CHAPTER 6
GRADE SEPARATION BRIDGES

6.1 Introduction

There are four individual grade separation bridges included in the project, in addition to the new river crossing. Two of the bridges are located in Minnesota, and two are located in Wisconsin. The bridges are:

- Trunk Highway 36 under Beach Road (Beach Road Bridge)
- Water Treatment Plant Access Road over the Union Pacific Railroad tracks (Treatment Plant Access Road Bridge)
- State Trunk Highway 64 under State Trunk Highway 35 (STH 35 Bridge)
- State Trunk Highway 64 under State Trunk Highway 35 and County Trunk Highway E (STH 35/CTH E Bridge)

See Figure 6.1 for locations.

Three of the bridges pass over the main TH 36/STH 64 corridor and will be visible to a large number of motorists. Two of the bridges—Beach Road and STH 35—form gateways to the St. Croix River Valley and to the new river crossing. The visual quality planning process determined that these two structures were very important visually as gateways to the scenic valley.

6.2 Beach Road Bridge

6.2.1 Context and Existing Conditions

The existing Beach Road Bridge will be replaced with a new bridge just west of the existing crossing over TH 36. The current Beach Road Bridge marks the transition from the developed areas in Oak Park Heights and Stillwater above the river bluff into the scenic St. Croix River Valley. Approximately one half of the length of the proposed bridge is a curved section, so the probable structure type is a curved steel plate girder bridge. The structure depth will be approximately seven feet.

6.2.2 Evaluation Criteria and Guidance

VQRC guidance provided strong direction that Beach Road was an important portal to the river valley. Traveling east, it helps to define the transition from the urban area of the Oak Park Heights and Stillwater commercial area to the St. Croix River Valley. The Beach Road Bridge also creates an entry onto the new extradosed river bridge. The VQRC expressed the desire to tie this over crossing structure to the context of the river valley, which includes historical, cultural, and geological resources. Examples of these resources are expressed by the rock outcroppings prevalent along TH 95 and stone retaining walls prominent along roadways in the area. The desire to reflect the existing context, together with the bridge’s function as an approach portal to the new river crossing with its modern construction form, provides an interesting dichotomy for form, structure, and visual quality.

6.2.3 Recommendations

It is recommended that the Beach Road Bridge be constructed with a two span arrangement with the one pier located between westbound TH 36 and the TH 95 on-ramp. The exact geometry and horizontal clearances will be developed during the preliminary bridge design phase with the intent to create a clean, open, balanced appearance.

The visual preference established through the visual quality planning process considered the Beach Road Bridge and the STH 35 Bridge in Wisconsin as portals
or gateways to the scenic St. Croix River Valley. As drivers approach Beach Road from the west, their field of view will be narrowed and focused by the bridge, easterly towards the river bridge and the Wisconsin bluff. Likewise the STH 35 Bridge on the Wisconsin bluff provides a similar experience when approaching the river from the east. The VQRC recommended that these two bridges have similar design features.

The visual concept that was developed for the Beach Road Bridge played off the relationship between the river crossing bridge, the approaches to the river crossing and the gateway characteristics of the over crossing structures on either side of the river. The curved elements, materials, and finishes from the river bridge were incorporated into the Beach Road Bridge through the use of precast concrete fascia panels, smooth
curved barriers/parapets, and curved metal railings. The piers were tapered in both the longitudinal and transverse direction, wider at the ground line and narrow below the pier cap. The abutments were battered toward the ends of the bridge with flared wingwalls. Natural limestone or simulated limestone was preferred as the surface finish for the abutments and wingwalls.

After reviewing the bridge concept in the draft Visual Quality Manual, representatives from Oak Park Heights commented that the concept for the Beach Road Bridge was not appropriate for the city. A revised design that uses more traditional bridge elements including limestone or simulated limestone was developed. The revised concept is a two span steel plate girder structure; the girders would be painted brown or dark brown. The multi-columned piers are faced with a simulated limestone finished with a multi-colored stain. Abutments are vertical and wingwalls are parallel with the bridge alignment, and the surfaces are treated with a coursed limestone pattern similar to the piers. Concrete barriers/parapets are also faced with simulated stone, and tall end posts are incorporated at the ends of the bridge to terminate the ornamental metal railing. The ornamental railing would be a traditional picket design and painted to match the steel girders. This revised concept is shown graphically in Figures 6.2 and 6.3. Figure 6.4 is the visualization showing the view travellers entering the river valley will see.

The Beach Road Bridge will be further refined in the preliminary and final bridge design phases and will consider the natural, historical, and cultural aspects of its location, and also its sense of continuity and compatibility with other structures and project elements in the corridor.

6.3 STH 35 Bridge

6.3.1 Context and Existing Conditions

State Trunk Highway 64 will be on new alignment in this area. STH 35 is located a short distance back from the bluff line of the St. Croix River Valley at the location of the proposed STH 35 Bridge. The highway forms the edge of the agricultural land to the east, and the dense river forest to the west. Homes, nearly invisible from the highway, dot the top of the bluff west of STH 35.

The bridge carrying Wisconsin State Trunk Highway 35 over STH 64 and the Loop Trail is shown in the layouts developed for the SFEIS as a two-span prestressed concrete beam bridge. The Loop Trail is separated by a concrete barrier for consistency with the Combination Traffic Rail on the River Bridge as it joins the roadway on the northern edge of the westbound lanes on its approach to the new river crossing bridge. A similar barrier is recommended for the south side of STH 64 from the River Bridge abutment wingwall, extending past the abutment of the STH 35 Bridge as discussed in Chapter 4. The profile for STH 64 was set to develop a compromise between keeping the height of the River Bridge as low as possible, while minimizing the impacts to the Wisconsin bluff (see Figure 6.5). The two Wisconsin bridges—STH 35 and STH 35/CTH E—have been planned and budgeted as prestressed concrete beam bridges. This bridge type is economical and low maintenance, and is the preferred bridge type where span, length, geometry, and depth of structure allow.

6.3.2 Evaluation Criteria and Guidance

Observations made regarding Beach Road and the entryway to the scenic St. Croix River Valley, and the approach to the extradosed spans of the new river
6.3.3 Recommendations

The entry to Wisconsin for eastbound travelers is important and described later, but the most dramatic affects are for the westbound travelers, so the recommendations in the VQM concentrate on the conditions for the westbound traveler. STH 64 has crossed several miles of open agricultural land where views are controlled and the visual field has been narrowed by the hedgerow landscape concept described in Chapter 4. For the approach to the scenic Lower St. Croix River Valley, the goal is to communicate a sense of the special place the travelers will soon enter. The underpass at STH 35 presents an opportunity to further narrow the visual field using the hedgerow plantings leading up to the underpass. The Loop Trail, on the north side of the road, draws closer and becomes adjacent to the highway, as STH 64 enters a cut section in preparation for entering the river valley. A barrier separates the highway from the Loop Trail, narrowing the field of vision to the right. On the south side of the highway, a similar barrier is located at the edge of the shoulder, and the embankment for STH 35, that is planted heavily with trees, narrows the view to the left. There is a median barrier between the eastbound and westbound roadways that also narrows the field of view, in addition to its primary purpose as a safety feature. These visual clues may result in an unconscious slowing of the speed that will increase anticipation and the dramatic effect of the entrance to the valley (Figure 6.6).

The single-span bridge with abutments set about 10 feet behind the barrier of EB STH 64, and at the back of the Loop Trail on WB STH 64, will control and focus the view of the valley through this portal. Because STH 64 has a narrow median at this location, a single-span bridge can be used.

The recommended visual treatment uses the STH 35 Bridge as a portal to the scenic St. Croix River Valley. Views of the valley occur only as the driver follows the right-hand curve under STH 35. The extradosed spans of the new river crossing will be immediately viewable as the driver passes under STH 35, and the first tower and cables will feel close by. Eliminating the center pier and creating a single-span bridge accomplishes two objectives. A dramatic effect is anticipated of approaching the river spans and their towers and the cables. Also anticipated is a heightened sense of transition, leaving rolling terrain of Wisconsin behind and leaping out over the river. Over the Wisconsin shoreline, near the first tower—just a few hundred feet from the STH 35 portal—travelers will be 160 feet above the river surface, and have a spectacular view of the river valley.

The material of the deck, fascia panels, and barriers (concrete) and the form of the bridge (strong vertical and horizontal lines) will tie the STH 35 Bridge to the new river crossing. Figure 6.7 shows the recommended treatment of curved fascia panels to suggest the rounded soffit of the organic concept of the river bridge. Use a simulated limestone masonry facing on the abutments and wingwalls. A natural stone appearance will tie the bridge to the scenic beauty and geologic context of the valley. While rock does not occur on the surface...
Chapter 6
Grade Separation Bridges

Figure 6.2
Beach Road Plan and Elevation Views
FIGURE 6.2
Beach Road Plan and Elevation Views
Figure 6.3
Beach Road Sections and Detail
FIGURE 6.3
BEACH ROAD SECTIONS AND DETAIL
Figure 6.4
Beach Road Visualization (EB)
VQM

FIGURE 6.4
Beach Road Visualization (EB)
FIGURE 6.5
STH 35 Plan and Elevation Views
FIGURE 6.5
STH 35 PLAN AND ELEVATION VIEWS
FIGURE 6.6
STH 35 Visualization (WB)
Figure 6.7

STH 35 Sections and Details

Transverse Section

(PREFERRED ALTERNATE)

Alternate Fascia Detail
FIGURE 6.7
STH 35 Sections and Details
along this section of the east side of the St. Croix River Valley, the stone should connect this eastern end of the new river crossing with the western end as symbolized by the Beach Road Bridge. Short concrete wingwalls, or end posts, will be parallel to STH 35. The curved stone-faced walls will be tangent to STH 64, curving into the embankment slopes, with sloping front faces.

The recommended superstructure type is prestressed concrete beams. An alternative detail to the concrete fascia panels detail is also shown in Figure 6.7 in case budget limitations require the elimination of the curved fascia panels. A standard fascia detail can be modified so that the deck overhang meets the bottom of the top flange cleanly at a single point, with a single plane. The fascias should have a short overhang, and the soffit should curve smoothly to the combination traffic barrier. Since STH 35 is on a very flat profile, there is a small amount of asymmetry, as the Loop Trail is on the north side of STH 64, and the maintenance area behind the barrier on the south side of STH 64 will place the abutment end slopes at slightly different distances from edge of traveled way for the eastbound and westbound roadways. The visual masses of the abutments and retaining walls should be balanced, rather than striving for symmetry about the center line of STH 64. For westbound vehicles traveling around the curve, the lack of horizontal symmetry will be far less noticeable than the visual mass of the two abutments.

The traffic barriers on the STH 35 Bridge will be a combination traffic rail, a concrete base with a steel tube above. This railing will reduce the visual bulk of the bridge to travelers on STH 64, and it will allow a better vista of the river valley to travelers on STH 35. The southbound (west) shoulder of STH 35 on the bridge will be a natural gathering place for cyclists and pedestrians who might use STH 35 because of the vista of the river valley and new river bridge. No accommodations to attract additional visitors to this spot should be made, as such a gathering on the shoulder of a roadway may result in less safe conditions. With the expectation that the highway shoulder on the bridge will be an attractive stopping place, a two-tube metal railing will be placed on top of the combination traffic barrier.

The roadway slopes up (cut section) on each side of STH 64 are approximately 25 feet tall. Since there is a stormwater pond immediately east of STH 35 on the south side of STH 64, and since runoff into the river valley is controlled, there should be no drainage swales on either side of the highway immediately under the bridge. This will draw in the end slopes of the bridge, helping further to narrow the field of view. The landscape guidance suggests holding the side slopes to a maximum of 1 vertical to 3 horizontal where that can be maintained to make slope maintenance and planting easier. Minimizing the amount of bluff impacted on the river valley side of STH 35 may lead to steeper slopes west of the bridge. The landscape type proposed east of STH 35 is hedgerow, but it will transition to the denser existing river terrace forest near the bluff line. The disturbed areas of the slopes will be planted behind the barrier to the south, and behind the Loop Trail to the north. This planting will partially screen the bridge wingwalls, helping the bridge to visually blend into the landscape.

For the eastbound motorist, STH 35 represents the entryway into Wisconsin. Because the west edge of the bridge is visible from the St. Croix River Valley, the desire is to minimize visual intrusion into the scenic river valley. Wisconsin entry signs will be placed east of the STH 35 Bridge, and non-structural items, where possible, will not be attached to the bridge. Traveling eastbound, the STH 35 gateway opens up to a gently rolling pastoral landscape, suddenly leaving the heavily wooded river valley and the steep slopes.
6.4 STH 35/CTH E Bridge

6.4.1 Context and Existing Conditions

The interchange that contains this bridge is located on a new alignment of both STH 35 and CTH E. The area is currently agricultural land.

The Wisconsin State Trunk Highway 35 and St. Croix County Trunk Highway E bridge over STH 64 will be a two-span precast, prestressed concrete beam bridge. Normal practice is to not carry a ditch section under a bridge, but to provide a culvert for longitudinal drainage where required. This standard brings the end slopes closer to the roadway under the bridge, and shortens the spans. The bridge is proposed as a conventional structure, to match the remainder of the bridges on STH 64, with the exception of the STH 35 Bridge discussed in the previous section.

6.4.2 Evaluation Criteria and Guidance

The VQRC provided guidance that this bridge should be viewed as a transition between the new river crossing bridge and the existing grade separation bridge at 150th Avenue, the project’s eastern limit. Additional guidance is for the bridge structure to be similar to the bridge at 150th Avenue. A desire to incorporate local, natural materials to tie the STH 35/CTH E Bridge to the STH 35 Bridge was also expressed.

6.4.3 Recommendations

The treatment for the existing bridges in the STH 64 corridor to the east is stub/semi-integral abutments set at the top of the end slopes. This minimizes abutment size and the size and visual mass of the wingwalls. The pier is a multi-column frame with square columns and square ends. The pier cap has circular haunches between each set of columns. A simple rustication treatment of vertical grooves is applied to the pier columns, wingwalls, and abutment faces. The visual intent for the STH 35/CTH E Bridge is to match the bridges on the STH 64 corridor located east of the project area. Figures 6.8 and 6.9 show the recommended treatments. The color of the finished concrete surfaces will match the treatment of the 150th Avenue Bridge.

The landscape in the interchange area is proposed as Oak Savanna. The slopes of the embankment for STH 35/CTH E will have clusters of upper story trees that provide for sight lines, clear zones, and snow storage. Ground cover is grasses and other low-lying types of vegetation. The views to the wingwalls will not be screened by this type of landscape. See Chapter 4 for additional landscape detail.

Slope paving will consist of crushed stone matching the color of the stone treatment used at the Beach Road Bridge and the STH 35 Bridge for continuity. A clear binder is recommended to allow the color to be visible (Figure 6.10).

6.5 Treatment Plant Access Road Bridge

6.5.1 Context and Existing Conditions

The proposed Treatment Plant Access Road Bridge is a new structure, crossing over relocated railroad tracks just north of the TH 36/TH 95 interchange in Minnesota. The road passes through dense river terrace forest and serves an industrial area screened by heavy vegetation.

The layouts developed for the SFEIS show the bridge carrying the Treatment Plant Access Road over the extended Union Pacific Railroad tracks as a three-span...
FIGURE 6.8

STH 35/CTH E PLAN AND ELEVATION VIEWS
FIGURE 6.8
STH 35/CTH E Plan and Elevation Views
Figure 6.9
STH 35/CTH E Sections and Details

Transverse Section

Pier Elevation

Rustication Detail

Column Section

Transverse Section and Pier Elevation
FIGURE 6.9

STH 35/CTH E SECTIONS AND DETAILS
6.5.2 Evaluation Criteria and Guidance

Because this bridge is screened from view from most motorists, residents, and visitors in the project area and no roadway passes under the structure, limited aesthetic enhancements have been planned. Providing access primarily to industrial uses, it is appropriate for aesthetic treatments to be limited. Consequently, minimal specific guidance and criteria have been provided by the VQRC for this structure.

6.5.3 Recommendations

Utilize good design practices that consider the entire structure, rather than structurally optimizing individual components without regard to the effect on proportions and other elements.

The interaction between the vertical clearance requirements and the horizontal clearance requirements for railroad tracks and adjacent maintenance roads, allows radial piers to be used at this location with little penalty for the clear span over the railroad on this highly skewed crossing. The beams must allow a minimum of 23 feet of vertical clearance over the railroad, but the horizontal distance for this clearance extends only 9 feet from the centerline of the tracks. Much larger horizontal clearances are required, both on the side of the tracks that have a maintenance road, and the opposite side of the tracks. This means that a cantilevered pier cap up to approximately 8 feet deep can encroach within the horizontal clear area. This allows single column piers supporting the curved steel beams to be placed radial to the Treatment Plant Access Road (see Figure 6.11). The ends of the pier cap should be approximately equal to the beam depth to maintain a good sense of proportion. Use radial piers and radial abutments to simplify the appearance of the bridge, simplify the design, and simplify the fabrication of beams and construction of the other bridge elements. The resulting span arrangement is well balanced and efficient, with span lengths of approximately 78 feet, 100 feet, 78 feet.

All elements and treatments of the Access Road Bridge are conventional. Standard F Rail safety barriers should be used. See Transverse Section on Figure 6.12. The curved steel beams are concentric and constant depth. Use single column piers with a cap beam that tapers from approximately 8 feet deep at the column to approximately 4.5 feet deep. The top of the pier cap...
should be parallel to the superelevation of the roadway, resulting in a two percent grade along the length of the cap. The underside of the cantilevers should slope upward at approximately 1 vertical to 6 horizontal. Because of the superelevation, the slopes on each side of the cap will be slightly different. The column and the cap ends should be vertical, and rounded. No rustication is recommended. See Pier Elevations on Figure 6.12. The abutments are standard parapet abutments, set radial to the Access Road. The wingwalls are concentric to the Access Road. The exposed heights of the abutments will vary as a result of the radial abutments intersecting the cut slopes at different angles.

On the west end of the south abutment, a large retaining wall parallel to the railroad tracks will be required from the abutment south, until the grade of the Access Road is low enough for the side slope from the railroad drainage ditch to meet the roadway grade. Preliminary layouts show this wall to be approximately 200 feet long, and varying in height from approximately 25 feet tall at the abutment to less than 5 feet tall at the south end. A cast-in-place concrete cantilever retaining wall is recommended. Use a surface treatment that includes an area of simulated limestone masonry. The simulated masonry should start approximately three feet above finished grade, and extend upward as far as necessary to create a well proportioned area. The area should not reach the top of the wall or barrier on top of the wall. Where the simulated masonry comes within about two feet of the top of the wall, the height should be reduced, parallel to the simulated courses of stone. A band of smooth concrete should be located between the formliner pattern and the abutment corners (Figure 6.12) and at vertical joints in the retaining wall. The desired effect is of an area of stone veneer, and not of a stone wall or abutment. Avoid the appearance of narrow triangular slivers of stone caused by sloping grades at the top or bottom of the wall. Avoid the difficulty of matching courses across vertical joints. The color system used on the finished surfaces of the abutments and the piers is a single-color system. Crushed stone slope paving is recommended between the abutment faces and the bottoms of the railroad ditches under the bridge.
FIGURE 6.11
Water Treatment Plant Access Road Plan and Elevation Views
**FIGURE 6.11**

**Water Treatment Plant Access Road Plan and Elevation Views**
Figure 6.12
Water Treatment Plant Access Road Sections and Details
Figure 6.12
Water Treatment Plant Access Road Sections and Details