



Lt. Cmdr. John C. Waldron Memorial Bridge

PIERRE & FORT PIERRE, SD
SDDOT STAN03WN US 14

**Design Principles & Guidelines
Recommendations Report**

November 2017



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PART A: Analysis

SECTION 1: INTRODUCTION

The existing the John C. Waldron Memorial Bridge carries US Highways 14 and 83, as well as SD Highway 34 over the Missouri River between Fort Pierre, Pierre, SD. The existing structure is a 10-span, 4-lane structure. It was opened in 1962 and has a total length of 1,659 feet. The two main navigational spans are each 235'-0" long, with approach spans ranging from 109'-0" to 175'-6". It is a non-redundant haunched steel plate girder bridge that the Office of Bridge Design has determined is in need of replacement, due to the bridge nearing the end of its useful service life.

Project Development Process

A replacement bridge has been identified in the South Dakota Department of Transportation's (SDDOT's) long-range development plan, with the preliminary replacement study completed in conjunction with the Environmental Assessment document for the project in 2016. The final design began in 2017 and construction of the bridge is planned to begin in 2021.

Associated with the replacement bridge project is a full series of potential aesthetic enhancement treatments that respond directly to the context in which it's situated, as well as designing a structure that addresses important issues such as access to downtowns, neighborhoods, businesses, parks, trails, and the waterfront. Maintaining and reinforcing the physical and social connections between Pierre and Fort Pierre is as crucial a component for this project as improving the regional transportation and mobility functions of this major structure.

Through a collaborative stakeholder outreach program that included representatives from the SDDOT, the cities, various agencies, community leaders, business, and property owners as well as the Federal Highway Administration (FHWA), a comprehensive palette of aesthetic treatments for bridge elements was thoroughly vetted.

Key Issues

The following report is a summary of the potential for bridge aesthetics and other off-bridge enhancements that could be included into the Final Design of the John C. Waldron Memorial Bridge as requested the Cities of Pierre and Fort Pierre. The treatments shown are still meant to show intent and to be conceptual in nature in that aspects of what is presented may be revised during the final design process.

Included too in this report is information regarding anticipated additional costs associated with the various treatments so that the SDDOT and the cities of Pierre and Fort Pierre can assign capital cost and ongoing maintenance responsibilities for the various elements included in the final solution. It is the hope of all Stakeholders that the resulting structure comports with both the Community's vision for a fitting infrastructure asset that everyone can point to with civic pride, as well as with the SDDOT's expectation for an efficient and serviceable structure that will last well through the 21st century.



EXISTING WALDRON BRIDGE APPROACH FROM THE FORT PIERRE SIDE



EXISTING WALDRON BRIDGE LOOKING WEST FROM PIERRE SHORELINE



VIEW OF EXISTING WALDRON BRIDGE FROM FORT PIERRE BLUFF



VIEW FROM EXISTING WALDRON BRIDGE LOOKING WEST TOWARD FORT PIERRE

SECTION 2: VISUAL CONTEXT

Next to buildings, bridges are typically the largest objects that are constructed by communities. It is therefore imperative that, if planned and constructed properly, they recognize and suit their context such that they become a unique visual and functional community asset for generations.

Key Issues

The existing Waldron Memorial Bridge across the Missouri River has been a community icon for generations. Residents and visitors to the twin cities of Pierre and Fort Pierre use it, often several times a day, to cross the river, they use it as reference for directions, it's used for orientation purposes and, on occasion, use it as a place to engage directly with the river for special events and celebrations. The bridge is as visually iconic within the cultural landscape as the state capitol dome in Pierre or the grain elevators and stockyards of Fort Pierre.

Spatially, the bridge sits within the river area between the bluffs seen in both Pierre and Fort Pierre. It, and the railroad bridge found just upstream of the US 14 bridge, are the largest structures in the area to cross the river except for the Oahe Dam located upstream of this location. The bridge's physical and visual presence is unavoidable and therefore requires that the design of the replacement structure be thoughtful and respectful of this context.

Architectural Context

The South Dakota state capital building, finished in 1910, is probably the most noteworthy building displaying architectural significance within the city of Pierre or the capital region. It, and the Soldiers & Sailors World War Memorial building located directly across the street, were developed in the Greek neoclassical architectural style typical of government and the City Beautiful movement in vogue at the turn of the last century. Because the capital complex is modest and not in close proximity to the project site, this style exerts a diminished influence on the style of the new bridge. That said, the city as a whole exhibits a simple but eclectic mix of early to mid-20th century residential, institutional, and commercial vernacular styles germane to the region. Fort Pierre has a slightly more traditional western United States-style of building types that suits its agricultural and livestock basis.

All this was considered through the Stakeholder vetting process and it was thus determined that a simple, neo-Federalist style of architecture would be most suitable for the various elements of the new bridge. It affords a wide latitude of detail that can be easily executed in a plastic material such as cast-in-place and precast concrete.

Examples of the existing visual context may be seen on the following page.

Viewer Groups and Viewpoints

Who can see the bridge and from what vantage point has a direct effect on what architectural elements the bridge features. The three primary viewer groups that view the bridge are: 1) viewers from either shoreline, street, or bluff; 2) viewers in vehicles on the bridge or its approaches and; 3) viewers in boats on the river. While the viewers from the cities or the bluffs see the bridge in gross terms as a blended component of the overall landscape, views along the shore line or from the river have a much more intimate view and the detailing must respond accordingly. Each of these groups has a different and very specific perspective of the bridge that the detailing of the structure must adequately address.



VIEW LOOKING EAST TOWARD PIERRE



SHORE LINE PATH UNDER EXISTING BRIDGE ON FORT PIERRE SIDE WITH LOW CLEARANCE



VIEW OF EXISTING WALDRON BRIDGE FROM FORT PIERRE SHORELINE



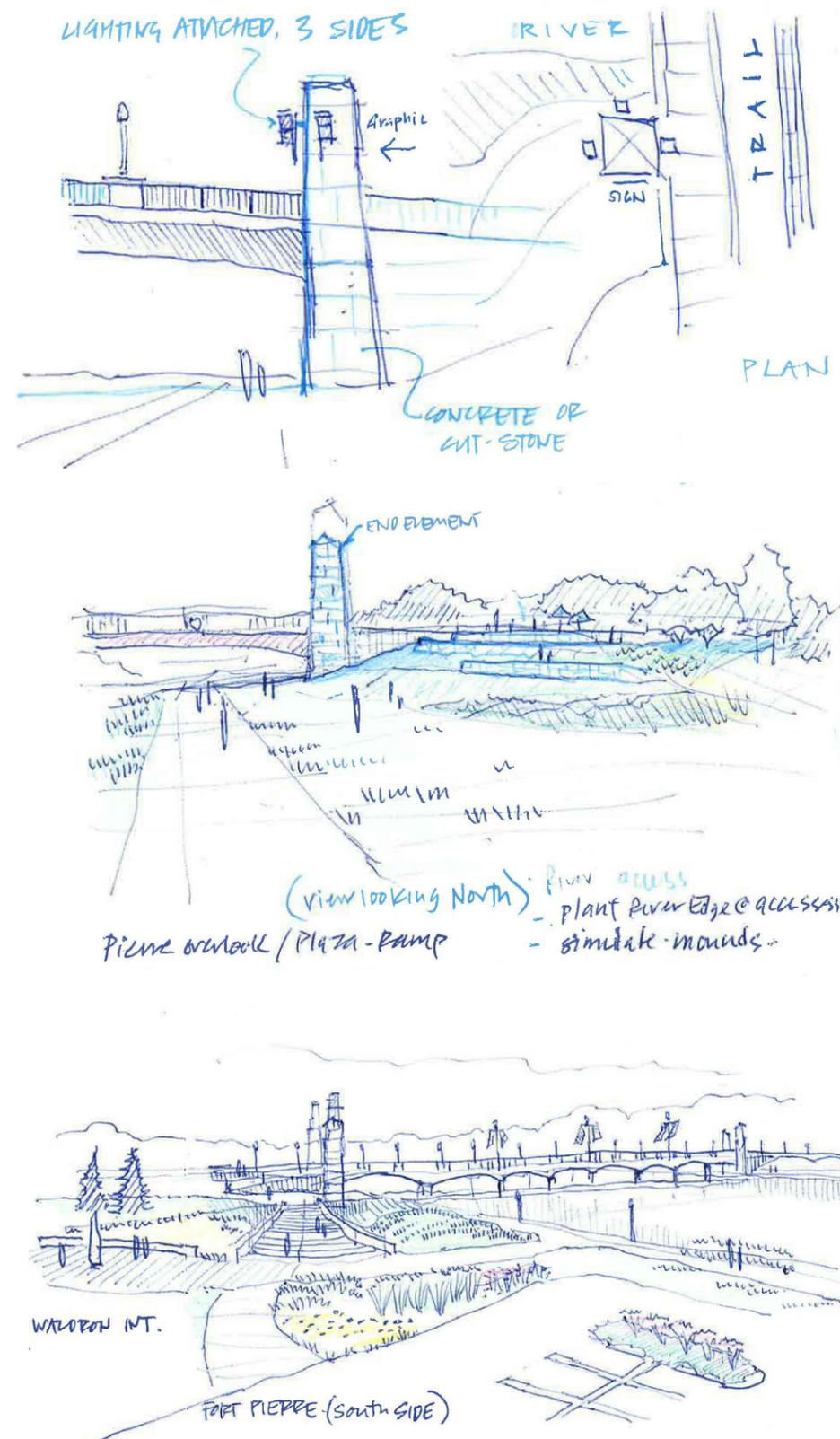
SOUTH DAKOTA STATE CAPITAL BUILDING



VIEW UNDER EXISTING BRIDGE ALONG PIERRE SHORELINE



RECREATIONAL BOATERS HAVE FULL VIEW OF THE BRIDGE FROM THE RIVER



EARLY CONCEPT SKETCHES

SECTION 3: DESIGN CONCEPTS

At the end of the initial conceptual design process that was conducted by URS/AECOM, the Stakeholders had formulated an Initially Preferred Design (IPD) for the treatment of the new structure that was reached by consensus of the participants. A meeting conducted on June 16, 2016 presented the summary of the concepts and ideas for the new bridge and its immediate environs to the project stakeholders. It established an overall theme and location for the bridge, its pier spacing, pier and pier cap type and shape, girder type and shape, belvedere objectives, railings, parapets, and the on-shore end of bridge plaza directions.

Key Issues

From the initial concept, further study was necessary to further explore element, style, and material options so that a holistic and integrated bridge and off-bridge schematic could ultimately be advanced to the Final Design phase. It was very important to take the Initially Preferred Design as a thematic point-of-beginning to further refine all the various components of the structure. This way, all the work done to date would be retained and incorporated into advancing the project through the Design Development phase of the process.

It should be noted that there will be an agreement regarding the initial capital and ongoing maintenance cost responsibilities between the state and the cities. Regarding any potential aesthetic enhancements considered beyond what the state would typically include in any new bridge project, it has been agreed to in principle that:

- » The SDDOT is willing to accommodate additional aesthetic enhancements as long as they don't interfere with the traveling public and safety. SDDOT funding participation will be limited to the cost for typical bridge SDDOT improvements.
- » Where there is an alternative between a SDDOT standard or typical version and a decorative / more aesthetic version, the SDDOT will fund up to the cost of the SDDOT norm.
- » The SDDOT will only contract with the Cities for additional aesthetic enhancements.

The Process

Using the IPD as a basis, the designers next considered various component and material options for the cities' consideration. Two belvedere location options were presented. Two roadway lighting options were also developed as well as four options that utilized various configurations of concrete and masonry veneer were developed and presented to the cities for discussion. Included as well was the idea of including end-of-bridge pylons demarcating the extent of the structure. The goal of the design iteration process was to vet various options with the cities so that they had a full range of design options to consider and choose from.

Initial Concepts

Architectural Treatment Styles

Four groups of style option themes for the treatment of the various bridge components were developed and presented to the stakeholders; two concrete styles and two masonry veneer styles. The two concrete options use rubbed finish concrete and offsets, rustications, and formwork to develop the dimension, shade, and shadow features that give the elements depth and interest. One group utilizes a traditional "shadow box"-like inset panel effect in the pilaster and barrier surfaces while the second concrete option shows a set of three fluted vertical rustications in the pilaster surface and as series of sets in the barrier face using a rhythm of spacing.

The two masonry options utilized two different stone veneer types; one using sandstone of a regional origin in a dimensioned stone pattern, the second being granite fieldstone in a more random ashlar pattern. All four treatments would have a cap.



END PYLONS DEFINE THE CORNERS OF THE STRUCTURES



LARGE SCALE END PYLONS FUNCTION AS GATEWAY ELEMENTS

End of Bridge Pylons

Both the existing and proposed bridges are a major crossing of the Missouri River that function as a prime gateway into the South Dakota state capital of Pierre. US 14/US 83/SD 34 is also a component of the Lewis and Clark Historic Trail. Major river crossings are of great and iconic civic importance and should be celebrated. Because the existing and new bridges are officially designated the "Lt. Cmdr. John C. Waldron Memorial Bridge", the designers took the opportunity to use the idea of including a cenotaph as an end pylon on each of the four corners of the bridge. A cenotaph is, "**a tomb or a monument erected in honor of a person or group of persons whose remains are elsewhere**".

There are multiple examples in the United States and around the world where cenotaphs are employed as the beginning and end pylon treatments of a major bridge structure (see examples). The architectural treatment style of the cenotaphs can easily comport with whatever the preferred architectural style of the rest of the proposed bridge's elements become.

Piers and Pier Caps

The piers and pier caps kept the shape developed in the initial study but only added a series of inset panels into the pier cap area.

Fence Railing

A railing is necessary along the outside edge of the pedestrian walkway. The initial study determined that a black steel railing with vertical pickets and a mid and top rail with a star insert is appropriate. This railing would be suitable along a pedestrian walkway with or without periodic pilasters and would also be appropriate at the edge of the belvederes as well.

Lighting

The Initially Preferred Design offered two options for lighting. Both options located the light poles for Fort Pierre-bound traffic on the barrier at the northern edge of the bridge deck and for the Pierre-bound traffic along the barrier that separates the traffic from the pedestrian walkway. One lighting option type utilized typically sized roadway light poles and arms on the north side of the bridge and the same pole with a second pedestrian-level fixture mounted

off the back of the pole to illuminate the walkway side. The second option utilized all pedestrian-height poles (assumed to be at a closer spacing to achieve adequate photometric lighting levels) for both roadway and pedestrian walkway lighting along both sides of the bridge.

Another option also considered for this report was a lighting scheme that used all roadway-height poles along the outside edge on the northern side of the bridge and on the separation barrier along the Pierre-bound side to light the roadway and supplementing that with pedestrian pathway lighting in a linear LED fixture located within the top rail of a railing mounted on the separation barrier between the Pierre-bound roadway and the pedestrian pathway. This lower light would only illuminate the walking surface allowing the roadway-height pole on this side of the bridge to focus on illuminating only the roadway.

One issue raised by the Department relating to their ongoing maintenance program was the need to have no low overhead obstructions above the pedestrian walkway as they will be utilizing a boom truck with articulating arm for under-bridge inspections which would preclude the use of light poles mounted on the outside edge of the south side of the bridge as well as pedestrian-level luminaires mounted off the back of a roadway pole on the barrier between the Pierre-bound roadway and the pedestrian walkway.

Belvederes

The IPD included belvederes off the south/downstream edge of the new structure for viewing and river overlook purposes. Two options for the location of the belvederes were developed and presented for consideration: 1) one belvedere at each of the bridge pier bents closest to both shorelines along with two more at the pier bents that flank the main channel in the center of the river for a total of four belvederes altogether and; 2) one belvedere at each of the first two bridge pier bents from both shorelines for a total of four. All the belvederes will have simple bench seating for pedestrians.



ARCHITECTURAL UNDERBRIDGE LIGHTING CAN HIGHLIGHT STRUCTURAL FEATURES AND ADD COMMUNITY INTEREST AT NIGHT

Architectural Lighting for the Bridge Structure

Separate and different from the decisions made for lighting the roadway, pedestrian walkway and any park path lighting that may be included, the architectural lighting of the bridge that features and highlights its structural aspects and creates a new and exciting civic amenity can be included. Since there are plans under consideration for the future lighting of the railroad bridge directly upstream to the north of this new bridge, coordination between the two structures' system displays is critical.

Off-Bridge Improvements

The IPD included a provision for pedestrian plaza areas on both ends of the new bridge that would allow pedestrians on the bridge's walkway to get down to and access the water's edge and access both cities' waterfront. The IPD provided for a simple hardscape area that connects to the bridge pedestrian walkway and extends under the bridge and the full height abutment at either end. The amenities and architecture indicate that a space for a connective path and ADA walkway down from the bridge walkway would be provided. It is the purpose of this report to develop those spaces further to provide information to the cities so they can evaluate each element and give the State and the design team direction for what to include in the Final Design phase.

Also mentioned and in consideration for further off-bridge improvements were features such as decorative paving, bench seating, kiosks/interpretive signage, bike stations/racks, public art, fishing pier(s), canoe/kayak launch(s), and possible steamboat launch(s). Additionally, gateway signage will be considered.

Final Proposed Alternative for Bridge Treatments

A presentation of the various treatment options outlined above was made to representatives of the State and the cities for their comment and concurrence. A Final Proposed Alternative that combines the stakeholders' preferences into one aggregate design was developed and is illustrated in component detail in the next section of this report. This design summary will be carried forward into the Final Design phase of the project.

PART B: Recommendations

SECTION 4: BRIDGE ELEMENTS & TREATMENTS

Drawing upon the body of collaborative stakeholder work previously done to date, the results of that design effort, the Initially Preferred Design, became the stylistic point-of-beginning for the design work that further fleshed out the parameters and details of all the bridge structure components.

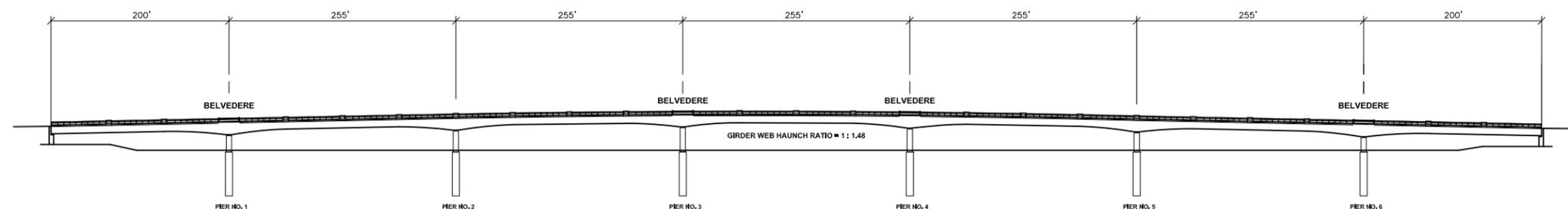
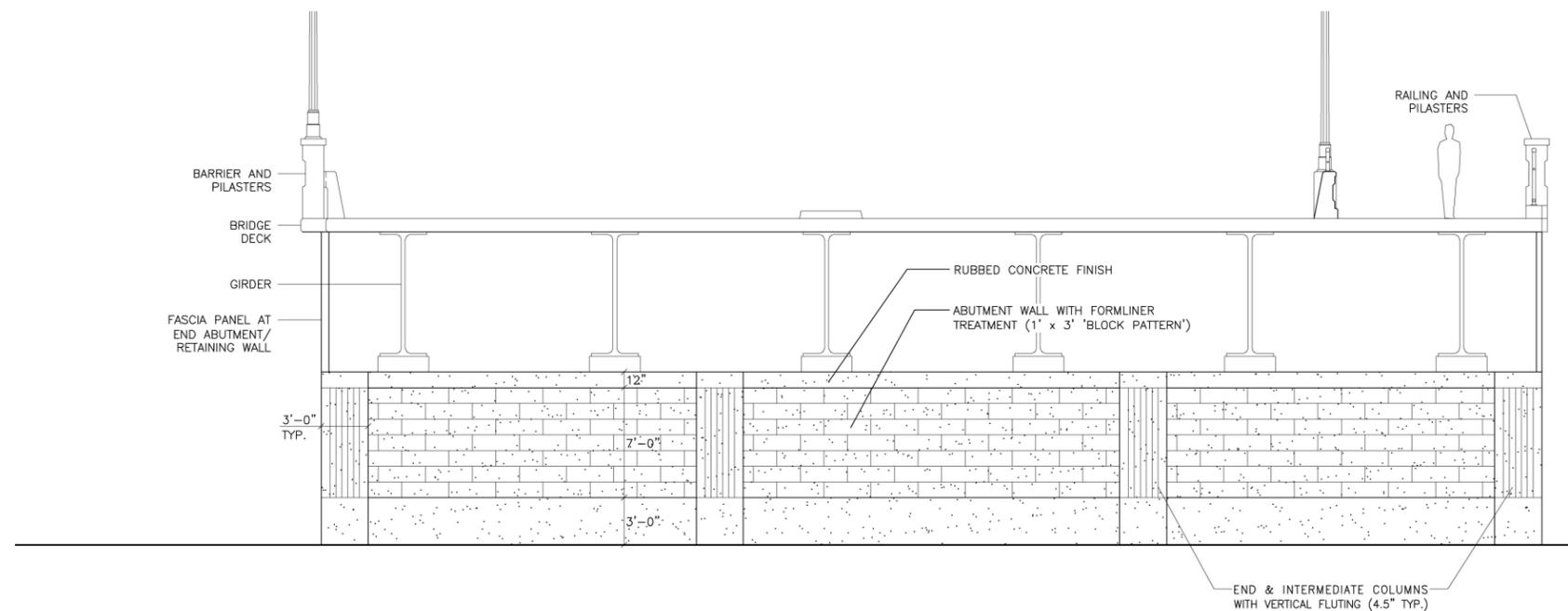
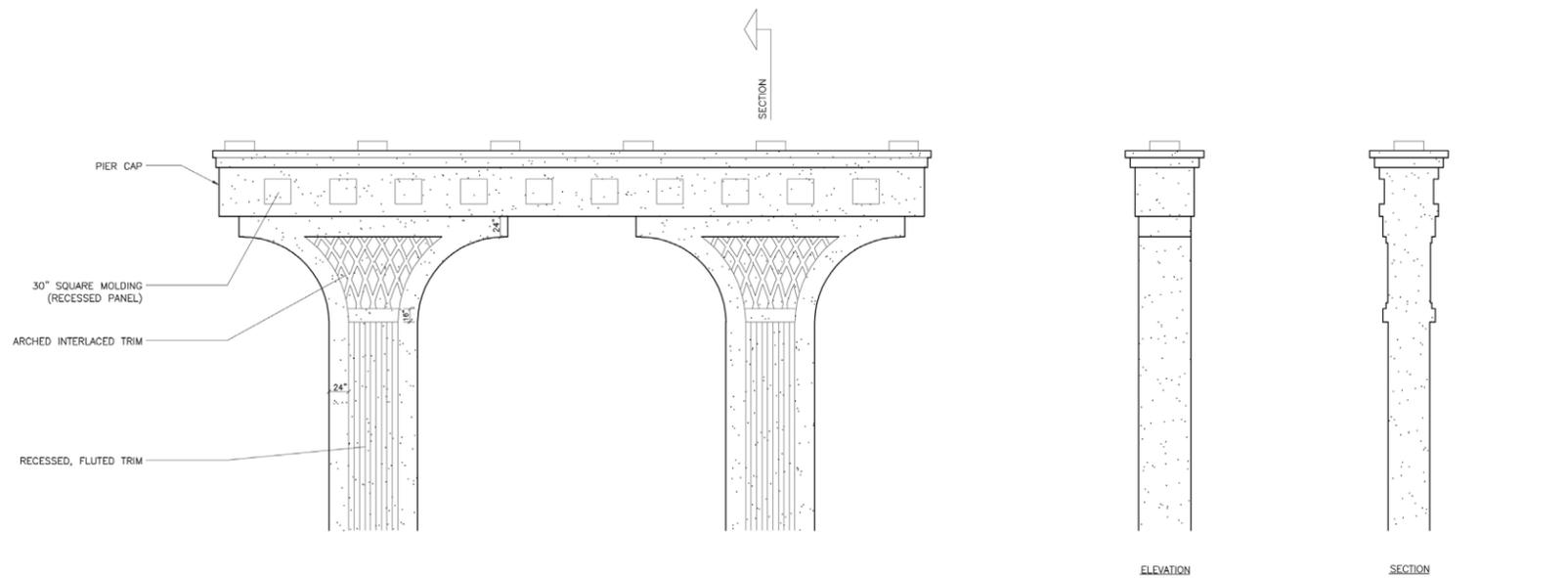
Substructure

Span Arrangement

The Initially Preferred Design for the new bridge provided for eight spans in lengths ranging from 130' to 235'. After further discussion with the design team and the Bridge group at the SDDOT, it was determined that a bridge with seven spans, five middle spans at 255' each in length and two end spans at 200' each would be acceptable. By reducing the number of spans by one, the cost of one pier can be eliminated thus reducing the overall substructure cost.

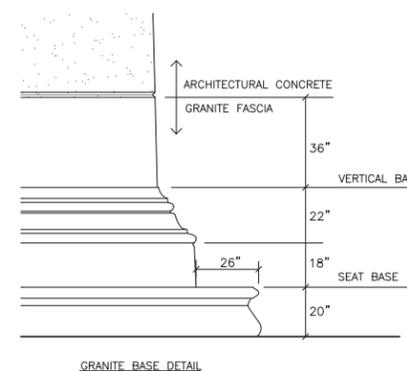
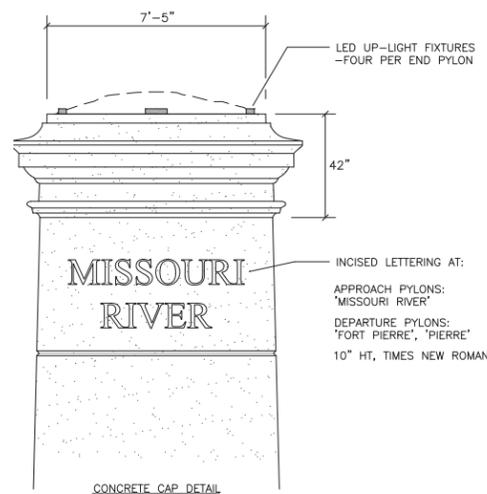
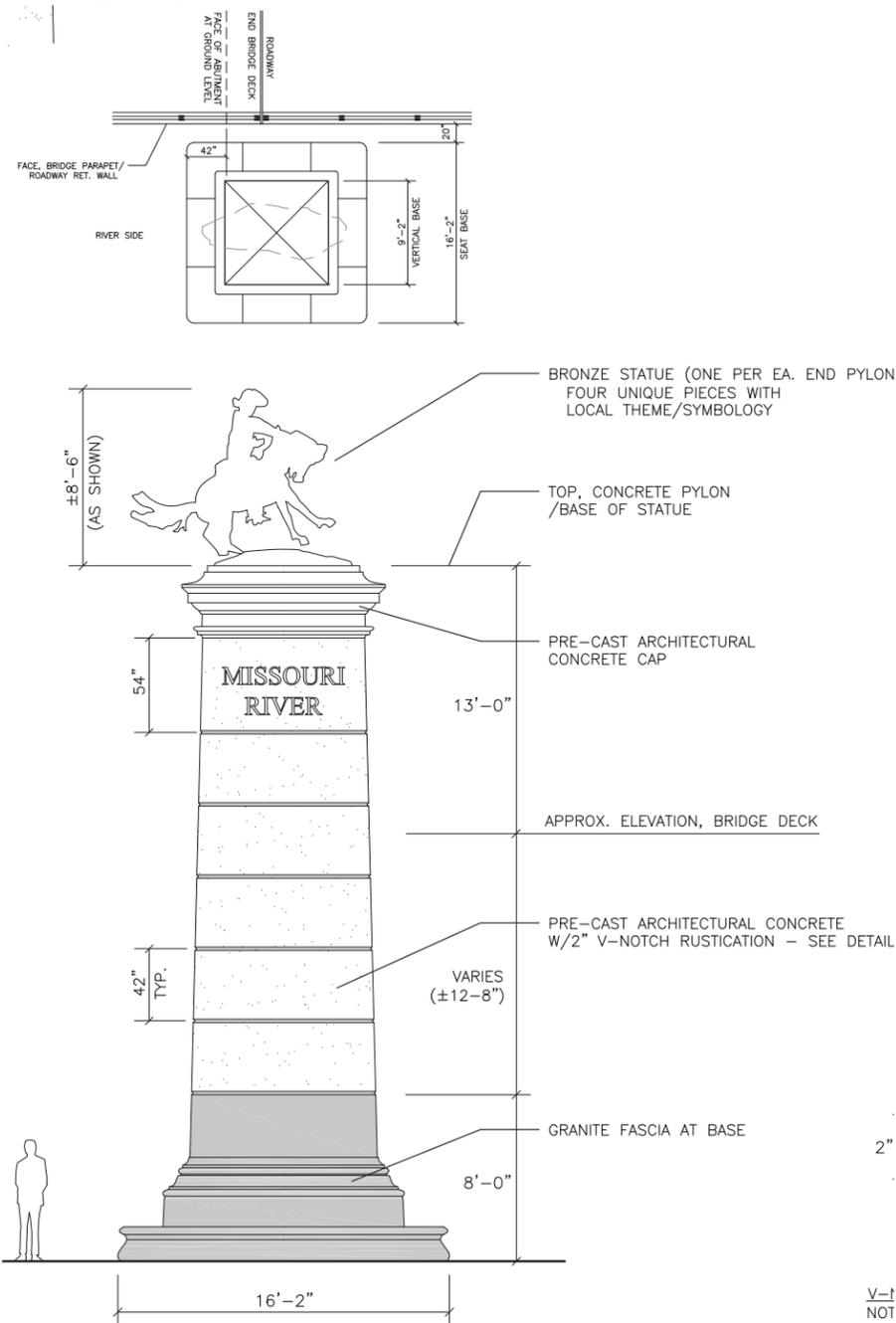
Piers and Pier Caps

From the Initially Preferred Design, it was determined that a two-column pier with pier cap would be used. SDDOT had also indicated that the piers should not have a waterline cap to prevent people from accessing or climbing on to them from boats. To harmonize with the treatments selected for the superstructure, the piers and pier caps would have a rubbed concrete finish that could also feature Federalist-style vertical fluting on the column portion of the pier and arched fluting and a shadow box dentil styled pier cap.



FORT PIERRE

PIERRE



Abutments

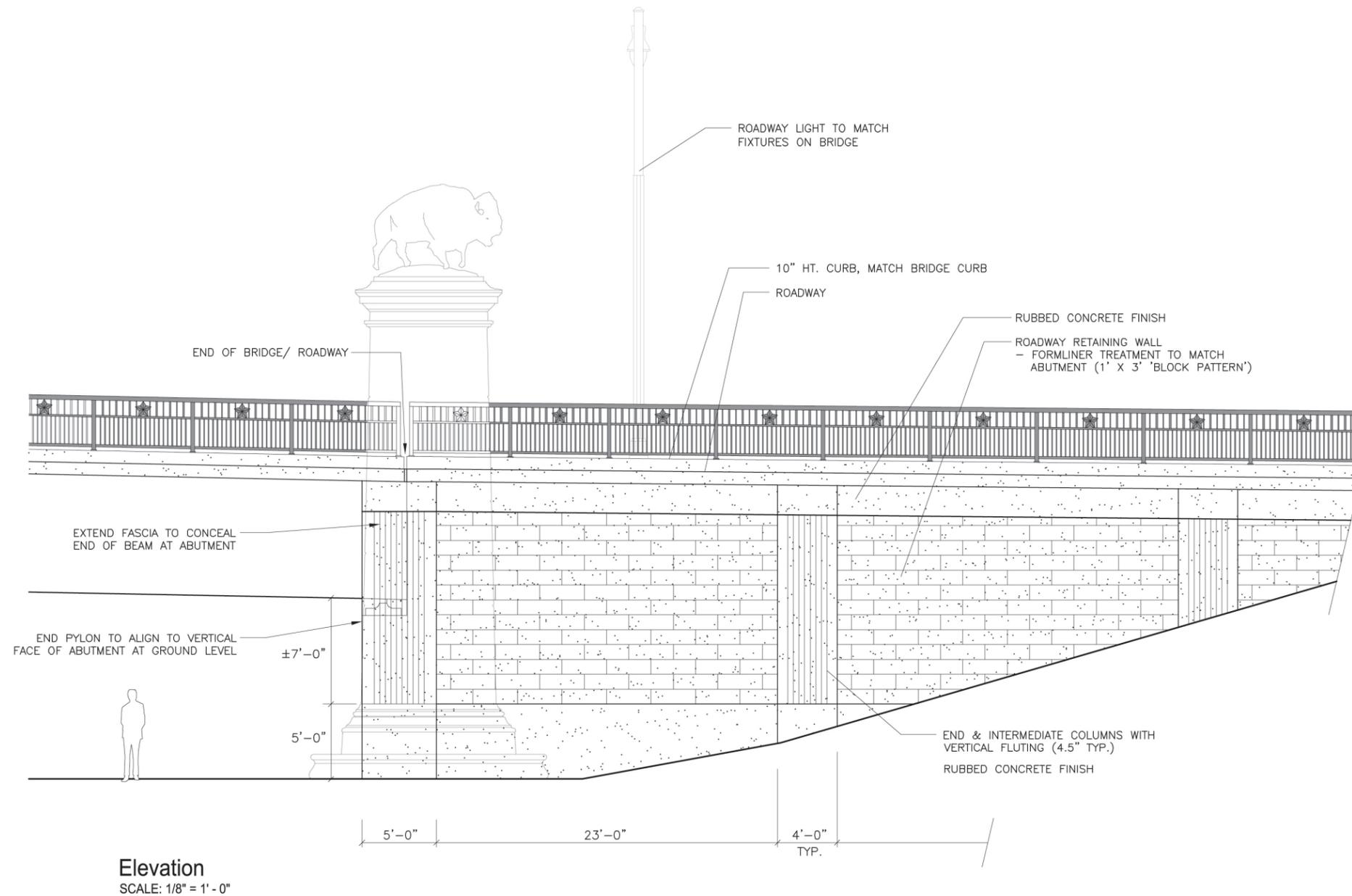
To maximize the amount of usable space beneath the bridge and between the shoreline and the abutment face, vertical-face abutments will be used. The treatment of the abutment face and wing wall returns will be a single color rubbed finish concrete and formliner or rustication strip surface treatment with a pattern that emulates large block soldier coursing. A base plinth for the abutment wall and a bridge seat cap of rubbed concrete will be included as well. The corners of the abutment and at the intermediate false columns in the abutment face will include simple vertical fluting similar to that used on the pier columns.

End Pylons

It was noted during the Design Development phase of this project that in many instances, a bridge of this size and importance that crosses a major body of water typically includes two sets of end pylons, one at each of the four corners of the bridge demarcating where the structure begins and ends. In the case of this new Lt. Cmdr. John C. Waldron Memorial Bridge, the end pylons would also serve as cenotaphs. In keeping with the overall architectural theme of the other bridge components, end pylons were developed that would be in the simple Federalist-style.

The pylons would have a robust base plinth that could function as some plaza seating that would act as an essential element to the plaza space since the pylon sits squarely within the plaza limits. The shaft of the pylon would be a simple rubbed concrete finish with horizontal rustication strips leading to a precast capital which would provide an opportunity to locate regionally-themed public art pieces germane to each city's heritage and cultural. These art pieces could be up lit for further accentuation. Inscribed into the river-facing top panel of the right-side pylon on each end of the bridge would be the name of the city into which you are about to enter.

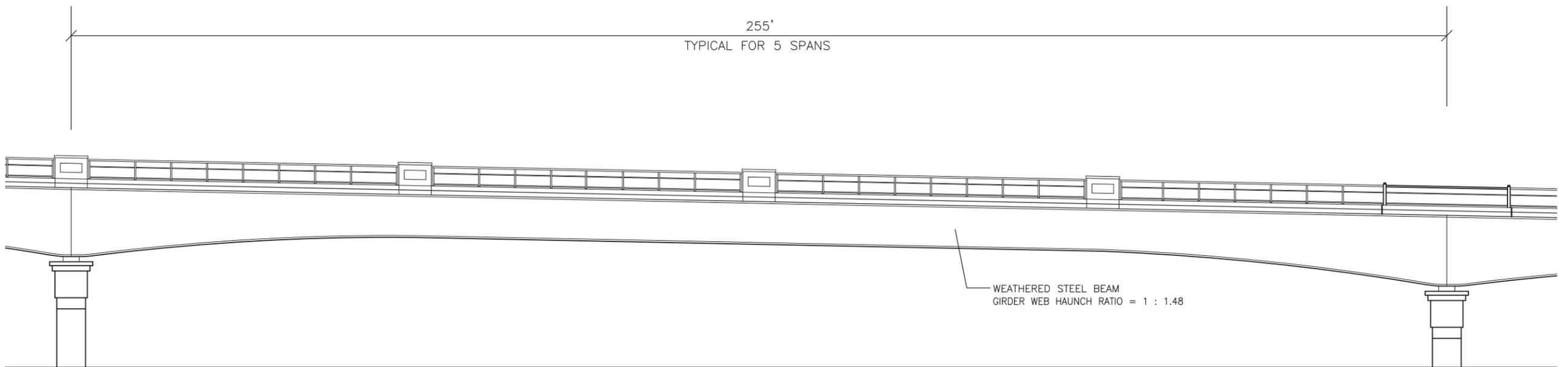
The four corner pylons would be separate, free-standing structures not connected to the bridge abutments. Architectural precast panels offer the greatest amount of design flexibility and quality control with the outside of the unit exhibiting an architectural precast concrete finish with the necessary rustications included. The base and cap would be the same as described above.



Wing Walls and Retaining Walls

Any bridge wing walls or large retaining walls throughout the project will most likely be mechanically stabilized earth-type (MSE) walls as they are cost effective and easy to construct. While functional and efficient, the inherent pattern in the wall created by the joints between the precast panels is an unavoidable visual element that must be considered. Staying with the rubbed finish concrete that feature Federalist-style formliner or rustication strip surface treatment with a pattern that emulates large block soldier coursing and vertical fluting treatments used elsewhere, the jointing of the MSE wall panels could be made part of the overall horizontal and vertical pattern. Intermittent smooth false columns with fluting, oversized shadow box and false arches and built up caps and plinths for all wall surfaces would be appropriate.

Smaller retaining walls, depending on size, extent and intended use, could be either a cast-in-place wall with a surface treatment similar to that seen on the inside face of the separation barrier on the bridge or a precast concrete large-scaled unit gravity-type wall similar to the style and treatment of the Redi-Rock wall system seen on the Fort Pierre side of the river immediately adjacent to the shoreline path and the Drifters Restaurant parking lot.



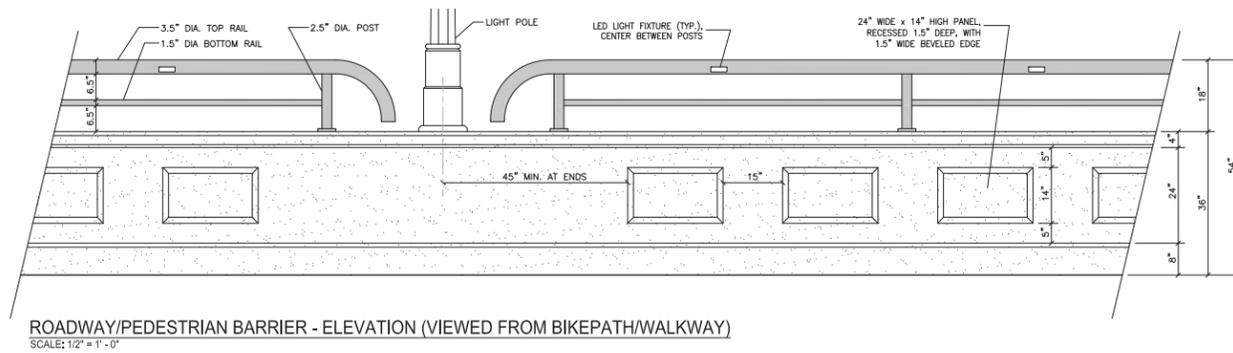
Superstructure

Beams and Girders

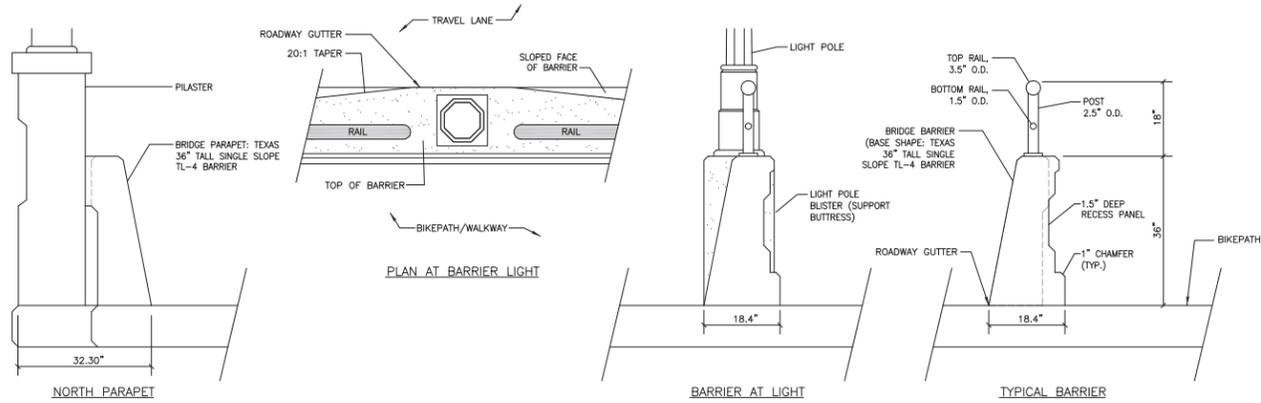
Both concrete and steel-type girders were considered during the initial study phase of the project. Steel girders were selected. The vertical alignment of the new structure will be approximately symmetrical around center line of river. SDDOT expressed a preference for weathering steel over painted steel. Given the potential for pier rust staining from weathering steel, a possible steel surface coating may be needed and would have to be coordinated with the other aesthetic features. The girders will be haunched weathering steel girders.



PROPOSED DESIGN

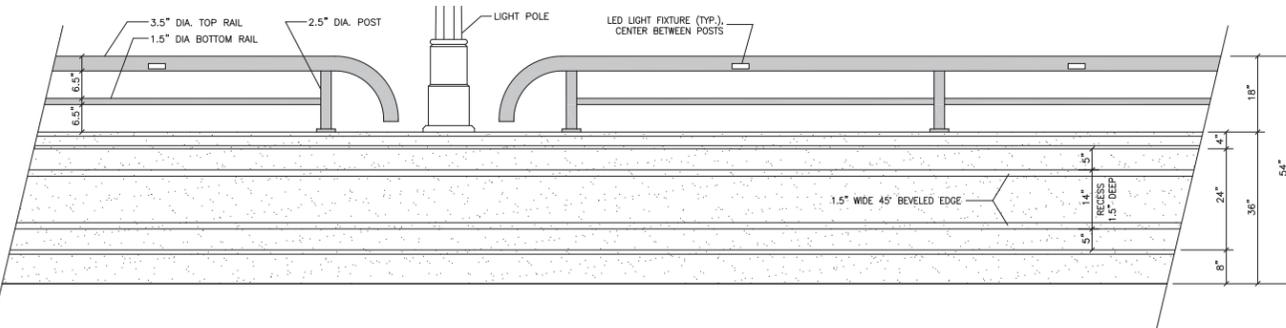


ROADWAY/PEDESTRIAN BARRIER - ELEVATION (VIEWED FROM BIKEPATH/WALKWAY)
SCALE: 1/2" = 1'-0"

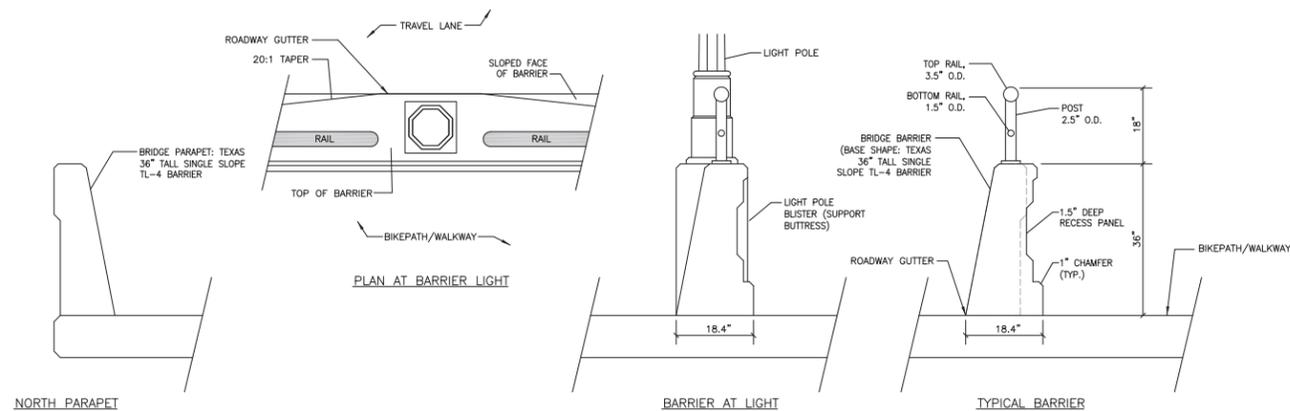


BARRIER DETAILS
SCALE: 1/2" = 1'-0"

SDDOT STANDARD



ROADWAY/PEDESTRIAN BARRIER - ELEVATION (VIEWED FROM BIKEPATH/WALKWAY)
SCALE: 1/2" = 1'-0"



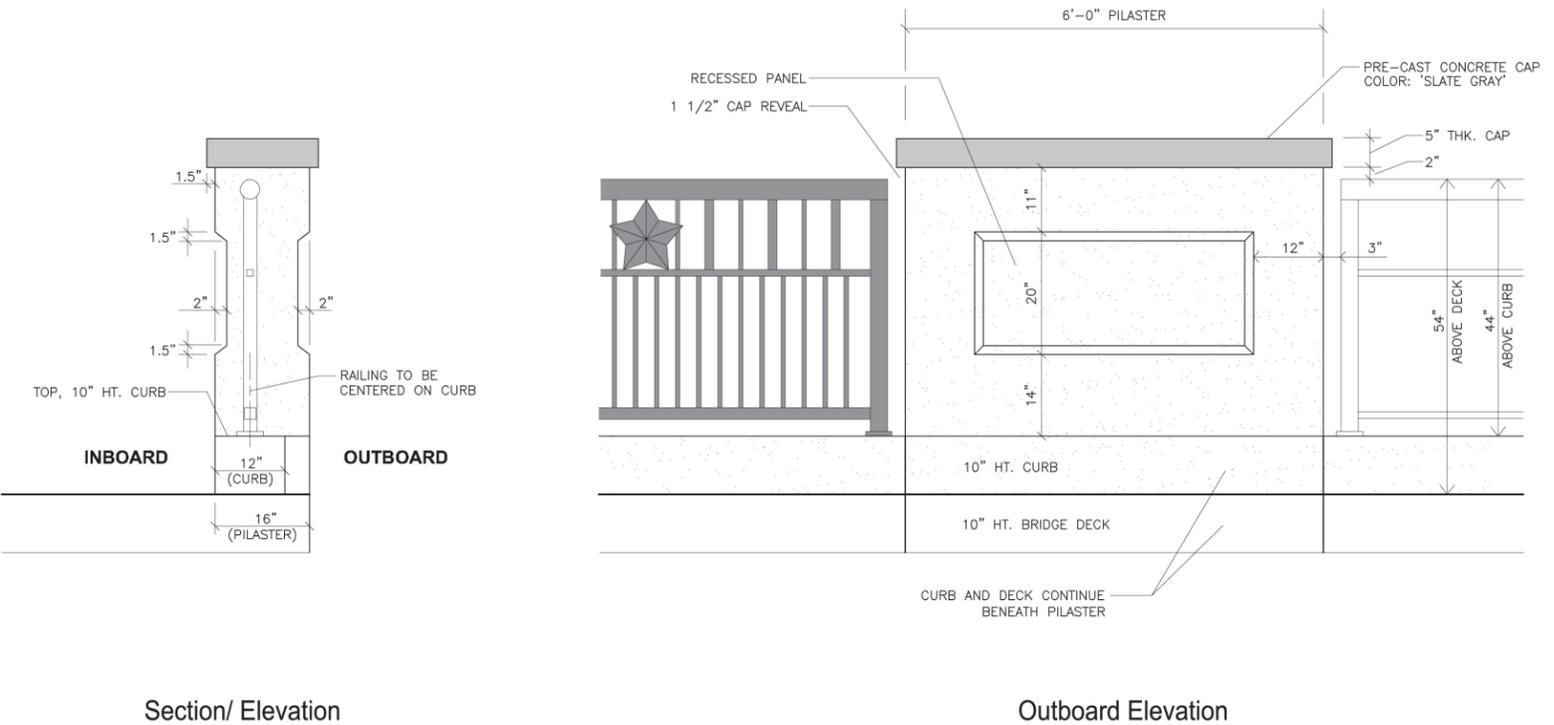
BARRIER DETAILS
SCALE: 1/2" = 1'-0"

Barriers and Parapets

A standard 36"-high, single-slope traffic barrier would be used on both sides of the roadway. On the northside/Fort Pierre-bound side of the bridge, the barrier would sit on the edge of the deck. The roadway side would have a smooth single slope surface. The "standard" SDDOT treatment of the outside face of the barriers would include a continuous, single inset recess for the entire length of the barrier. The proposed design would have the outside face of the barrier facing towards the river with a repeating inset shadow box panel pattern in the rubbed concrete finish in both the barrier as well as the pilasters.

The proposed design of the concrete barrier separating the Pierre-bound traffic and the pedestrian walkway would have the smooth single slope surface on the roadway side and the same repeating inset shadow box panel pattern facing the walkway. Because the pedestrian walkway is also a bike path, this barrier would also feature an additional 18"-high top rail to achieve the 54" height required adjacent to cyclists.





BRIDGE PILASTER
SCALE: 1/2" = 1' - 0"

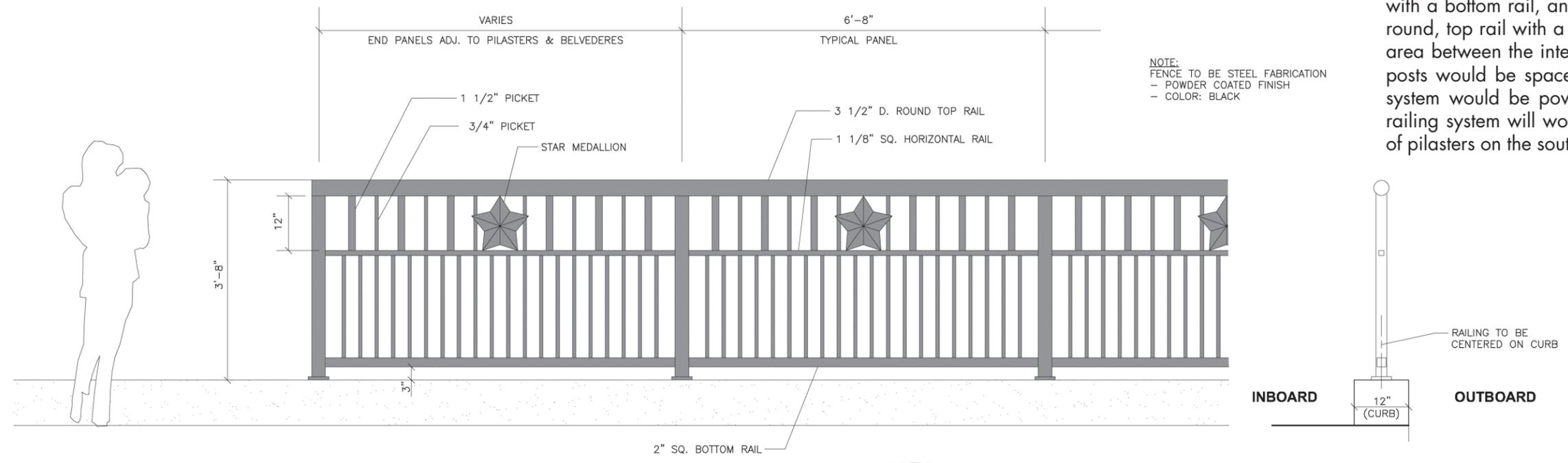
Pilasters

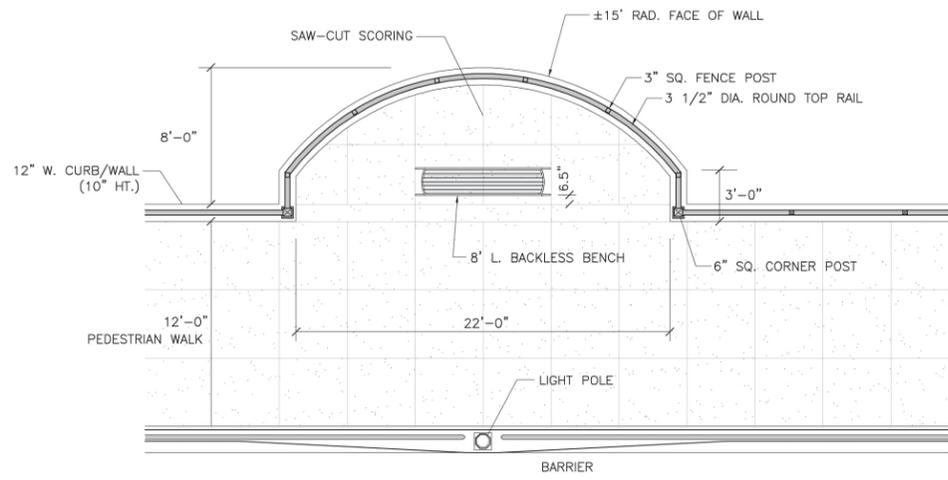
For the proposed design, both the north and south sides of the new bridge will have a repeating series of pilasters on the outside edge of the bridge deck. The spacing will be an equal increment of the distance between the bridge piers. Pilasters on the north side of the bridge will be a built-up component of the concrete roadway barrier and will be the location of the roadway light poles as the spacing dictates on that side.

The pilasters on the south side of the bridge will be free standing located along the bridge deck edge and will interrupt the bridge fence rail at the same spacing as seen on the north side. The shadow box panel detail described earlier will be used on the outside face of the pilaster on both the north and south sides. The surface of the pilaster on the side that faces the pedestrian walkway will also have the shadow box treatment as well. For comparison, the SDDOT "standard" treatment of the southern edge of the bridge deck along the pedestrian walkway would be the only steel railing described below without pilasters. There would be no pilasters on the northern edge barrier.

Fence Railing

From the Initially Preferred Design, it was determined by the stakeholders that a simple vertical steel picket fence, 54" from the sidewalk to the top of the top rail, with a bottom rail, an intermediate rail and a larger, round, top rail with a repeating cast star insert in the area between the intermediate and top rails. Round posts would be spaced 6'-8". The entire fence rail system would be powder coated black. The fence railing system will work with or without the presence of pilasters on the south side edge of the bridge deck.

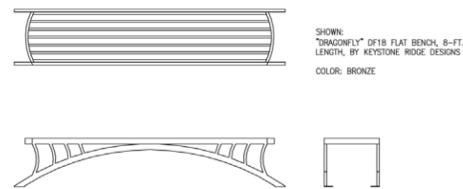
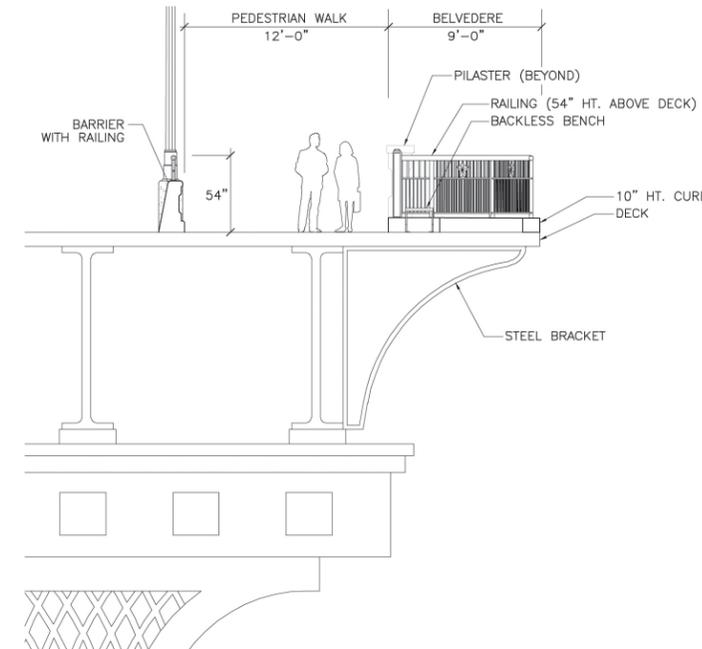




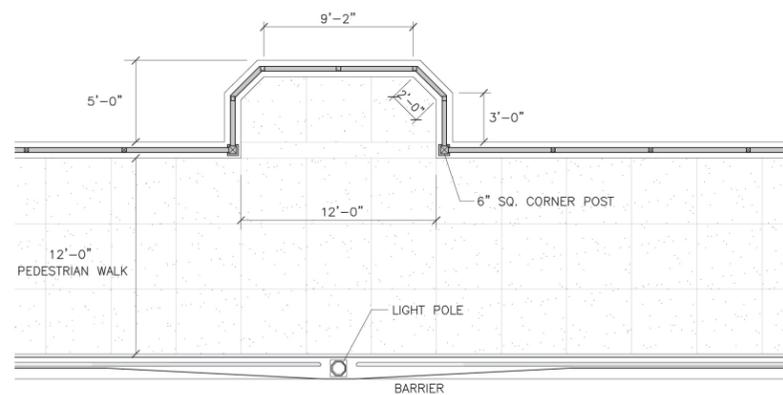
BELVEDERE 8' x 22'
SCALE: 1/8" = 1' - 0"

PROPOSED DESIGN

Plan



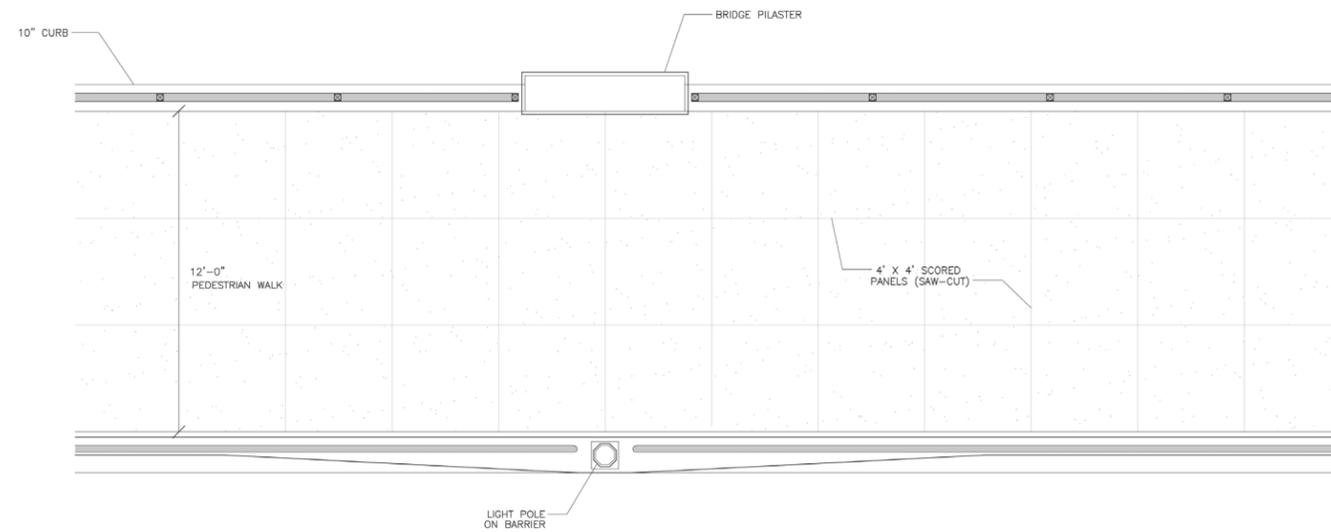
Bench Detail



BELVEDERE 5' x 12'
SCALE: 1/8" = 1' - 0"

SDDOT STANDARD

Plan



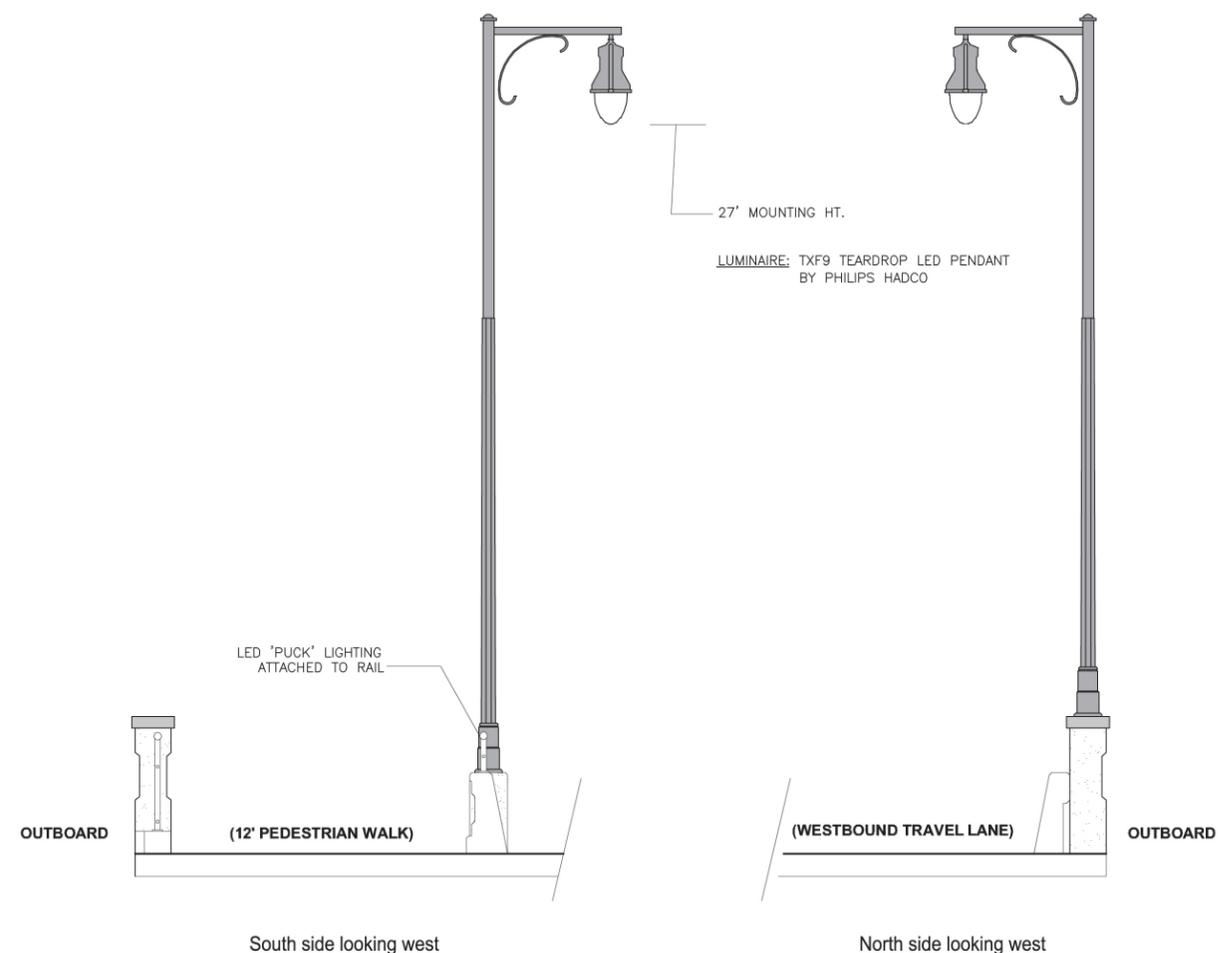
SIDEWALK - PLAN
SCALE: 1/4" = 1'-0"

Belvederes

Belvederes, or pedestrian walkway “bump outs”, will be located along the south side of the bridge with one belvedere at each of the bridge pier bents closest to both shorelines and two more at the pier bents that flank the main channel in the center of the river for a total of four belvederes altogether. Brackets attached to the girders below will support the cantilever. The fence railing will extend entirely around the outside edge of the belvedere. For comparison purposes, a “standard” SDDOT belvedere would be approximately 12’ wide and would protrude approximately 5’ from the edge of the bridge deck and would not have any seating. The proposed design would have the belvederes at roughly 22’ wide, semicircular and extending approximately 8’ off the edge of the deck. Simple bench seating will be provided in the proposed design at each belvedere.

Sidewalks

The sidewalk on the pedestrian walkway on the bridge will be a simple concrete pavement that could include a decorative scoring pattern.



LED Performance

LED:	Cree XPG	Lumens	CCT
DUV:	.001	104 lm	2700k
CCT:	2700k, 3000k, 4000k, 5000k	111 lm	3000k
CRI:	>80*	119 lm	4000k
Life:	90% at 51k hrs based on LM-80 testing	127 lm	5000k
Warranty:	5 year limited warranty		

*At 5000K CRI >70

LED LIGHT FIXTURE IN BRIDGE FENCE TOP RAIL

Lighting – Roadway/ Pedestrian/ Bridge Architectural

Three types of lighting will be required for the new bridge: lighting for the roadway, lighting for the pedestrian walkway and underbridge architectural light that highlights the design aspects of the overall structure.

- » Roadway Lighting - The proposed design includes lighting of the roadway accomplished by using 30'-high decorative steel pole and bases with 6' arms and scrolls, an acorn-shaped teardrop luminaire with LED components spaced approximately 130' (every other pilaster) on-center on the north side pilasters and blisters in the separation barrier aligned across the roadway from one another.

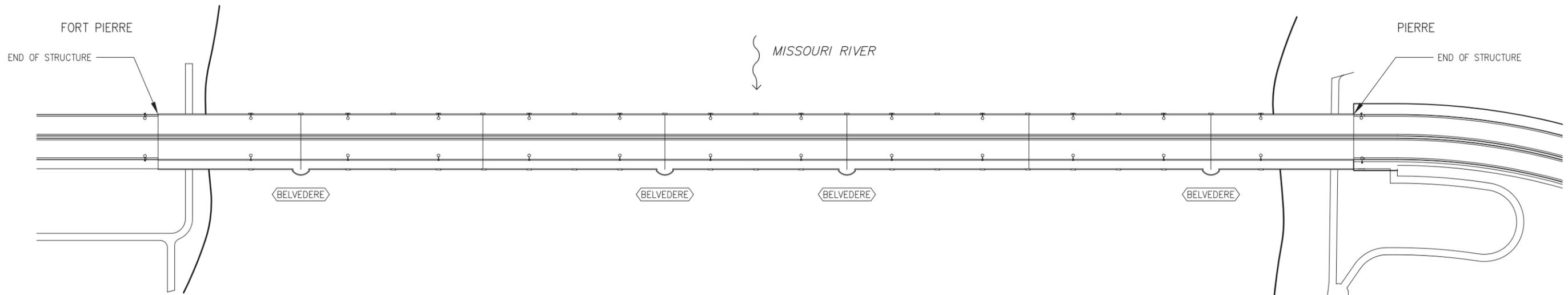
For comparative purposes, the "standard" method SDDOT would consider to light the roadway would include 50'-high aluminum poles with 8' mast arms, "cobra head-style luminaires, possibly utilizing an LED technology, alternately spaced across the roadway approximately 250' on-center apart (125' o.c. opposite side to opposite side).

- » Pedestrian Walkway Lighting – The proposed design lights the pedestrian walkway using miniature LED "puck" fixtures threaded and embedded in the top rail that's mounted on the separation barrier at approximately 6'8" on-center in between the top rail post's spacing. The illumination distribution pattern would be 45° and only cast light downward onto the walking surface.

For comparative purposes, the "standard" method SDDOT would use to light a pedestrian walkway would be to either decrease the spacing of the roadway poles and use a IES distribution pattern that would create sufficient lighting "behind" the pole to adequately illuminate the pedestrian surface.

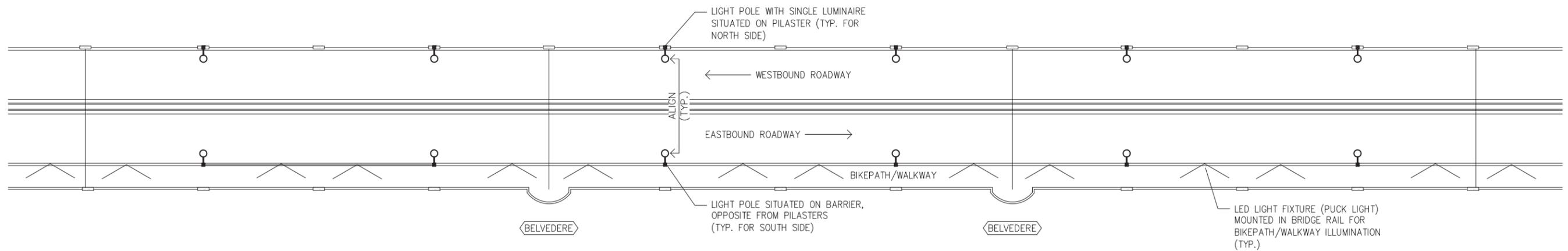
Alternately, they may consider mounting a "pedestrian"-style luminaire and arm off the back of the roadway pole at least 15' above the sidewalk surface (the minimum 15' mounting height would be so that the pedestrian luminaire and arm did not interfere with the State's inspection truck's articulated underbridge arm). What the reduced spacing would need to be to create acceptable illumination levels and uniformity ratios on the pedestrian walkway would require further study.





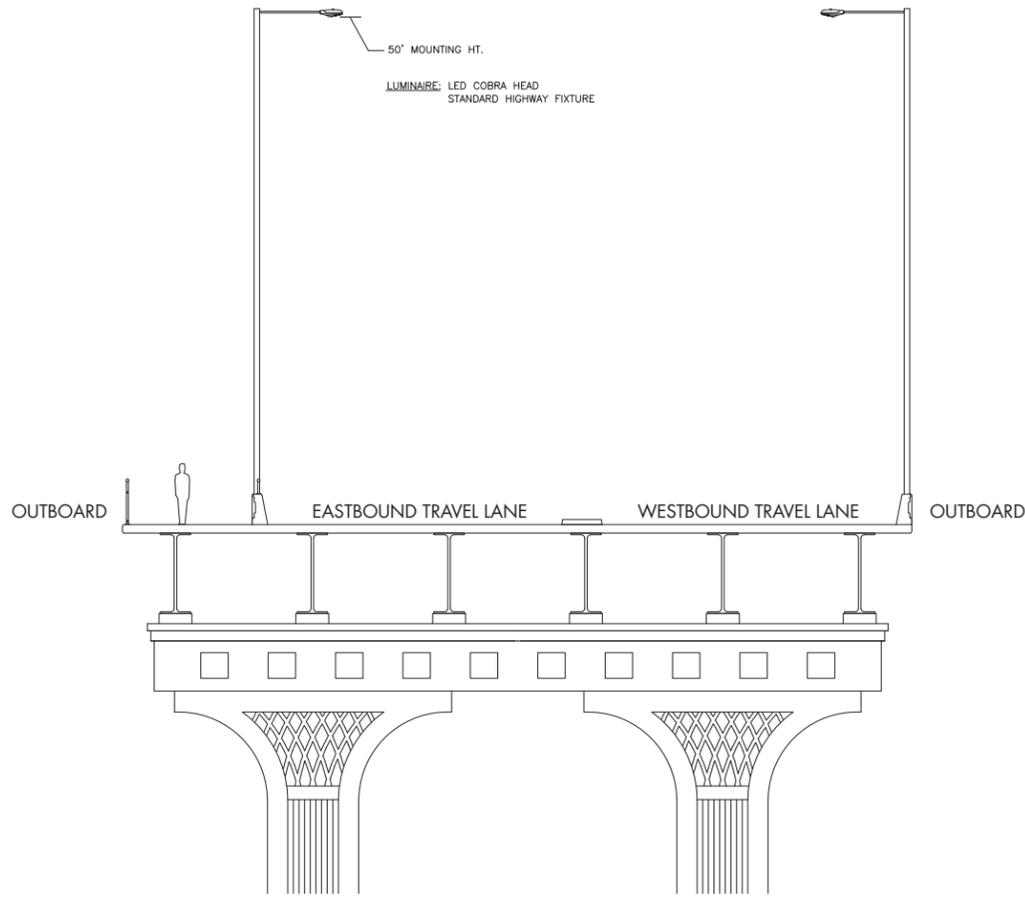
LIGHT POLE LOCATION PLAN - OVERALL STRUCTURE

SCALE: 1" = 150'

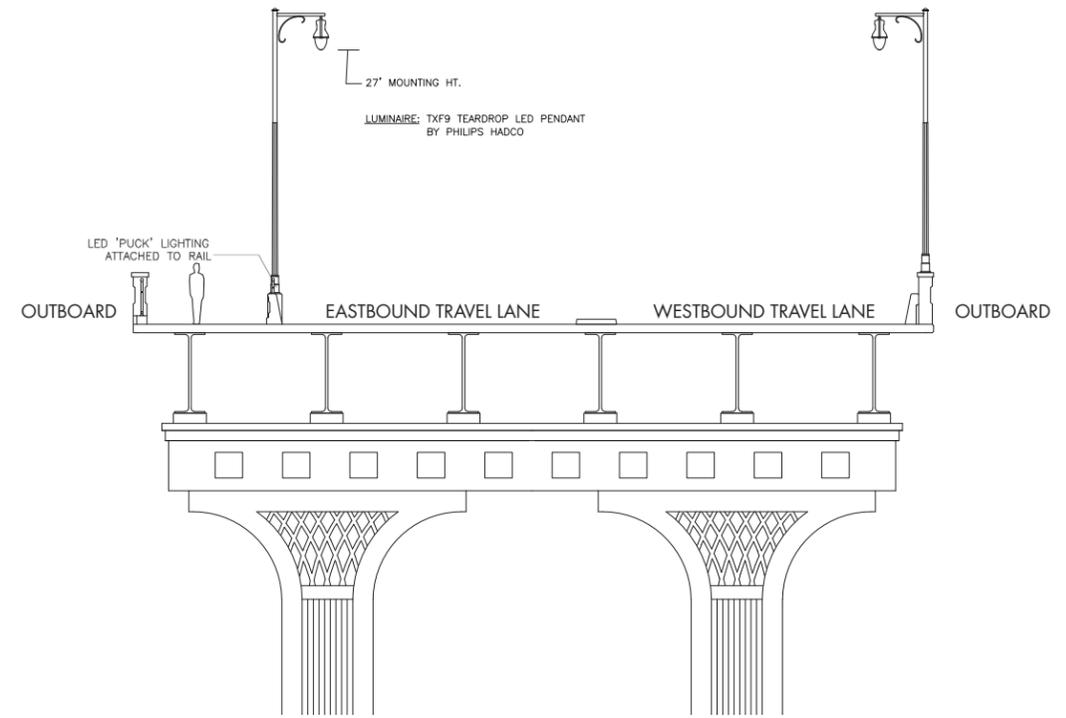


LIGHT POLE LOCATION PLAN ENLARGEMENT AT MID-SPAN

SCALE: 1" = 60'



SDDOT STANDARD



PROPOSED DESIGN



SDDOT "STANDARD" LIGHTING SCHEME

- » Architectural Lighting for Structures – Located over a river that teems with fishermen, boaters, and swimmers during the summer season, the motorists, boaters, and residents of Pierre and Fort Pierre will view the new John C. Waldron Memorial Bridge from many vantage points. Area residents on both sides of the river count on the bridge to get them to work and home on a daily basis. The new bridge will act as an orienting feature in the landscape during the day and, if lit dramatically, will at night as well. The architectural under bridge lighting design, with low levels of light below the deck is intended to highlight the linearity of the structure and the bridge’s main spans and piers to reveal the beauty of the structure without imposing upon the river and shoreline viewers.

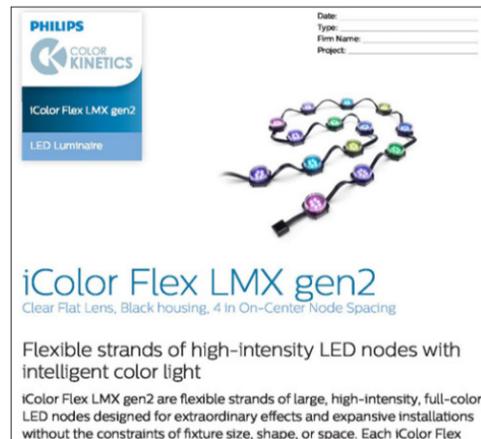
The lighting design will be a dynamic lighting system that enhances and reinforces the link between the two communities. With the potential for color-changing lighting events as desired along the length of the structure and within the pier articulations, the design would utilize cost-saving, energy efficient, easy to maintain, high-lumen LED light fixtures that provide great color saturation for the below-deck lighting of the in-water piers and the abutments at each end to highlight the architectural beauty of the bridge.



PROPOSED LIGHTING DESIGN FEATURES ILLUMINATION OF THE MAIN STRUCTURAL COMPONENTS OF THE BRIDGE AS WELL AS HIGHLIGHTING ITS LINEARITY

The underside of the bridge will be washed with light to create reflections in the water. The design would utilize digital multiplex controls to allow each fixture to be controlled individually and special effects such as fading to create unique light combinations on the structure. Lighting design coordination with the potential lighting of the railroad truss bridge directly north of this structure is also possible.

The view of the bridge from both cities and the river will express the beauty and strength of the structure while incorporating movement, color, and playfulness into the design so that the new bridge is not just functional, it remains the icon the previous bridge was to the communities on both sides of the river. The new John C. Waldron Memorial Bridge would glow like a beacon in the night in central South Dakota, underpinned in different colors and shades, set against the backdrop of a picture-perfect South Dakota evening sky. The aesthetic lighting of the bridge will create an illuminated focal point on the riverfront and provides a lasting impression as a gateway and connector for the two cities.



LED STRAND LIGHTS UNDER DECK EDGE





EAST PLAZA - PIERRE SIDE



WEST PLAZA - FORT PIERRE SIDE

SECTION 5: OFF-BRIDGE IMPROVEMENTS

During the Initial Concept Design phase of the project, SDDOT and the cities of Pierre and Fort Pierre discussed what opportunities existed to plan for potential additional community amenities in the immediate areas surrounding the bridge termini and include them with the construction of this project. It was noted that both communities had an interest in making the new bridge and the context in which it is situated better places for their residents and visitors alike. It was also clearly understood by all the parties that while certain off-bridge improvements may be included as part of the overall effort of this project, the design, installation, maintenance, and operating cost would be borne solely by the cities. The following areas of interest were discussed:

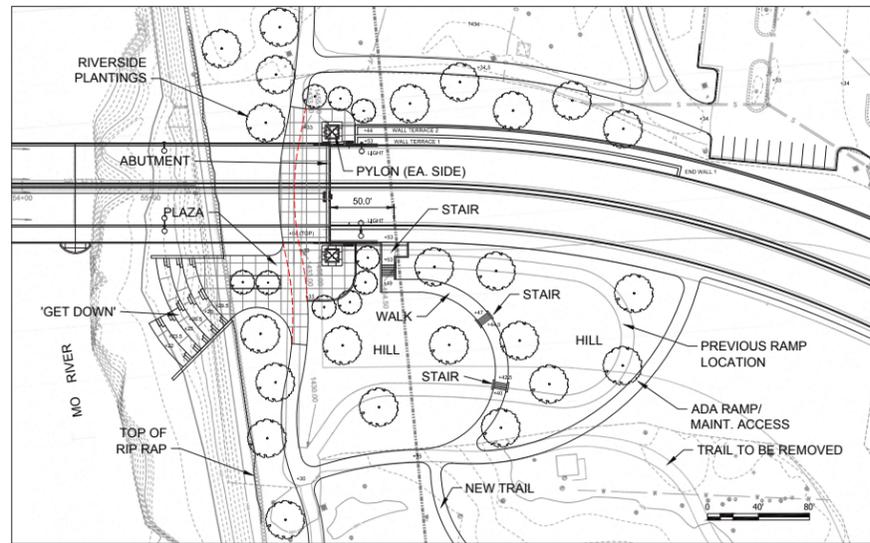
Plazas and Other Park Improvements

Initial approved concepts had shown a broad, sweeping plaza at the southeast corner of the bridge in Pierre. The four corner quadrants of the bridge where it touches the riverbank each have their own unique opportunity to explore and interpret the unique characteristics of both the State of South Dakota and the cities of Pierre and Fort Pierre. The major plazas will be located on the south side of both ends of the bridge, with the possibility to add smaller plazas and interpretive areas on the north sides. Access to the plazas will be from the pedestrian walkway on the south side of the bridge via stairways and ramping.

The smaller plazas on the north side of the bridge will only be accessed by the adjacent trails and underbridge paths. The southeast plaza in Pierre could have a prairie bluff theme and the southwest plaza in Fort Pierre would focus on the memorial bridge's namesake, Lt. Commander Col. Waldron and his ties to the community, his history as a WWII aviator and as a fighter squadron leader.

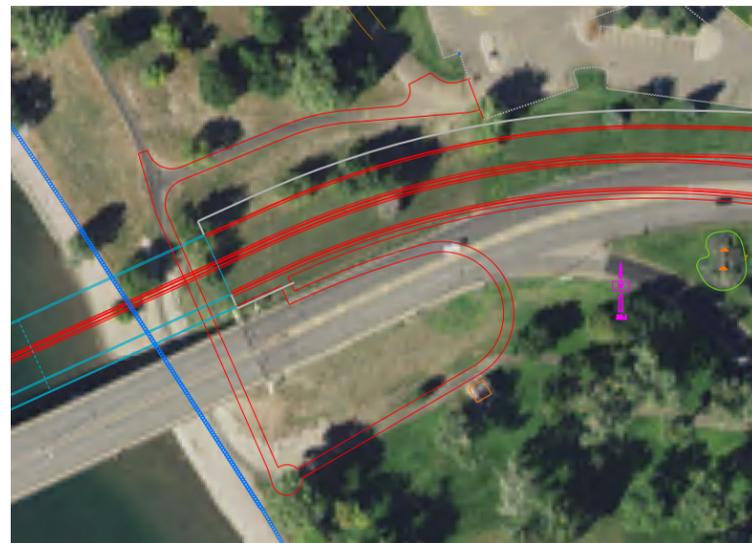
Other park improvements could include an expanded parking area to accommodate loading and off-loading for the paddle-wheeler, as well as recreational parking and access to the river for paddle-sports. No traileered boat launch will be provided at this location. New paths from the parking area will then be tied into the riverfront trail system that leads to the bridge plaza areas.

PROPOSED DESIGN

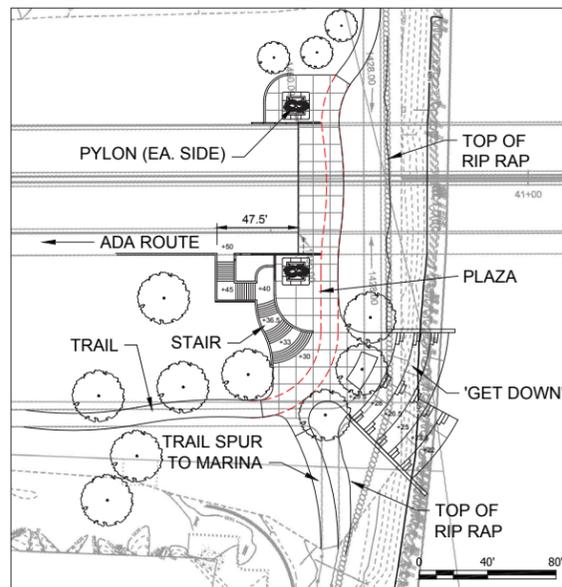


EAST PLAZA - PIERRE SIDE

SDDOT STANDARD



PROPOSED DESIGN



WEST PLAZA - FORT PIERRE SIDE

SDDOT STANDARD



Underbridge trails would follow the top of the embankment as they do now and link existing riverfront pathways. New direct access to the trails will be provided via stairway and ramps on the south side of the bridge near the river. It is understood that the City of Pierre will be upgrading their park trails to be 12-foot wide in the near future, holding them back from the bridge construction area, for connection later.

On the Fort Pierre side, the public river trail that currently follows the bank near Drifter's bar and restaurant will be rerouted to head directly to the west, then south to connect back to the trail and sidewalk system that ends at the AmericInn Lodge and Suites hotel. This is due to a pedestrian bridge crossing that would be needed at the new marina location to keep the current route.

River Access

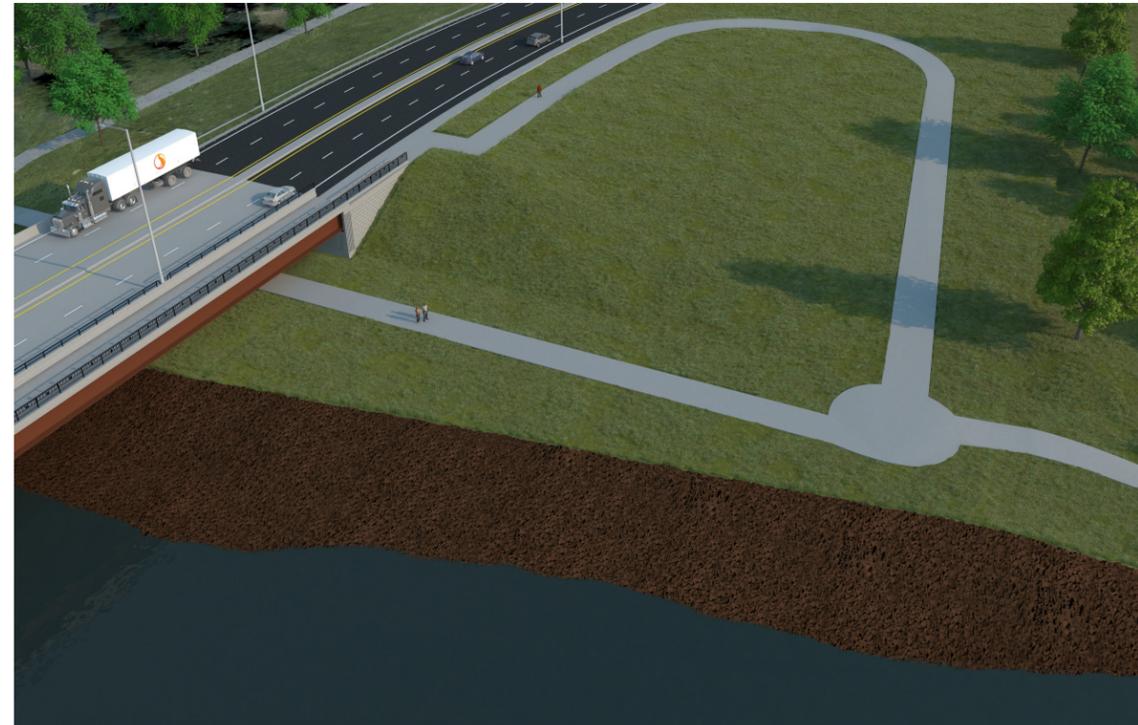
River access will be provided adjacent to the major plaza areas by providing both ramped and stepped "get down" terraced areas down to the water's edge for a set distance. These areas will be somewhat limited in their overall length due to the need to remove rip rap shoreline stone but will provide easy water access for pedestrians.

PROPOSED DESIGN



EAST PLAZA - PIERRE SIDE

SDDOT STANDARD



PROPOSED DESIGN



WEST PLAZA - FORT PIERRE SIDE

SDDOT STANDARD





CONNECT UNDERBRIDGE PATH TO ADJACENT PIERRE PARK PATH SYSTEM



CONNECT UNDERBRIDGE PATH TO ADJACENT PIERRE PARK PATH SYSTEM



SHORELINE PATH SYSTEM FORT PIERRE



IMPROVE SHORE LINE ACCESS



FISHING PIER



FISHING PIER



STEAMBOAT LAUNCH FACILITY



CANOE / KAYAK LAUNCH FACILITY

Fishing Piers

Fishing piers were determined to be a low priority at subsequent planning meetings and are recommended to be placed outside of the bridge area, downstream to take advantage of other park support facilities such as parking and restrooms on the Pierre side in Steamboat Park and the new marina on the Fort Pierre side. We noted that boat ramp and fishing areas are provided downstream a short distance near the LaFramboise Island Nature Area park causeway on the Pierre riverfront.

Boat Launches – Steamboat / Kayak

The steamboat launch was determined to be a low priority at subsequent planning meetings and is recommended to be placed just outside of the bridge project area. Further information is required on the operational requirements of the steamboat/paddlewheeler for determining specific needs of mooring and passenger loading and unloading desires in the vicinity of the bridge. It is our recommendation that temporary steamboat mooring be done in Steamboat park with direct access to an expanded parking and trail connection to the parking area.

Steamboat mooring in Fort Pierre is more problematic, due to the riverfront construction of the new private marina to the south of Drifters. It is possible however, that temporary riverside mooring could be established to take advantage of the large parking lot already in place adjacent to Drifters.

Canoe and kayak access to the river would be provided by stepped access to the water’s edge.

SECTION 6: COST INFORMATION



Introduction and Purpose

During the Initial Design phase, both communities had a strong desire to make the bridge not only functional and safe, but also a point of pride uniting both cities. It's important to note that the SDDOT is willing to accommodate additional aesthetic enhancements as long as they don't interfere with the traveling public and safety. Further, in consideration of any upgrades or additional improvements to the project, SDDOT stated that their funding participation will be limited to the cost for what a "typical" or "standard" state bridge project would incorporate. Where there is an alternative between a SDDOT standard or typical version and a decorative / more aesthetic version, the SDDOT will only fund up to the cost of the SDDOT standard with any additional cost being the responsibility of the city(ies).

Additional bridge enhancements that would improve the overall aesthetics of the bridge and that the cities considered a worthwhile civic improvement could be included with the bridge's construction but funded through a cost sharing agreement developed with the State prior to the commencement of construction.

For certain improvements that encompass the entire structure, both cities would have to agree to its inclusion into the project and agree to a funding strategy before it could be included in the project. For instance, if one city were to believe that the additional cost of upgrading the lighting on the bridge was an important and worthy expenditure of their municipal funds, the other city would have to agree to it as well as it would not be possible to upgrade the lighting on only one half of the structure.

It was also clearly understood by all the parties that while certain off-bridge improvements may be accommodated as part of the overall planning effort of this project, the design, installation, maintenance, and operating cost would be borne solely by the cities.

Base Cost Data

For the basis of comparison and to determine what optional project costs could be included in addition to the project's base cost, excluding utilities, the following items are assumed to be components of the basic bridge cost funded by the SDDOT:

- » Weathering Steel Haunched Girders;
- » Piers, Pier Caps and the Basic Architectural Treatment of the Pier Surfaces;
- » Bridge Deck and Approach Slabs;
- » Vertical Face Abutments, Wing Walls, and Retaining Wall(s) Necessary to Construct the Abutment and the Basic Architectural Treatment of those Surfaces;
- » Steel Fence Railing with Cast Star Emblems for the Pedestrian Walkway for the Length of the Structure;
- » Single Sloped Concrete Traffic Barriers with a "Standard" Single Recess insert on the Outside Face on Both Sides of the Roadway;
- » Six-inch Raised Center Median;
- » Top Rail on Barrier Separating Pedestrian Walkway and Pierre-Bound Roadway for Bike Path Compliance;
- » Four "Standard" 5'x12' Belvederes with Standard Concrete Pavement;
- » 37 Replacement Flagholders;
- » "Standard" SDDOT Lighting of the Roadway and the Pedestrian Walkway;
- » Standard Concrete Sidewalk Pavements Within the Project Limits;
- » Standard Concrete Pavement and Stairs in Plaza Areas to Connect Back to the Existing Path System



The following items are considered not to be part of the basic bridge cost and, to be included in the project, their entire cost, including design cost, would be the responsibility of the cities of Pierre and Fort Pierre:

- » Pilasters and Their Architectural Treatment on the South Side of the Bridge (Taking the Place of Fence Railing as Appropriate and Built into the Northside Barrier;
- » Additional Formwork and Concrete Necessary to Implement the Inset Panel Architectural Treatment of the Non-Roadway Faces of the Single Slope Concrete Barriers;
- » End Corner Pylons;
- » Larger-Sized Belvederes with Benches
- » Decorative Light Poles and the Cost of Pedestrian Lighting in the Top Rail in the Separation Barrier;
- » Architectural Lighting of the Structure;
- » Plaza Improvements Including Decorative Pavements, Benches, Seat Walls, Bike Racks, Kiosks, Interpretive Signage, Public Art and Additional Park Path Improvements;
- » Additional Shoreline Access Improvements Beyond Repair of Existing Rip-Rap;
- » Fishing Pier(s);
- » Boat Launch(es)

Relative Order-of-Magnitude Cost Information

For the purposes of comparison and to understand just the differential between the "standard" bridge project cost and the cost of the additional items requested by the cities, this report will list only the cost differential for an item that would be the responsibility of the city(ies):

Item Description	Construction	Design	Total
Pilasters (both sides of bridge)	\$150,000	\$ 15,000	\$165,000
Inset Panel Treatment on Barriers	\$13,000	\$ 0	\$13,000
End Pylons (4 corners):	\$ 680,000	\$60,000	\$740,000
Larger Belvederes (4 total)	\$65,000	\$5,000	\$70,000
Decorative Roadway Lighting (total for entire bridge):	\$173,000	\$35,000	\$208,000
Architectural Lighting of the Structure:	\$232,000	\$40,000	\$272,000
Pierre Plaza and Park Improvements:	\$193,000	\$40,000	\$233,000
Fort Pierre Plaza and Park Improvements:	\$193,000	\$40,000	\$233,000
Shoreline Access Improvements (each):	\$164,000	\$30,000	\$194,000
Fishing Pier (each):	\$30,000	\$15,000	\$45,000
Boat Launch (each):	\$55,000	\$20,000	\$75,000





LT. CMDR. JOHN C. WALDRON MEMORIAL BRIDGE - PROPOSED DESIGN



LT. CMDR. JOHN C. WALDRON MEMORIAL BRIDGE - SDDOT STANDARD TREATMENT

SECTION 7: GENERAL

STAKEHOLDERS, ACKNOWLEDGEMENTS AND REFERENCES

This document was created only through the participation of the following agencies and stakeholders:

PARTICIPATING STAKEHOLDERS

Participating in this study were the following stakeholders:

» **South Dakota Department of Transportation (SDDOT)**

- Office of Project Development
- Office of Structural Engineering
- Office of Road Design
- Pierre Area Section Office

» **City of Pierre**

- Office of the Mayor
- Office of the City Engineer and Planning

» **City of Fort Pierre**

- Office of the Mayor
- Department of Public Works

ACKNOWLEDGEMENTS

The direction and contents of this report could not have done without input from and the able assistance of the following individuals:

From the **SDDOT**:

Sam Gilkerson, Project/Consultant Manager
Brian Raecke, Road Design Program Manager
Steve Johnson, Bridge Design Program Manager
Pete Longman, Traffic Signals & Lighting
Kevin Marton, Bridge Hydraulics
Dean VanDeWiele, Pierre Area Engineer
Dave Madden, Bridge Design
Kevin Griese, Geotechnical
John Forman, Pierre Region Engineer
Bronson Blow, Utility Relocation Coordinator

From the **City of Pierre**:

Steve Harding, Mayor
Kristi Honeywell, City Administrator
John Childs, City Engineer, Planning Director
Leon Schochenmaier, Ex Officio

From the **City of Fort Pierre**:

Gloria Hanson, Mayor
Rick Hahn, Director of Public Works

From **Stantec Consulting**:

Tony Hunley, Project Manager
Mark Limpert, Local Agency Coordinator
Dale Grove, Principle-in-Charge
Sam King, Bridge Design Lead
Jeremy Freihammer, Roadway Design Lead
Mike Fitzgerald, Roadway Lighting
Jeff Grob, Aesthetic Enhancements Lead
Tom Berenbrock, Aesthetics Designer, Bridge
Chris Nolan, Aesthetics Designer, Bridge
Todd Wichman, Aesthetics Designer, Site
Jennifer Caroland-Shaw, Visualizations
Denise Fong, Architectural Lighting Lead
Megan Sudol, Architectural Lighting
Paula Kunatee, Graphic Designer

REFERENCES

The following manuals and publications were used as reference materials during the course of the preparation of this report:

- » *Environmental Assessment and Section 4(f) De Minimis Analysis*, U.S. Department of Transportation, Federal Highway Administration, and South Dakota Department of Transportation, dated May 2016
- » *Federal Highway Administration Finding of No Significant Impact (FONSI) and Section 4(F) De Minimis Impact Finding*, U.S. Department of Transportation, Federal Highway Administration, and South Dakota Department of Transportation, dated November 2016.
- » *US 14 / US 83 / SD 34 Missouri River Bridge, Report of Findings*, dated September 12, 2016.
- » *Flexibility in Highway Design*, U.S. Department of Transportation, Federal Highway Administration, latest edition.
- » *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities*, Institute of Transportation Engineers
- » *A Guide to Best Practices for Achieving Context Sensitive Solutions*, NCHRP Report 480, National Cooperative Highway Research Program, Transportation Research Board
- » *Integration of Context Sensitive Solutions in the Transportation Planning Process*, U.S. Department of Transportation, Federal Highway Administration, Office of Planning
- » *Standard Specifications for Roads and Bridges*, South Dakota Department of Transportation, 2015 Edition.
- » *Road Design Manual*, South Dakota Department of Transportation, Current Edition