systems. Due to the high cultural and commercial importance of this area, aesthetic enhancements are desired for the new river crossings and adjacent elements.

Benesch and Poe have completed a concept evaluation of a wide range of aesthetic enhancements that can be considered for implementation within the planned scope of work for this signature project. The objectives of this report are to:

- Identify aesthetic enhancement opportunities
- Present ideas and visuals
- Discuss potential cost premiums

Identify Aesthetic Enhancement Opportunities

The concept evaluation phase identified eleven project elements that can be targeted for aesthetic enhancement and are discussed within the following sections of this report (click to go to section):

1. Pier Type & Shape
2. Girder Shape
3. Path Bridge Structure Type
4. Pedestrian Overlooks
5. Barriers & Railings
6. Lighting
7. Monuments & Wayfinding
8. Concrete Surface Treatments
9. Steel Coatings
10. Maskwall
11. Path End Ramps

Present Ideas and Visuals

Aesthetic enhancement ideas are presented within this report as a combination of narrative descriptions and visuals. The visuals presented herein represent a combination of project-specific renderings that Benesch has developed and photos/renderings from other transportation projects that may be applicable to this project.

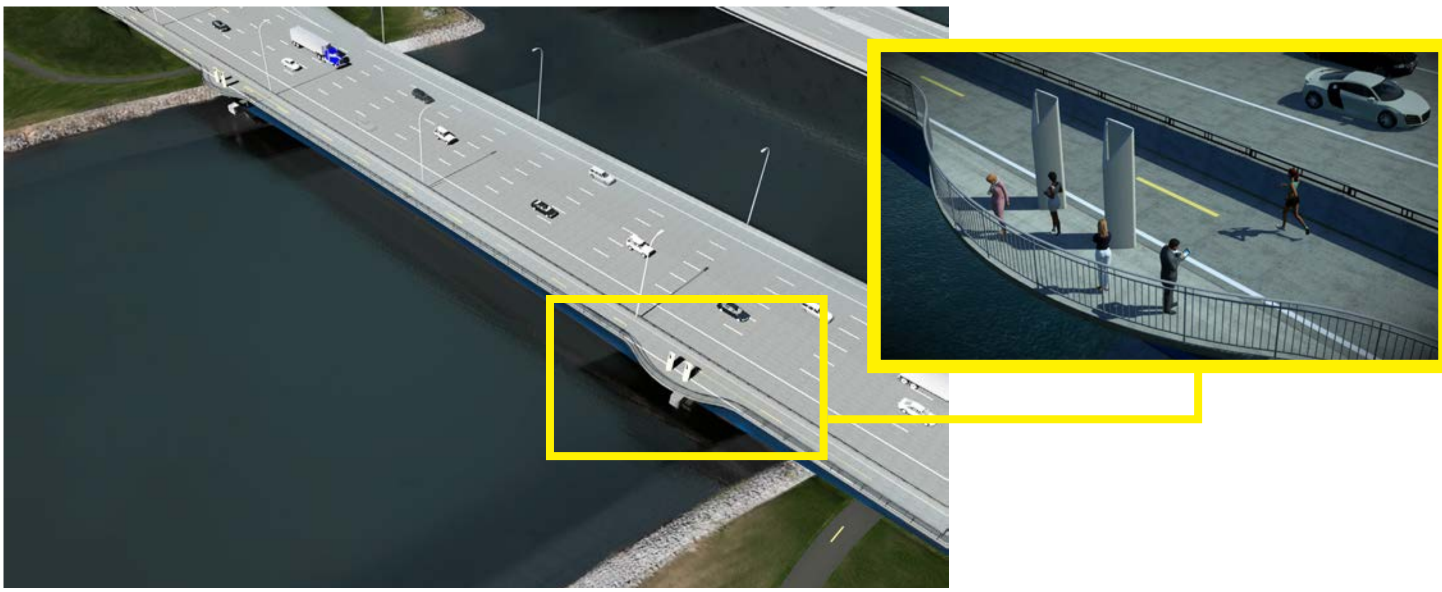
Cost Considerations

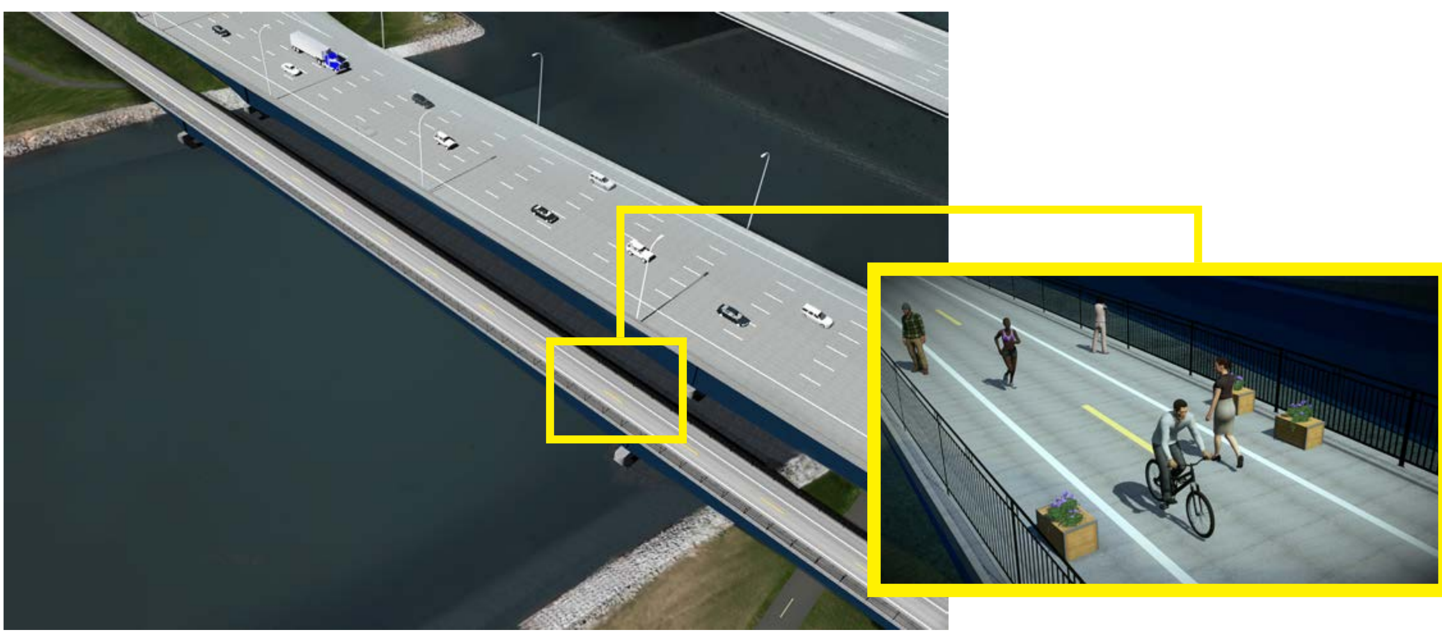
Within each section of this report, discussion has been included on the potential cost premiums associated with aesthetic enhancement of the targeted project elements. Potential cost premiums are presented with respect to the base scope of work required to complete this project. Note that some targeted elements are required as part of the base scope (i.e. piers and girders) and cost discussion is focused on the additional cost of enhancement; for other elements that are not required as part of the base scope (i.e. maskwalls) the cost would be a direct add to the project. It is important to note that the objective of this report is not to estimate a total project cost impact associated with implementation of a comprehensive aesthetic enhancement plan. It is anticipated that the project stakeholders will review the aesthetic opportunities and determine which opportunities are most desirable for this project. Actual cost magnitude will be determined as the final design is developed and the scale of aesthetic enhancement is agreed upon.

Project-Specific Renderings – Bridge Layouts

The proposed design concept for replacement of the I-35 NB and SB bridges over the Oklahoma River includes construction of long-span girder bridge structures that can allow the Oklahoma River to be classified as an Olympic level Class A rowing facility. In addition to replacement of the existing roadway bridges, a multi-use path crossing of the river along I-35 SB will be constructed. There are two design options for this multi-use path. The first options involves constructing a single widened SB structure that will accommodate both the I-35 SB traffic as well as the multi-use path. The multi-use path and I-35 SB traffic will be separated by a separation barrier. The second option involves constructing an independent path bridge west of the new I-35 SB bridge.

The below renderings have been created to provide a general understanding of the two primary design options as it relates to the proposed multi-use path. The subsequent sections of this report go into greater detail regarding aesthetic enhancement options and costs, with example photos provided to help visualize the aesthetic options.





AESTHETIC RENDERING MAP

1 PIER TYPE & SHAPE

2 GIRDER SHAPE

3 PATH BRIDGE STRUCTURE TYPE

4 PEDESTRIAN OVERLOOKS

5 BARRIERS & RAILINGS

6 LIGHTING

7 MONUMENTS & WAYFINDING

8 CONCRETE SURFACE TREATMENTS

9 STEEL COATINGS

10 MASKWALLS

11 PATH END RAMPS

Click on any of the featured subjects to go directly to its respective section.

PIER TYPE & SHAPE 1

The proposed I-35 Bridges include two river piers for each structure. The piers are positioned to provide an open channel that accommodates an Olympic level Class A rowing facility with seven to eight racing lanes. The piers will be most visible to users of both the river and trail system beneath the bridges. For enhanced aesthetic value, different pier types/shapes may be considered.

Three pier types that may fit the Oklahoma River crossing site constraints include:

- Continuous wall piers
- Multi-column piers
- Hammerhead piers

These three conventional pier types can be aesthetically enhanced by modifying the shape of the columns or wall stems, as well as introducing different concrete surface treatments (see Concrete Coatings & Formliners).

Continuous Wall Piers

Figures 1.1 and **1.2** illustrate continuous wall piers. In **Figure 1.1,** aesthetic enhancement comes in the form of a vertical ribbed texture along the face of the wall stem and a rounded/striated end face. In **Figure 1.2**, an asymmetric wall pier was constructed that includes one sloped end and a textured surface.

Figure 1.1: Surtees Bridge, Stockton-On-Tees, United Kingdom

Figure 1.2: Mohawk Valley Gateway Overlook Bridge, Amsterdam, Netherlands

Click here to return to the rendering map!

RENDERING MAP

Multi-Column Piers

Figures 1.3 and **1.4** illustrate multi-column piers. In **Figure 1.3**, a two-column rectangular system with striated columns is utilized, with unique geometry to accommodate a path bridge penetration through the pier. In **Figure 1.4**, wrapped double-Y style columns were combined with a tapered pier cap to create the illusion of piers rising out of the water. The pier style was repeated across both approaches to this signature Mississippi River bridge.

Hammerhead Piers

Figure 1.5 illustrates a hammerhead pier. For this bridge, the hammerhead pier style was enhanced through the introduction of curved/tapered edges and an in-fill stem pattern. A hammerhead pier type is not anticipated to be a practical solution for the main I-35 NB and SB structures, as this pier type best accommodates a narrower roadway. However, similar styles could be incorporated into a multi-column pier configuration.

COST CONSIDERATIONS

The cost premium associated with a customized pier type or shape is primarily associated with customization of formwork, increased concrete volumes to achieve the desired effect and increased complexity of rebar placement. For this project, it is anticipated that modifying a conventional continuous wall or multi-column pier type to have a more customized shape will increase the cost of each pier by $25,000 to $75,000 (more customization would result in higher cost premiums).

Note that the cost premium associated with formliners and/or surface treatments at piers is discussed elsewhere within this report.

Figure 1.3: Red Gate Road over the Fox River, St. Charles, IL

Figure 1.4: I-74 over the Mississippi River, Quad Cities, IL/IA

Figure 1.5: I-80/I-380 Interchange, Johnson County, IA

GIRDER SHAPE 2

The proposed I-35 Bridges include a steel girder superstructure, with girder depths that may exceed 10-feet to accommodate a main river span length exceeding 350-feet. The steel girders will be most visible to users of the river and trail system beneath the bridges. Different steel girder shapes can be considered that balance structural efficiency with aesthetic value.

I-shaped welded plate girders are currently proposed for the I-35 bridges. I-shaped plate girders are typically a uniform depth across the length of a bridge; however, a haunched girder shape is also commonly utilized for longer spans. A haunched girder has an increased girder depth at the piers with a shallower section at midspan. Not only does this create extra structural capacity where it is needed in the negative moment region over the piers, but the varying depth can create a more slender appearance. A haunched girder also will allow for an increased vertical clearance over the Oklahoma River at midspan. Haunched I-shaped plate girders are illustrated in **Figures 2.1** and **2.2**.

In addition to I-shaped plate girders, steel box girders may be a fit for the I-35 bridges. Steel box girders are generally more expensive than I-shaped plate girders, but they offer additional advantages such as reduced depth and increased torsional rigidity. Of note, steel box girders are a structurally efficient option for bridges with large variable overhangs such as those that may be considered on the path side of I-35 SB. **Figure 2.3** illustrates a haunched steel box girder interstate bridge.

COST CONSIDERATIONS

There is not anticipated to be a notable cost premium associated with haunched steel I-shaped plate girders versus uniform depth girders. The increased fabrication costs of a haunched girder are partially, to mostly offset by the material and girder erection savings realized by using a more efficient structural section.

For a steel box girder, it is expected there will be a 15% to 30% cost premium on the furnished and erected steel cost when compared to a steel I-shaped plate girder.

Figure 2.1: Hulton Bridge Over the Allegheny River, Allegheny County, PA

Figure 2.2: Rouchleau Mine Bridge, Eveleth, MN

Figure 2.3: Nene Bridge, Peterborough, United Kingdom

PATH BRIDGE STRUCTURE TYPE 3

A multi-use path will be constructed on the west side of I-35 SB, either on a shared structure with the roadway bridge or an offset independent path structure. If an independent path structure is pursued, there are several viable options for the superstructure configuration crossing the river.

It is anticipated that an independent path structure would require similar span configurations and lengths as the proposed I-35 roadway bridges, where a main span length exceeding 350-feet is required to accommodate the open channel rowing requirements. Each section below touches on path bridge types that can achieve the span configuration required. Bridge types are generally presented in order of increasing cost for this project.

Steel Plate/Box Girders

For an independent path bridge, a similar steel girder superstructure as that proposed for the I-35 roadway bridges could be implemented. Girders may either be uniform depth or haunched and either I or box shaped. More information on these options are included in the Girder Type section.

Steel Truss

Steel truss bridges use a combination of top/bottom chord, diagonal and vertical steel members to create long span path structures. Several vendors manufacture prefabricated truss bridges as an economical solution for path structures; however, given the length of spans required to cross the river, a custom-designed steel truss bridge would be anticipated for this project. Features of truss structures that impact the aesthetics include: aspect ratio of the panels and overall structure; bracing patterns; truss location (i.e. above or below deck). See Figure 3.1. Note that the bridge in Figure 3.1 utilizes a combined arch and truss type superstructure.

Figure 3.1: Menomonee Valley Bike Path Bridge, Milwaukee, WI

Figure 3.2: RiverEdge Bridge, Aurora, IL

Figure 3.3: Milwaukee 606 Trail Bridge, Chicago, IL

Segmental Concrete

Segmental concrete construction splices together short precast concrete sections that are post-tensioned in place. Uniform depth or haunched bridge profiles can be achieved, as can curved or S-shaped alignments. See **Figure 3.2**.

Tied/True Arch

Tied/true arches use a curved steel rib to suspend a bridge deck with hangers. Arch spans are most often utilized for span lengths exceeding 300-feet; that said, arch spans for shorter lengths are also viable. Arches offer a high degree of aesthetic enhancement to a project, with several variations possible. This includes: skewed overall bridge geometry (**Figure 3.3**); skewed arch ribs to create basket-handle style (**Figure 3.4**), a single arch rib (**Figure 3.5**), various aspect ratios and construction with/without bracing. Arch structure types do not readily accommodate curved or S-shaped alignments.

Cable-Stayed

A cable-stayed bridge supports the bridge deck from cables connected directly to tall towers. These tall towers can be in a multitude of shapes, including but not limited to: A-type, H-type, inverted Y, single pylon, diamond shape. Cable-stayed bridges can be symmetrical (tower at each end) or asymmetrical (single tower at one end) and can support a range of curved or S-shaped path alignments. See **Figure 3.6**.

Figure 3.4: Broadway Bridge over Arkansas River, Little Rock, AR

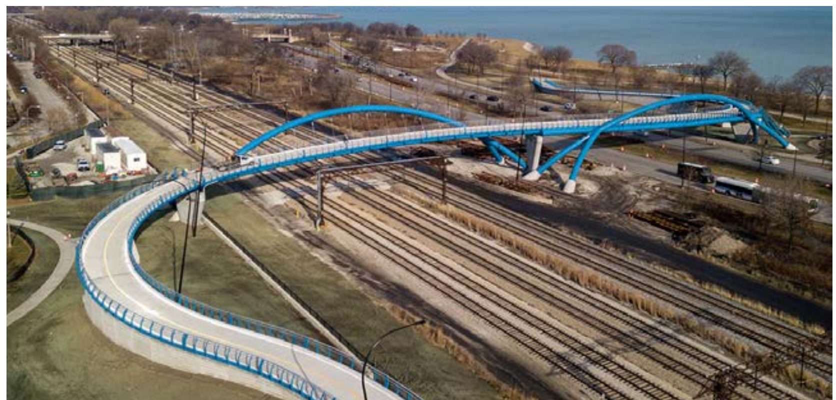


Figure 3.5: 41st Street Bridge, Chicago, IL

Figure 3.6: Dublin Link Bridge, Dublin, OH

Figure 3.7: Peace Bridge, Alberta, Canada

Hybrid/Abstract Structures

Unconventional hybrid structure types may also be considered for an independent path bridge, such as tube bridges. These hybrid structure types require extensive customization and are typically led through development by a bridge architect. See **Figure 3.7**.

COST CONSIDERATIONS

Constructing an independent path structure – in-kind but offset from the roadway structure - is anticipated to carry a $2M-$4M cost premium when compared to a shared structure. This cost premium is primarily associated with independent operations that would be required to construct this bridge and the likelihood that an independent bridge would have a wider path width than a shared use bridge. This increase in path width would result in more economical aspect ratios and provide for a continual "viewing space" of the river and facilities below.

If a more signature path structure type is desired – such as a steel truss or arch – the anticipated cost premium would increase into the $8M-$12M range (relative to the base cost of a combined structure). Given the span configuration and site parameters, neither a cable-stayed or hybrid/abstract structure type are considered practical for this project. Both options would involve a cost premium that is significantly larger than that of the steel girder, steel truss or arch bridge types.

PEDESTRIAN OVERLOOKS 4

A multi-use path will be constructed on the west side of I-35 SB, either on a shared structure with the roadway bridge or an offset independent path structure. In either alternate, pedestrian overlooks may be added to the outside of the structure to provide a safe area for path users to stop and experience the river and its surroundings.

Figure 4.1: Red Gate Road over the Fox River, St. Charles, IL

Figure 4.2: I-74 over the Mississppi River, Quad Cities, IL/IA

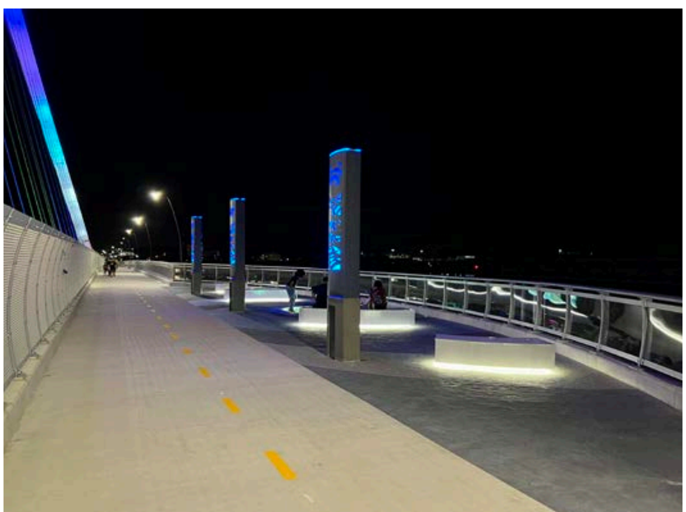


Figure 4.3: I-74 over the Mississppi River, Quad Cities, IL/IA

Figure 4.4: I-74 over the Mississppi River, Quad Cities, IL/IA

Pedestrian overlooks may be used for pedestrians and bikers to congregate as well as to place monuments, planters, bike racks, or any other elements that may enhance the multi-use path user experience. Pedestrian overlooks are typically constructed with a cantilevered extension of the deck beyond the typical edge of deck. Detailed framing is required in order to support the overhangs and any ancillary loads that would also be placed in this area. **Figure 4.1** shows a small and simple overlook with no additional features. **Figures 4.2 through 4.6** show several larger overlooks that include extra lighting, monuments, seating, and a circular glass oculus that would allow individuals to look down at the river below. Overlooks may be placed anywhere along the structure; however, common locations are at the piers or at midspan. See **Project Specific Renderings** section (**page 2**) for a rendering of a pedestrian overlook concept for the combined path/I-35 SB bridge. The pedestrian overlook concept shown is an approximately 10' wide extension of the bridge deck and is approximately 60' in length.

COST CONSIDERATIONS

The cost premium associated with the construction of pedestrian overlooks along the multi-use path on the shared structure is dependent on the geometry and complexity of the overlook. For an overlook of similar size and usage to that shown within the Project Specific Renderings section, the cost premium is anticipated to be $300,000 to $500,000, per overlook.

Figure 4.5: Mohawk Valley Gateway Overlook Bridge, Amsterdam, Netherlands

Figure 4.6: Dawn Bridge, Shanghai, China

BARRIERS & RAILINGS 5

The proposed I-35 Bridges project will include several barrier and railing types. The exterior barriers and railings will be most visible to users of the river and trail system beneath the bridges, while the interior barriers will be most visible to I-35 SB and NB traffic as well as users of the multi-use path.

Figure 5.1: I-90 Over Arlington Heights Bridge, Village of Elk Grove, IL

Figure 5.2: SE Park Bridge, Franklin, TN

Figure 5.3: Farnsworth Ave over Indian Creek, Aurora, IL

Figure 5.4: I-74 over the Mississppi River, Quad Cities, IL/IA

Roadway Barriers

The roadway barriers must provide interstate level crash-worthiness and are therefore limited in terms of unique parapet options. An F-shape barrier is a conventional bridge parapet given in the Oklahoma State design standards and would be a suitable option for this project. As shown in **Figure 5.1**, formliners or concrete coatings may be placed on the exterior face of the parapets to enhance the aesthetics.

Roadway/Path Separation Barriers

If the proposed multi-use path is integrated onto the west side of the I-35 SB structure, a separation barrier will be required between the roadway and path. This separation barrier will need to provide interstate level crash-worthiness while also being of sufficient height to accommodate bike traffic on the path (typically 4'-6"). The separation barrier may include metal railings mounted on top of the concrete barrier, and also include formliners or concrete coatings on the vertical faces of the barrier. See **Figures 5.2 through 5.4** for examples of separation barriers used on several projects throughout the country.

Pedestrian Railings

Pedestrian railings offer the most opportunity for customization due to the reduced loading requirements. Pedestrian railings typically include vertical posts, a top handrail and an infill system. The posts and handrails are most commonly steel elements that may be painted or coated to any color or texture desired. Infill systems may include wire mesh, cables, thin posts, glass panels, etc. Geometry of pedestrian railing elements can vary significantly, provided that minimum height requirements and maximum opening sizes are met. See **Figures 5.4 through 5.6** for examples of pedestrian railings used on bridge projects. As shown in **Figure 5.6**, the railing configuration may also change at key points along the structure, such as pedestrian overlooks.

COST CONSIDERATIONS

Aesthetic enhancement opportunities are more limited for the roadway and path separation barriers, thus cost premiums for these elements are not anticipated to be significant. Where cost can vary more dramatically is with the pedestrian railings. Depending on the material, finish and complexity of the pedestrian railing, the cost of the railing may be double or triple that of a basic galvanized pedestrian railing option (up to $750 per linear foot variation). One example of a high premium railing type would be an all-stainless steel railing system with unique geometry.

Figure 5.5: Lakefront Trail Bridge, Chicago, IL

Figure 5.6: I-74 over the Mississppi River, Quad Cities, IL/IA

LIGHTING 6

The proposed I-35 Bridge project includes several opportunities for aesthetic lighting. Aesthetic lighting can be experienced by users of the river/trail system underneath the bridge, roadway/path users on the bridge, as well as onlookers and stakeholders within the general project area. A targeted aesthetic lighting plan can create a customized experience and draw users to the area.

Figure 6.1: Chicago Riverwalk, Chicago, IL

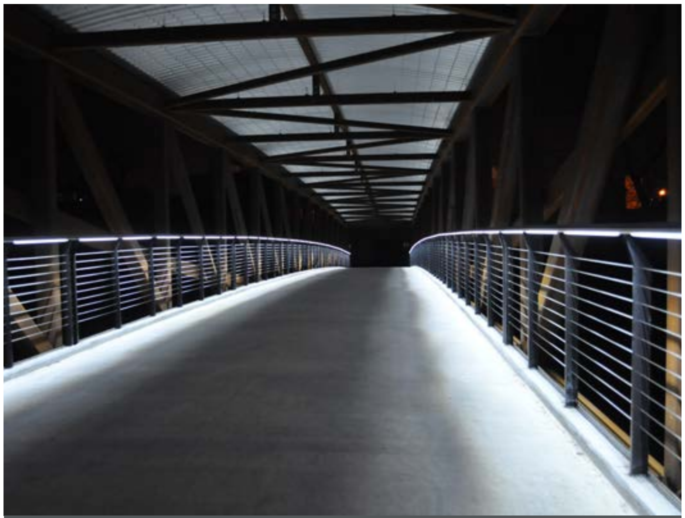


Figure 6.2: Menomonee Valley Bike Path Bridge, Milwaukee, WI

Figure 6.3: Murray Baker Bridge, Peoria, IL

Figure 6.4: I-74 over the Mississppi River, Quad Cities, IL/IA

Aesthetic lighting opportunities within the I-35 Bridges project include lighting of the following elements:

- Pedestrian Railings - **Figures 6.1** and **6.2**
- Substructure Elements (Piers and Abutments) - **Figures 6.3** and **6.4**
- Fascia Girders – **Figures 6.5** and **6.6**
- Roadway/Path Light Poles – **Figure 6.7**

Aesthetic lighting offers unique opportunities for stakeholder engagement and customization. Customization can come in the form of:

- Allowing public input to choose aesthetic lighting locations and schemes. One example of this is the nearby Skydance Bridge, with different light schemes available for use on any particular day.
- Programming interactive color patterns and combinations, such as red/green during the holidays, red/blue at 4th of July, river race day lighting, etc. (**Figure 6.8, following page**)
- Custom-designed light poles.

COST CONSIDERATIONS

The anticipated cost premiums associated with different aesthetic lighting elements are as follows:

- Integrated handrail lighting – Up to $250 per linear foot of railing
- Girder flood lights – Up to $600 per linear foot of fascia girder
- Custom roadway/path light poles – Up to $5,000 per light pole
- Substructure lighting – $10,000 to $20,000 per substructure unit
- Advanced light system controller and programming such that light colors may be varied and synchronized – Up to $500,000
- Multi-color LED lights, in lieu of all white lighting – 10% overall lighting premium

Figure 6.5: I35 W. Bridge, Minneapolis, MN

Figure 6.6: RiverEdge Bridge, Aurora, IL

Figure 6.7: I-74 over the Mississppi River, Quad Cities, IL/IA

Figure 6.8: I-74 over the Mississppi River, Quad Cities, IL/IA

Illustrated to the left is a color-changing scheme implemented on the recently constructed I-74 over the Mississippi River Bridge between Iowa and Illinois. A heavy stakeholder engagement plan was implemented to obtain feedback on lighting schemes. Lights can be programmed to provide thousands of different combinations.

MONUMENTS & WAYFINDING

7

Monuments and/or wayfinding elements may be added throughout the project limits to to enhance the user experience and connect the newly built structures to the community. These elements can be particularly impactful along the proposed multi-user path, where users can engage directly with these structures.

Figure 7.1: I-74 over the Mississppi River, Quad Cities, IL/IA

Figure 7.2: New York Street Bridge, Aurora, IL

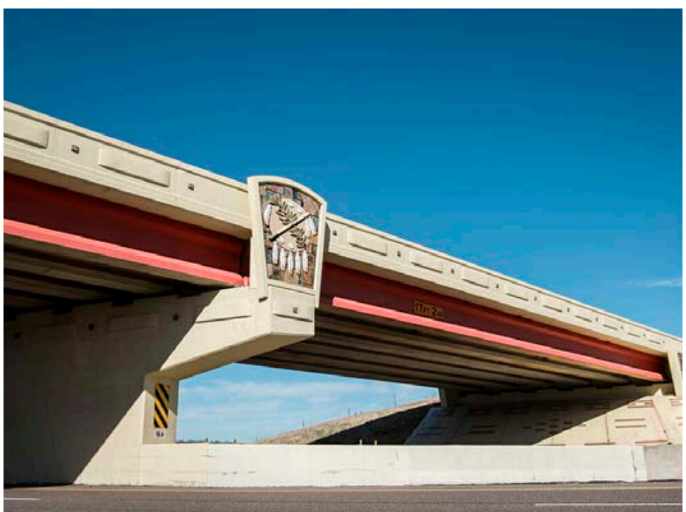


Figure 7.3: Heritage Bridge, Oklahoma City, OK

Figure 7.4: North Washington Street Bridge, Boston, MA

There are several types of monuments and wayfinding elements that may be added to the structure. Monuments such as the ones shown in **Figures 7.1** and **7.2** may be statues or sculptures placed directly onto the bridge surface. Monuments may also be built up onto the end sections of pier caps, as shown in **Figure 7.3** (Heritage Bridge in Oklahoma City). Unique elements such as the trellis system shown in **Figure 7.4** may also be added to the structure as a delineator between the traffic lanes and the multi-use path. Wayfinding signage such as the ones shown in **Figures 7.5** and **7.6** may also be added in several locations such as the exterior parapets, along the multi-use path, at the railings, etc.

COST CONSIDERATIONS

The cost associated with monuments and wayfinding elements on or adjacent to a structure is highly dependent on the size, shape, material, and complexity of each element. For a project of this magnitude, the cost of these elements – assuming more conventional materials are used – is anticipated to be approximately $5,000 to $10,000 per element furnished and installed.

Figure 7.5: I-74 over the Mississppi River, Quad Cities, IL/IA

Figure 7.6: Gulf State Park Bridge, Gulf State Park, AL

CONCRETE SURFACE TREATMENTS

8

The proposed I-35 Bridge project includes several concrete elements, including bridge substructures, retaining walls and concrete barriers. For concrete surfaces exposed to view, different concrete formliners and coatings can be incorporated.

Figure 8.1: SH-9 Bridge, Norman, OK

Figure 8.2: Main Street and I-35 Bridge, Norman, OK

Figure 8.3: Red Gate Road over the Fox River, St. Charles, IL

Figure 8.4: Epcot Center Drive, Orlando, FL

Concrete Formliners

Formliners allow for artwork, logos, symbols, and textures and patterns of almost any kind to be imprinted onto a concrete surface. **Figures 8.1** and **8.2** depict local bridge projects where formliners were utilized to highlight key aspects of Oklahoma's culture and identity. **Figures 8.3 through 8.5** show additional formliner patterns that have been used throughout the country. Many formliner fabricators have premade formliners in stock and ready for re-use to be more cost efficient; however, custom formliners may also be created.

Concrete Coatings

Coatings may be used to color stain a concrete surface and also to seal the concrete from water/salt infiltration. **Figure 8.6** shows an example where concrete coatings were used to vary the color of the concrete pier.

COST CONSIDERATIONS

The cost premium for concrete formliners is expected to be between $10 and $20 per square foot of formlined surface. The premium varies depending on the complexity of the formliner and whether the formliner is custom made or pre-stocked and how many uses can be achieved with each formliner. The cost premium for staining concrete is expected to be between $5 and $10 per square foot of applied stain/sealer.

Figure 8.5: Glenn Highway and Muldoon Road, Ancorage, AK

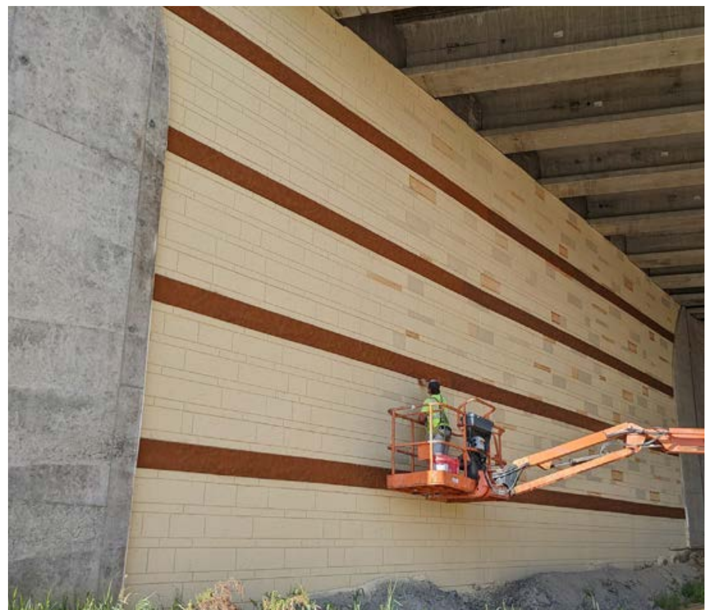


Figure 8.6: I-80/I-380 Interchange, Johnson County, IA

STEEL COATINGS 9

The proposed I-35 Bridge project includes several steel elements, including steel girders, railings and sign structures. Steel coatings may be used to provide corrosion protection while simultaneously creating different aesthetic options.

Stainless Steel

Stainless steel may be used for pedestrian railings along the proposed path. Stainless steel is strong, durable, and resistant to corrosion. Stainless steel has a shiny, reflective color. See **Figure 9.1**.

Paint Coatings

Different paint coatings may be used on all steel elements in the project. Paint systems provide varying degrees of corrosion protection, depending on the product. Paint coatings can be modified to any desired color. Examples of paint coatings can be seen in **Figures 9.2** and **9.5**.

Weathering Steel

Weathering steel is an option for the bridge girders. Weathering steel provides an inherent outer coating of corrosion on the surface. Once the outer surface has rusted, the steel beneath the surface is protected from further corrosion. Weathering steel results in a brown/orange rust color, as seen in **Figures 9.3** and **9.4**.

Figure 9.1: Throop Street Bridge, Chicago, IL

Figure 9.2: Throop Street Bridge, Chicago, IL

Figure 9.3: Addison Pedestrian Bridge, Chicago, IL

Metallization

Metalizing steel is an option for all steel elements in the project. Metalizing steel involves spraying on a coat of metal to a steel surface. This metal coat offers protection against corrosion and may be painted over. See **Figure 9.6**.

Galvanization

Galvanized steel may be used on railings and signs within the project. Galvanizing involves applying a coating of zinc to the surface of a steel element. This coating of zinc offers the base steel protection against corrosion and is generally considered extremely durable. Galvanization is typically done by dipping steel elements into a hot zinc bath (hot dip galvanizing). Galvanizing results in a silver/chrome color, as shown in **Figure 9.6**. The size of the zinc bath limits what steel may be galvanized. Galvanizing would not be feasible for the primary steel girder segments.

COST CONSIDERATIONS

Cost premiums associated with different steel coatings and finishes are highly dependent on market trends and conditions at the time of material procurement. In general for steel superstructure coatings, weathering steel and paint coatings are expected to have similar costs. Metalizing the girders prior to painting is expected to carry between a 20% and 30% coating cost premium. Galvanized coatings and stainless steel are not practical and/or feasible for the steel superstructures on this project, given segment lengths. Galvanized coatings and stainless steel finishes would be most applicable to smaller/lighter elements, such as pedestrian railings. However, it is noteworthy that the initial increase in cost of some of the coating options may be partially offset by reduced long-term maintenance costs.

Note that the cost premium associated with higher end steel coatings and finishes for pedestrian railings is discussed elsewhere within this report.

Figure 9.4: I-91 Interchange 29 Exit Ramp Flyover Bridge, Hartford, CT

Figure 9.5: Hulton Bridge Over the Allegheny River, Allegheny County, PA

Figure 9.6: Steel Truss Bridge - Galvanized

MASKWALLS 10

The proposed I-35 Bridges include abutments at both ends of each bridge. One option to hide the girder ends/bearings at the outside of the abutment is to construct a maskwall. Maskwalls would be visible to users of the river and trail system beneath the bridges.

Maskwalls are short cast-in-place or precast concrete walls placed at the end of an abutment. These wall segments can either be standalone or connect into an approach retaining wall system. For enhanced aesthetic value, concrete coatings or formliners can be placed on the outside face of the wall. See **Figures 10.1 through 10.3** for different maskwall concepts.

COST CONSIDERATIONS

Maskwalls are relatively low cost items. The cost premium associated with maskwall construction at the ends of a stub type abutment is expected to be approximately $20,000 per location.

Figure 10.1: Elk Street Diverging Diamond Interchange, Elk City, OK

Figure 10.2: I-74 over the Mississppi River, Quad Cities, IL/IA

Figure 10.3: I-5/French Camp Road Bridge, Sockton, CA

PATH END RAMPS 11

A multi-use path will be constructed on the west side of I-35 SB, either on a shared structure with the roadway bridge or an offset independent path structure. In either alternate, ramps at the ends of the river bridge must be constructed to create a connection between the elevated path crossing the river and the river level path network. These end ramps will be visible by the users of the river, the trail system beneath the bridges, and the roadway. Path ramps offer opportunities for aesthetic enhancement through unique alignments, types and adornments.

There are two options for making the ramp connections at the ends of the multi-use path river crossing: at-grade ramps or structural ramps.

At-Grade Ramps

An at-grade ramp would be a path built on an embankment or retained soil. This is generally the most economical ramp system, provided sufficient land is available for the earthwork needed to support the ramp run lengths to create the elevation change. Some aesthetic enhancement options include targeted landscaping and/or formliners when walls are required. **Figure 11.1** illustrates an at-grade ramp system.

Structural Ramps

A structural ramp would be a continuation of the main river structure; however, the ramp structure type would not need to be a direct match to the river bridge. Alternate materials could be utilized, such as concrete or timber. Structural ramps allow for more unique loop ramp alignments, require a smaller footprint than an at-grade ramp and allow for the space beneath the ramp to remain available for use. Structural ramps are generally more expensive than at-grade ramps given the cost of bridge materials and construction will exceed at-grade earthwork placement. Examples of structural ramps can be seen in **Figures 11.2** and **11.3**.

Elevator/Letdown Structures

Note that a third option for connecting path users from river bridge level to river trail level is an elevator/letdown structure. Letdown structures are typically very expensive and only utilized when space is not available for a ramp system. This constraint is not expected to exist for the I-35 Bridges, thus letdown structures have not been explored in this report.

COST CONSIDERATIONS

If there are no ROW constraints, the most cost-effective path end ramp option would be an at-grade ramp. Relative to an at grade ramp, the cost premium for a structural ramp option is expected to be $500K to $1M per bridge end, depending on overall ramp length and desired configurations.

Figure 11.1: 606 Trail, Chicago, IL

Figure 11.2: Menomonee Valley Bike Path Bridge, Milwaukee, WI

Figure 11.3: Chicago Riverwalk, Chicago, IL

PHOTO REFERENCES

All photographs, images, and renderings shown in this report have been taken, developed, or created by Benesch with the exception of the following:

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Figure 1.2: https://dailygazette.com/2016/08/17/some-skeptical-pedestrain-bridge-will-revitalize-c/
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