PROPOSED CONCEPT PLANS

Design Standards

The standards proposed for the design of Pioneer Road will meet criteria published in both AASHTO's *A Policy on Geometric Design of Highways and Streets* and the Wisconsin DOT *Facilities Development Manual.* Compliance with these standards is necessary to retain eligibility for both Federal and State Highway Funding.

The proposed Design Standards for Pioneer Road are shown in ***Table 4***.

Table 4
Pioneer Road - Design Standards

Proposed Speed Limit	35 mph
Future Design Level of Service	LOS "D"
Lane Widths	
Through Lanes	
Maximum	11 feet
Desirable	12 feet
Turn Lanes	
Maximum	10 feet
Desirable	12 feet
Cross Slope	2 percent
Maximum Horizontal Curvation	11 degrees 15 minutes
Maximum Vertical Gradient	5.5 percent
Minimum Stopping Sight Distance	
Crest Vertical Curve	275 feet
Sag Vertical Curve	275 feet
Overpass Minimum Vertical Clearance	
Above Roadway	15 feet 3 inches
Above Railroad	23 feet 0 inches
Storm Water Design	
Rainfall Recurrence Interval	
Roadway Storm Sewer	10 years
Underpass Storm Sewer	50 years/check 100 years
Curb and Gutter	30 inch, Type D
Bike/Pedestrian Path	
Width	10 feet
Maximum Gradient	6 percent
Bridge Design Loading	
River Bridge	HS20
Railroad Bridge	Cooper E80
Roadway Lighting	Signalized Intersections Only

Unique Roadway Segments

Analysis of the existing development patterns and the traffic volumes forecasted for Pioneer Road results in the identification of three unique roadway segments. The segments are Military Road to Park Avenue; Park Avenue to CTH V; and CTH V to USH 45. The characteristics of each segment will influence the development of the roadway cross-sections for that segment. Following is a list of the characteristics for each of these three roadway segments:

Military Road to Park Avenue Segment

- High traffic volume forecast of nearly 40,000 vehicles per day in 2020. Requires a minimum of 2-lanes in each direction.
- Adjacent commercial and industrial development including: International Paper, Mercury Marine, Badger Liquor, Hardy's Restaurant and others.
- Numerous high demand access points that service shift changes at the industries and peak periods at the commercial sites.
- High volume railroad crossing that currently carries 34 trains per day with a 50% increase expected by 2020.
- Bridge crossing over the Fond du Lac River.
- Very high volume crossing traffic on Main Street, Military Road, and Hickory Street. These are all arterial roadways serving downtown.
- Requires accommodation of a Bike/Pedestrian path and provision for future sidewalk.

Park Avenue to CTH V Segment

- Moderate forecasted traffic forecast of approximately 23,000 vehicles per day can easily be accommodated with 2-lanes in each direction.
- Adjacent residential development with most of the access on side streets or interior streets.
- Adjacent Middle School that has significant pedestrian demand.
- Few direct access points to Pioneer Road.
- Moderate volume on the cross streets.
- Requires accommodation of a Bike/Pedestrian path and provision for future sidewalk.

CTH V to USH 45 Segment

- Light traffic volume forecast of approximately 5,000 vehicles per day can be accommodated on a 2-lane road.

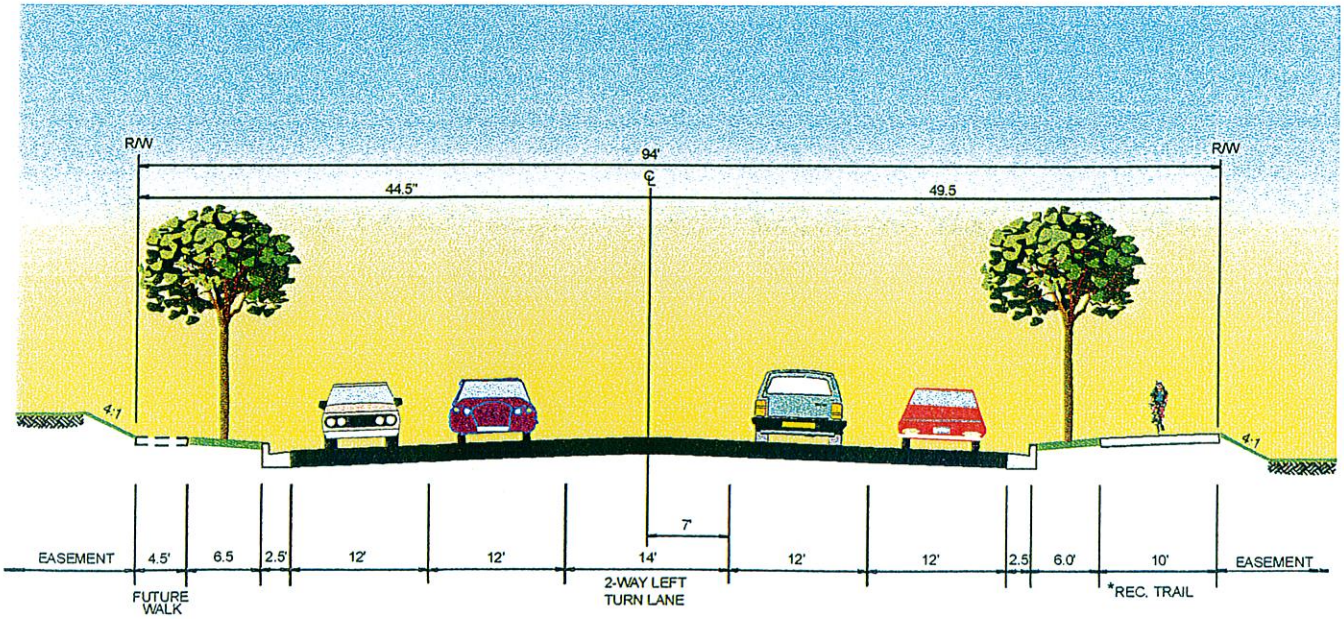
- Adjacent residential development with no high traffic volume driveways.
- Numerous residential access points.
- Low volume cross streets that serve residential areas.
- Requires provision for future sidewalk.

Proposed Typical Roadway Cross-Sections

Military Road to Park Avenue Segment

Three alternative roadway cross-sections were considered for the segment, one 6-lane and two 4-lane. The project advisors rejected the 6-lane cross-section due to the high cost and because it would cause considerable damage to adjacent property. The two 4-lane alternatives varied only with respect to the median. One cross-section had a 20-foot wide raised, landscaped median. The other cross-section had a 14-foot center two-way left turn lane (TWLTL) as a median. Both alternatives were presented to the TAC and at the public informational meeting. As a result of public comment, the project advisors favored the cross-section with the 14-foot TWLTL. The proposed roadway cross-section for Pioneer Road from Military Road to Park Avenue is shown in ***Figure 15***.

Figure 15
Proposed Cross-Section for Pioneer Road - Military Road to Park Avenue



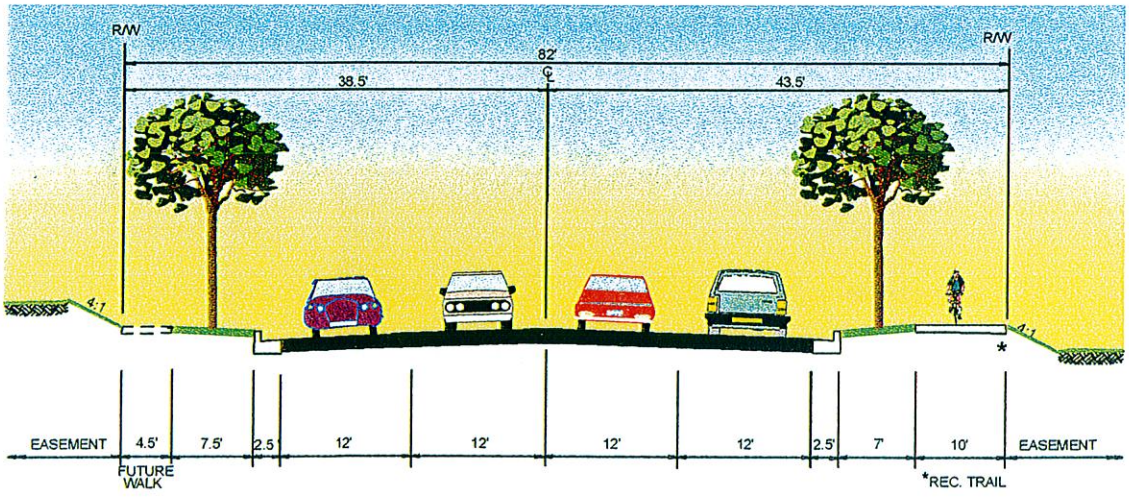
5-LANE URBAN
WITH A CENTER 2-WAY LEFT TURN LANE

* REC. TRAIL BEGINS AT THE C&NW R/W WEST OF HICKORY STREET

Park Avenue to CTH V Segment

Three alternative roadway cross-sections were also considered for this segment. All of them were 4-lane roadways. One alternative was a 4-lane urban section with a 14-foot TWLTL. This was rejected by the project advisors because the continuous left turn lane was not necessary, as there is not a lot of direct access to adjacent parcels in this segment. The other two alternatives varied only with respect to the median. One alternative had a 20-foot raised landscaped median and the other had no median. Both of the alternatives were presented to the TAC and at the public informational meeting. As a result of this input, the project advisors favor the alternative with no median, except for the portion of the street in front of Theisen School. In order to provide a safety refuge in the center of the street for those pedestrians that cross the roadway at mid-block locations the proposed roadway cross-section for a 1,000 foot segment in front of the school will include an 8-foot wide raised median. The proposed roadway cross-section for Pioneer Road from Park Avenue to CTH V (except in front of Theisen School) is shown in ***Figure 16***. The proposed cross-section for Pioneer Road in front of Theisen School is shown in ***Figure 17***.

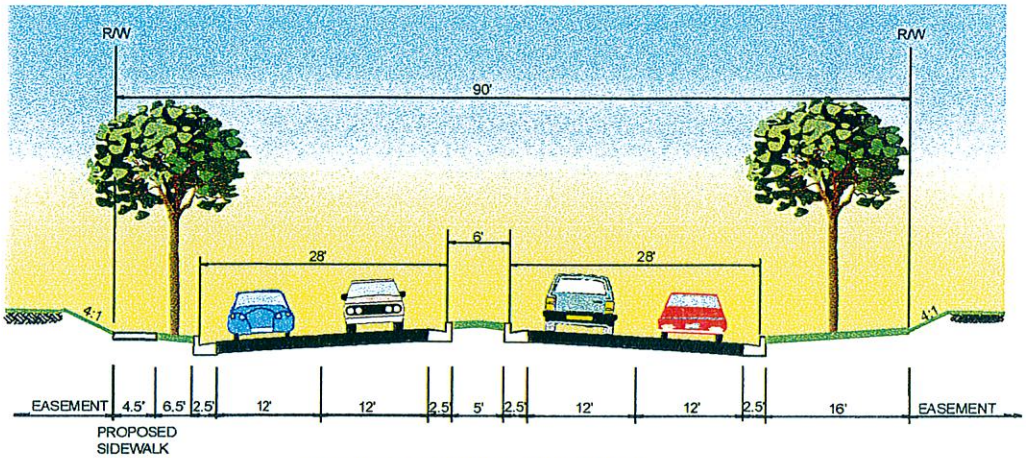
Figure 16
Proposed Cross-Section for Pioneer Road - Park Avenue to CTH V



4-LANE URBAN
DESIGN CLASS 3

*REC. TRAIL ENDS AT MARTIN ROAD

Figure 17
Proposed Cross-Section for Pioneer Road past Theisen School



*SIDEWALK ON NORTH SIDE BETWEEN MARTIN ROAD AND W. SCHOOL DRIVE

4-LANE URBAN / MEDIAN
DESIGN CLASS 4

CTH V to USH 45 Segment

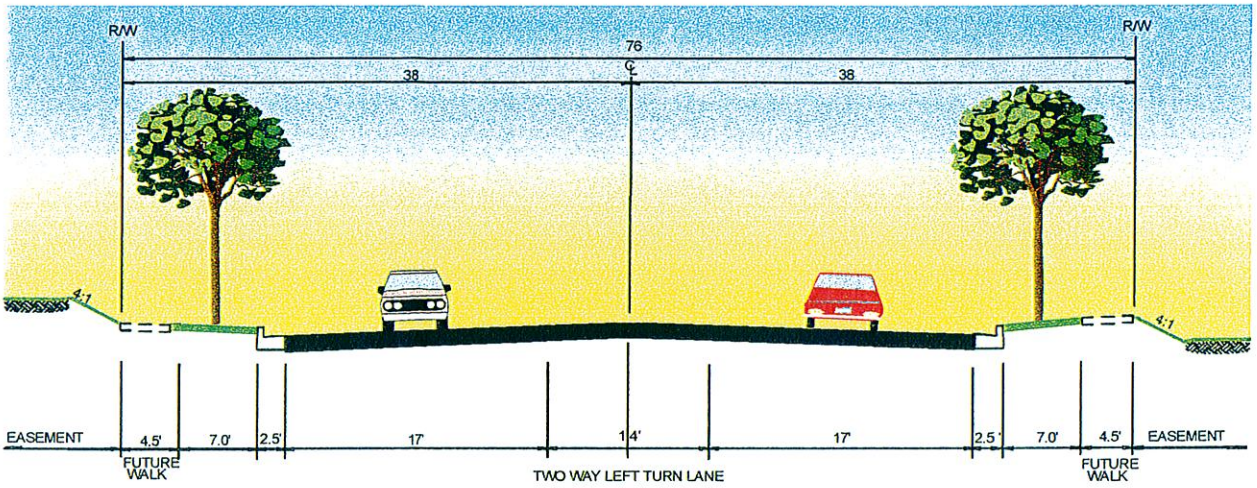
Three alternative roadway cross-sections were considered for this segment. They were defined as follows:

- A 2-lane 36 foot (F-F) roadway
- A 4-lane 52 foot (F-F) roadway
- A 2-lane 52 foot (F-F) roadway

This is a short segment and it has intersections at both ends that require turn lanes in addition to the through lanes to handle the forecasted traffic. The 36 foot wide cross-section will not be wide enough to accommodate the turn lanes. Further more, when the traffic volumes increase beyond the design year of 2020 it may be necessary to lengthen the turn lanes or increase the number of through lanes. If and when traffic volumes increase the street would need to be completely reconstructed at significant additional cost and disruption. Because of that possibility, the project advisors rejected the 36-foot wide alternative.

The other two alternatives vary only in regard to how the lanes are striped--whether the street operates as a two-lane or a four-lane roadway. After further analysis the recommendation is to stripe this segment as a two-lane roadway with a center two-way left turn lane (TWLTL). The center turn lane will provide a safer operation for traffic to left turn into or out of the numerous residential driveways along the segment. The proposed roadway cross-section from Pioneer Road from CTH V to USH 45 is shown in ***Figure 18***, following page.

Figure 18
Proposed Cross-Section for Pioneer Road - CTH V to USH 45



2-LANE URBAN
DESIGN CLASS 3

Railroad Grade Separation Study

The WCL track crossing between Hickory Street and Morris Street was investigated to determine if a grade separation is needed. As described in the preceding chapters, a grade separation is warranted at this location. This section describes the investigation, analysis and preliminary design conducted in association with the proposed railroad grade separation at this location.

Railroad Overpass versus Underpass

The WCL railroad is located between Hickory Street and Morris Street. Hickory Street is an arterial roadway that interchanges with USH 41 approximately 1,500 feet south of Pioneer Road and runs north into the City. Morris Street runs north-south and serves several large businesses in the vicinity of the Pioneer Road intersection. It is important that both of these side streets continue to intersect with Pioneer Road in the future.

The possibility of a bridge that carries Pioneer Road over the railroad was investigated. A bridge over the railroad must provide a minimum of 23 feet clearance between the rail and the bottom of the bridge. To maintain intersections at Hickory Street and Morris Street, steep gradients on both approaches of the overpass would be required. A 6.5% gradient would be required on the west side and an 8.5% gradient would be required on the east side (see ***Figure 19,*** following page). These gradients are too steep and violate project design standards. It was concluded that a bridge over the railroad is not a viable at this location.

A railroad underpass was also investigated. In this configuration, the Pioneer Road profile would be lowered to pass under the railroad. The railroad would pass over the lowered Pioneer Road on a bridge. There must be a minimum clearance between the roadway and the bottom of the railroad bridge of 15-feet 3-inches. Because less clearance is required for a railroad underpass this configuration is possible without violating project design standards. A railroad underpass is feasible and is the preferred method of grade separation. The setting of the Pioneer Road profile and selection of the railroad bridge structure are largely a function of the underpass drainage.

Underpass Drainage

Pioneer Road will pass under the railroad in a sag vertical curve, creating a sump situation at the bottom of the sag. Draining stormwater from the sump is a critical element in the design of the underpass. The underpass sump must be designed to drain a 50-year rainfall event and operate safely during a 100-year event. The underpass can be drained in two fashions—by a gravity storm sewer to the East Branch of the Fond du Lac River or by a mechanical storm sewer pump station that outfalls to the Fond du Lac River.

FIGURE 19 ROADWAY OVERPASS

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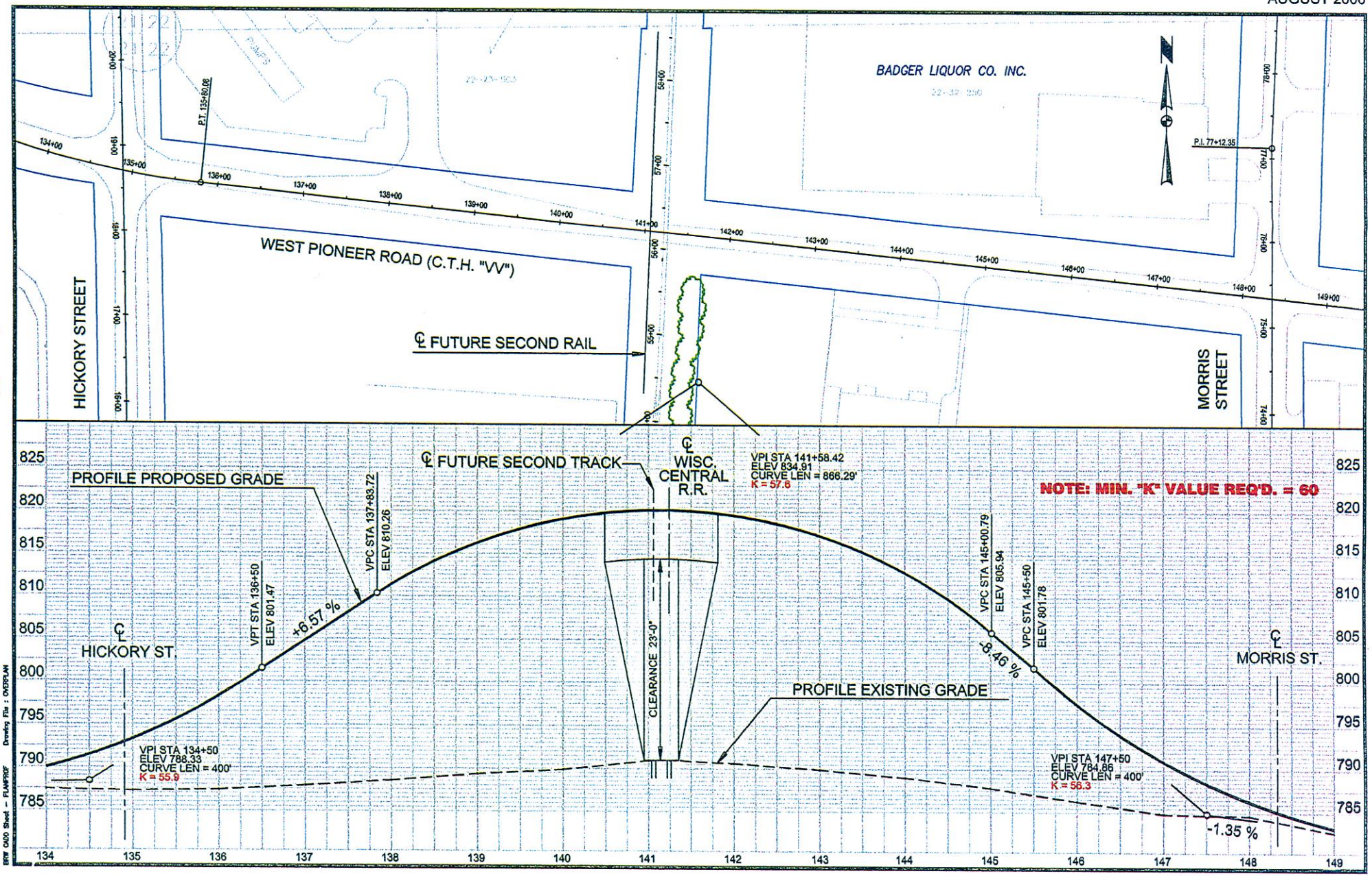

An analysis was conducted to determine if the underpass could drain the 50-year storm to the River by gravity. A swale will be required along the north and south sides of the underpass to intercept storm water before it enters the sump. Five inlets per side will be necessary to collect the remaining roadway water--one inlet per side along both tangents and three inlets per side at the bottom of the sag. The storm sewer gradient from the bottom of the sump to the river is critical. The roadway profile must be kept as high as possible to convey storm water to the River under this option. If the railroad is raised approximately 6 inches and the railroad bridge depth (top of rail to underside of deck) is kept to a maximum of 4.25 feet, the roadway sump can be drained by gravity to the River. A Thru Plate Girder type bridge is the only structure type that will meet the 4.25 feet depth requirement. Calculations indicate that stormwater runoff from a 50-year storm can be conveyed by gravity to the River against a 100-year tailwater in the River. The chances of a 50-year storm and a 100-year tailwater occurring at the same time are very low. A horizontal elliptical pipe was used to maximize pipe slope. The horizontal elliptical pipe ranges in size from 24-inches x 38-inches to 29-inches x 45 inches. The pipe would be laid at a 0.12% slope. The storm sewer alignment shifts to the north at a junction located approximately 400 feet from the River. This reduces the length of the pipe and due to the channel slope allows the outfall to operate against a slightly lower tailwater. A permanent easement would be required from two properties to construct this storm sewer outfall. See ***Figure 20-1*** and ***20-2*** (pages 27 and 28) for plan and profile drawings showing this configuration.

A storm sewer pump station was also considered. The pump station would lift stormwater from the roadway sump into to a much shallower storm sewer system that drains to the River. Roadway gradient would be less of a concern and a variety of railroad bridge types would be feasible including both concrete and steel girder structures. The storm sewer pump station requires a second, independent power source to ensure operation during large storm events. The initial cost of the storm sewer pump station is approximately $250,000. The cost of a second power source was approximately $100,000. The storm sewer pump station would also require regular scheduled maintenance.

After carefully considering the higher initial cost and the maintenance requirements of the pump station, draining the underpass by gravity was selected as the preferred option by the project advisors. This means that a Thru Plate Girder bridge is the only bridge type that can be used.

Underpass Right-of-Way and Cost Considerations

Two options for the Thru Plate Girder bridge span configuration and length were investigated. The length of the bridge depends primarily on the treatment of the cut slopes and their effect on the amount of right-of-way needed. The first option investigated was a 2-Span Thru Plate Girder Bridge. The second option was a 4-span Thru Plate Girder Bridge.

FIGURE 20-1 RAILROAD OVERPASS

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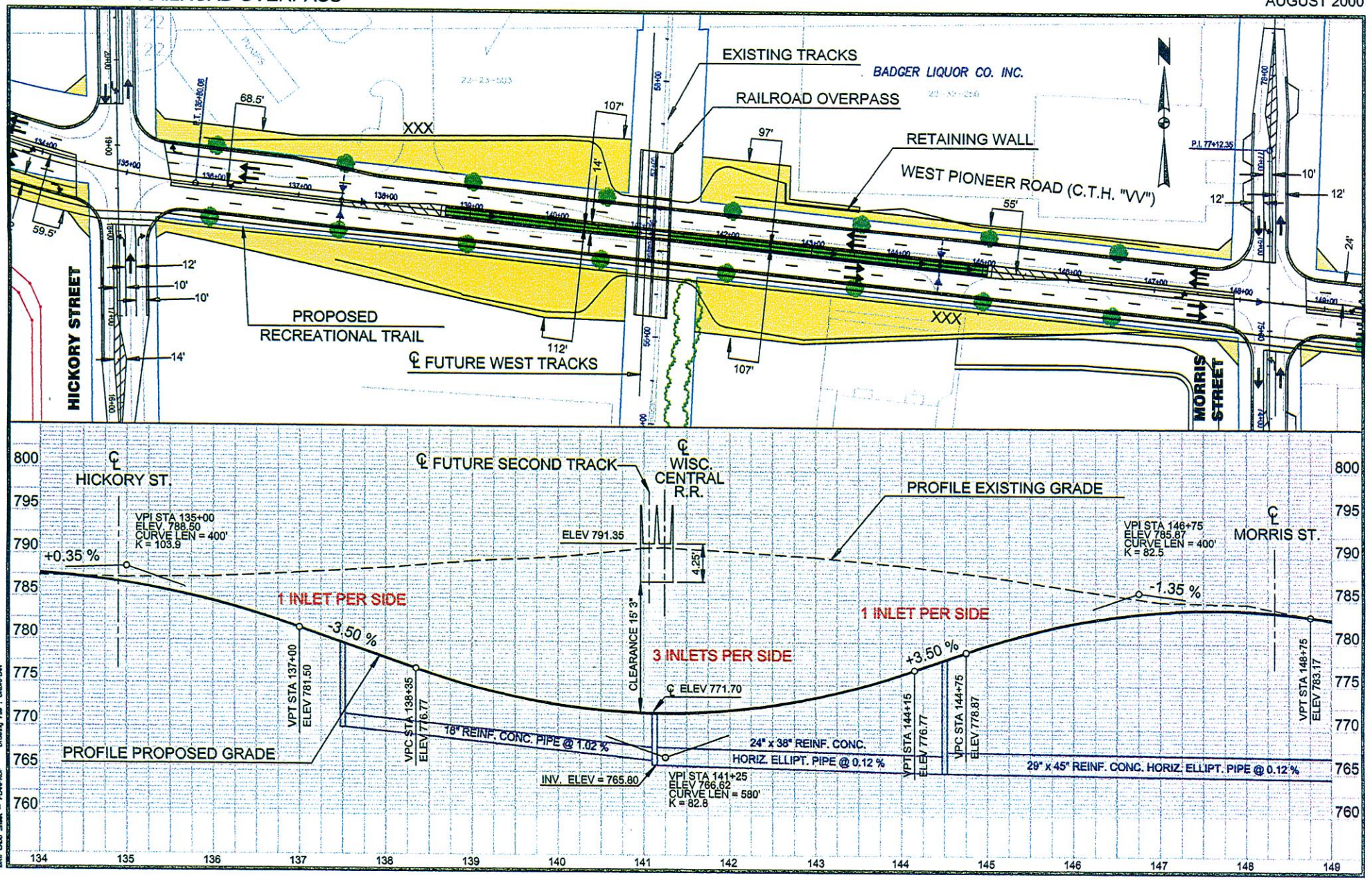

FIGURE 20-2 RAILROAD OVERPASS DRAINAGE OUTFALL

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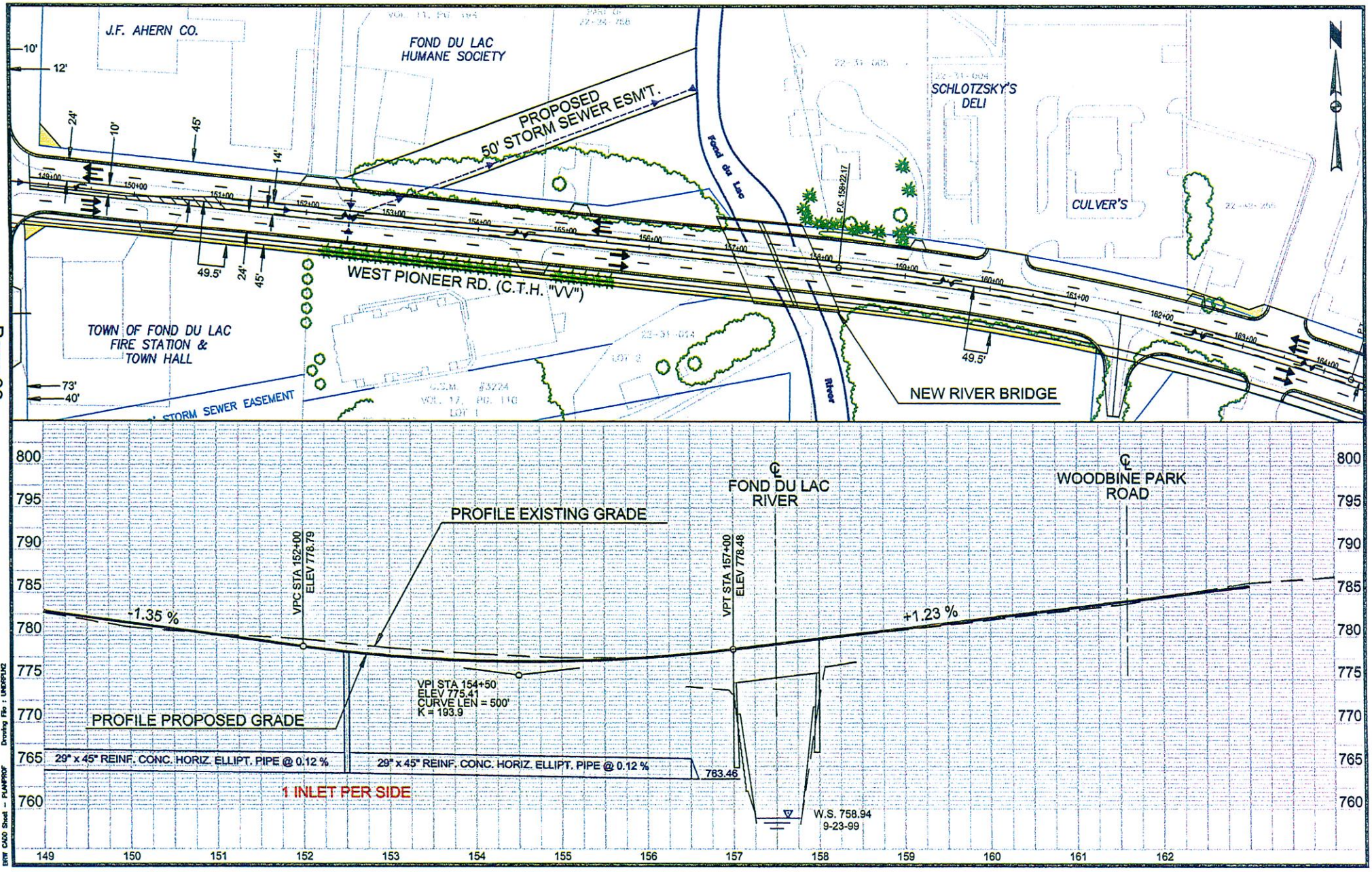

The 2 span Thru Plate Girder Bridge has a depth of 4.25 feet. The bridge has high, retaining wall abutments and a center pier. The bridge is 36 feet in width and accommodates two mainline tracks. The total length of the bridge is 104 feet (see ***Figure 21,*** page 30).

The 4 span Thru Plate Girder Bridge also has a depth of 4.25 feet. The bridge has a center pier and piers located in both terraces. The bridge has open-end spans with small, sill type abutments supported on piling. The total length of the bridge is 162 feet (see ***Figure 22,*** page 31).

The main difference between the two bridge alternatives involves the treatment of the roadway cut slopes. The 2 span option uses retaining walls that parallel the roadway on both sides of the railroad bridge (see ***Figure 23,*** page 32). This minimizes the right-of-way impact in the vicinity of the bridge.

The 4 span option utilizes 3:1 side slopes that require significantly more right-of-way. A small retaining wall will still be required in the northeast quadrant, near the Badger Liquor building (see ***Figure 24***, page 33).

Costs associated with the bridge options are shown in ***Table 5***.

Table 5
Railroad Bridge Construction Costs*

Bridge Description	Bridge Cost	Wall Cost	Earth-work Cost	R/W Cost	Total
2-Span Thru Plate Girder	$587,800	$630,000	$320,000	$34,000	$1,571,800
4-Span Thru Plate Girder	$705,700	$120,000	$391,000	$110,200	$1,326,900

*note: The above estimate does not include items with identical costs that are common to both options. Railroad Bridge costs assume two mainline tracks.

Both options were presented to the public. The savings in retaining wall construction cost in the 4 span option more than offsets the additional right-of-way cost and bridge construction cost. On this basis, the 4 span 162 foot long Thru Plate Girder Bridge was selected.

Geotechnical Analysis

A single boring was advanced to a depth of about 70 feet, just northwest of the existing railroad crossing site. Subsurface conditions encountered consisted of about 11 feet of loose fill over lean clay, sand and sandy clay, which is typical of the. The boring did not extend to bedrock. Groundwater was encountered in the fill material, above the clay. Native soils appear suitable for either spread footing or driven pile bridge foundations.

FIGURE 21 2-SPAN THROUGH PLATE GIRDER BRIDGE

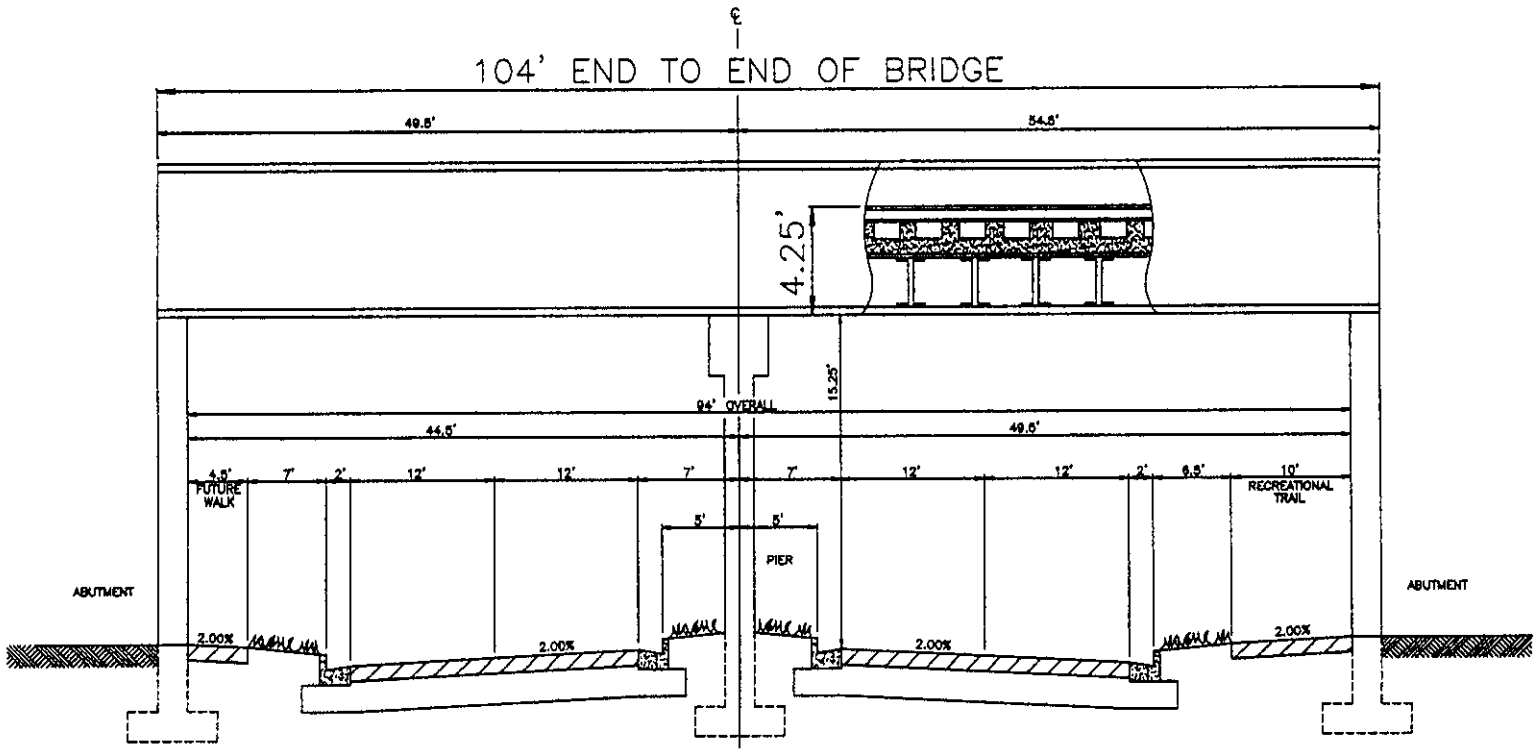

FIGURE 22 4-SPAN THROUGH PLATE GIRDER BRIDGE

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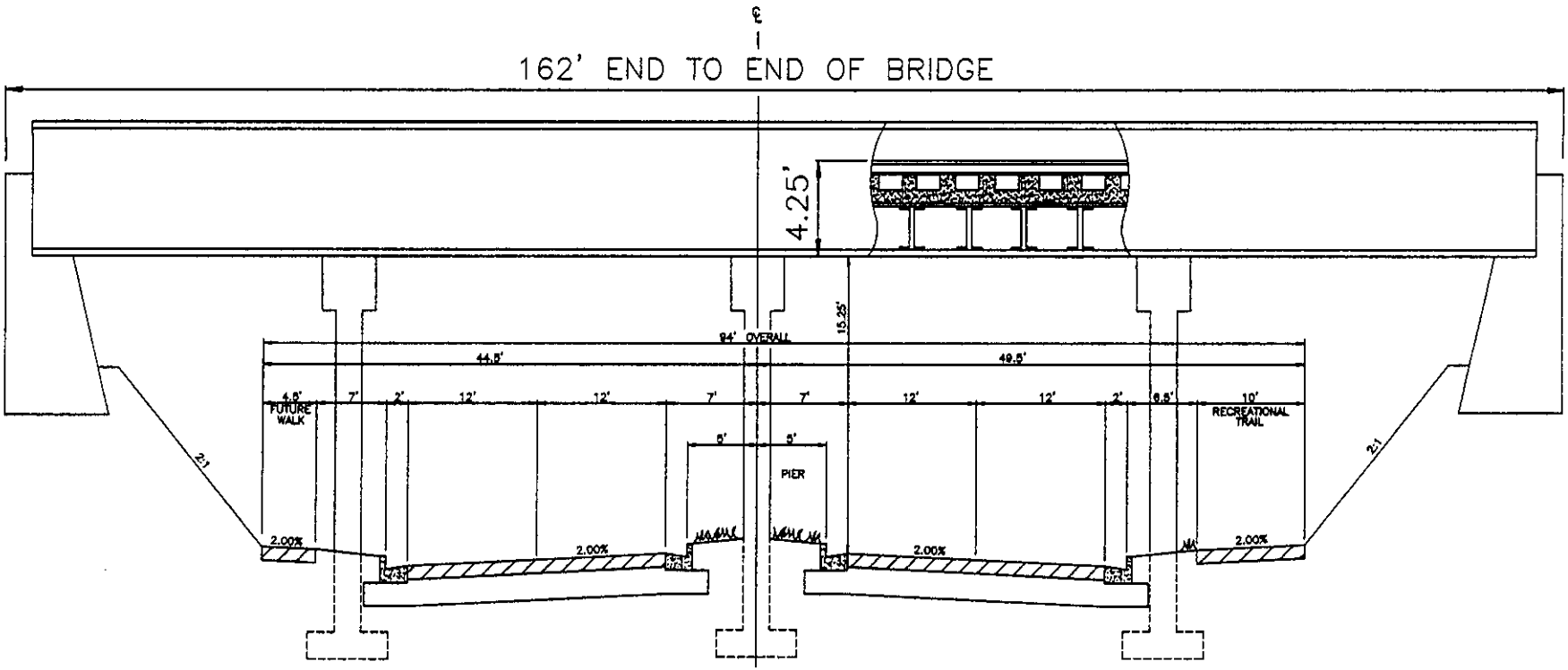

FIGURE 23 2-SPAN THRU PLATE GRIDER BRIDGE WITH RETAINING WALLS

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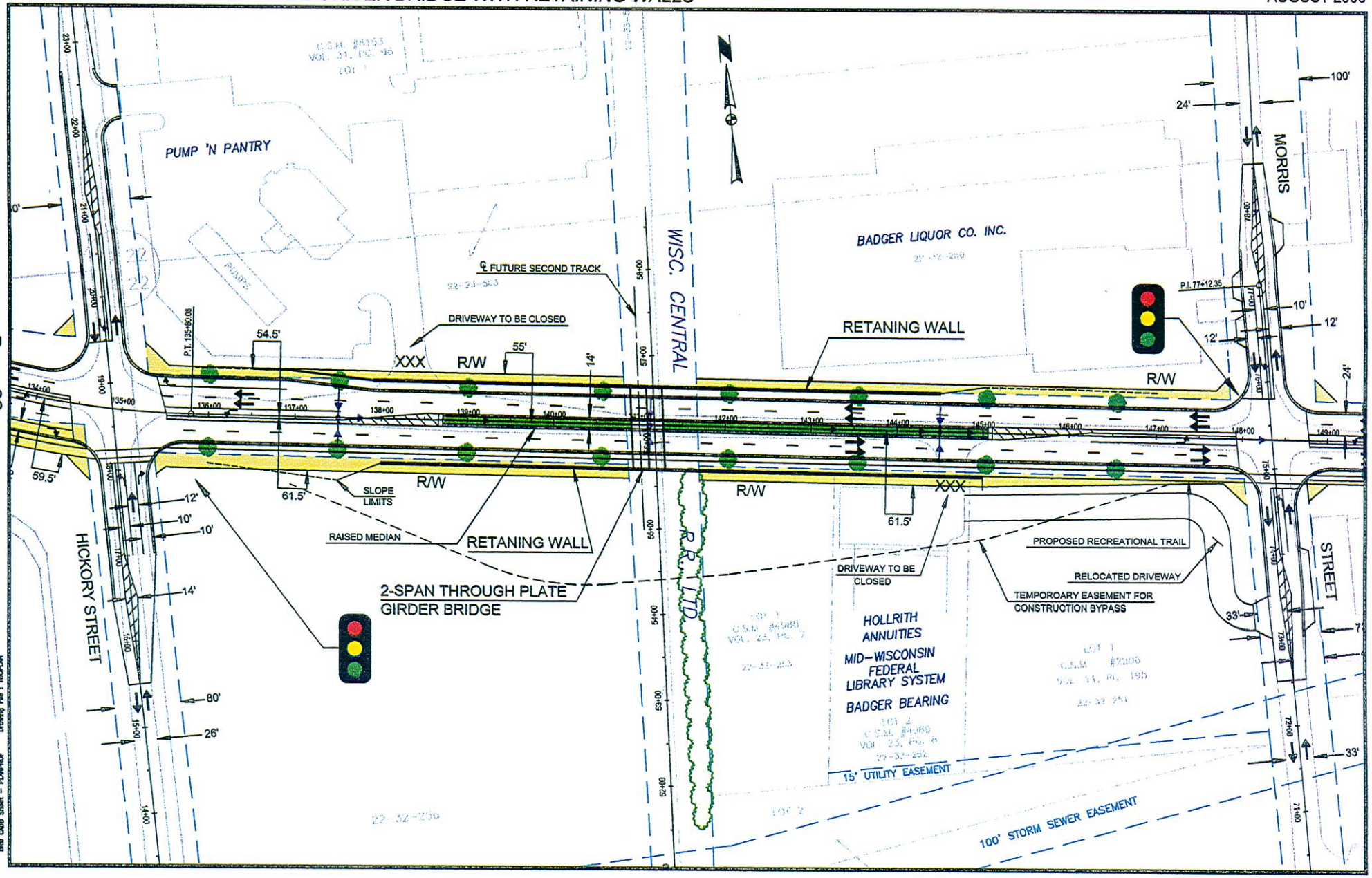

FIGURE 24 4-SPAN THRU PLATE GIRDER BRIDGE WITH CUT SLOPES

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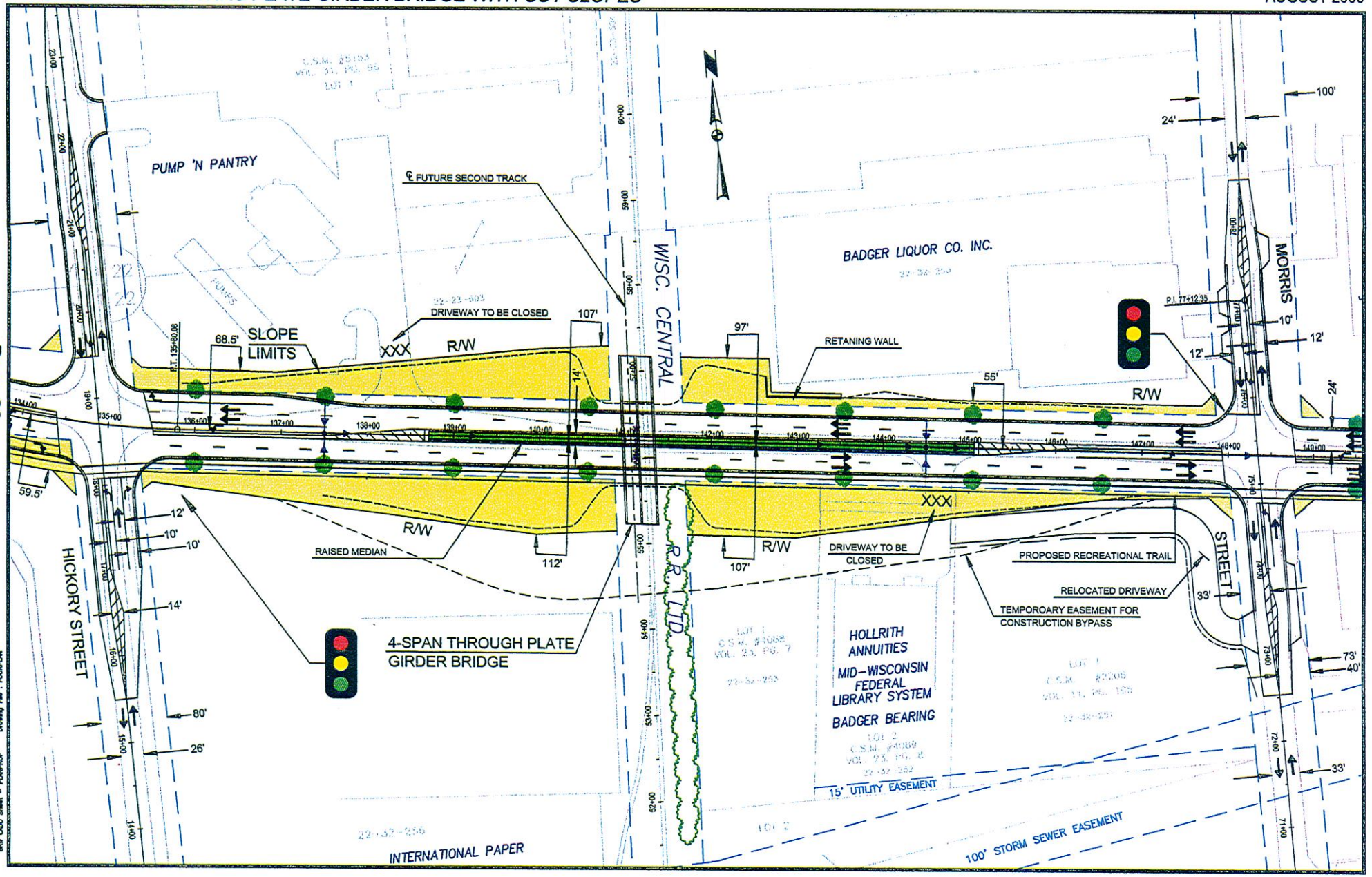

Maintenance of Traffic During Underpass Construction

Maintenance of both railroad and roadway traffic will be an important consideration during the construction of the railroad bridge and roadway underpass. Both railroad traffic and Pioneer Road traffic will need to be maintained during construction. Railroad traffic will be maintained on a temporary shoofly constructed parallel to the existing mainline. A minimum of 50 feet of separation between the bridge and the shoofly is required for the bridge construction. It is necessary to locate the shoofly to the east of the existing mainline tracks due to the close proximity of International Paper and gradient constraints associated with their spur. A temporary spur track will need to be constructed for International Paper. ***Figure 25*** (page 35) is a plan and profile drawing that shows work associated with the temporary shoofly and spur.

The project advisors have concluded that a suitable detour for Pioneer Road does not exist; therefore, traffic on Pioneer Road will be maintained on a temporary bypass roadway. The temporary bypass will be located to the east of existing Pioneer Road due to the close proximity of the Badger Liquor building to the west of Pioneer Road. The temporary bypass roadway will have a 25-mph speed limit. Locating the temporary bypass roadway to the east will require a substantial temporary construction easement. It will also require the construction of a temporary parking lot to the east of the commercial building occupying the site. ***Figure 26-1*** (page 36) shows a plan layout of the proposed temporary bypass roadway. ***Figure 26-2*** (page 37) shows a plan layout of both the temporary shoofly and the temporary bypass roadway.

It is anticipated the railroad bridge and roadway underpass would be constructed in two stages. Stage one involves the construction of the railroad bridge. At the beginning of the first stage the temporary shoofly and temporary bypass roadway would be constructed. Railroad traffic would be shifted to the shoofly and roadway traffic would be shifted to the temporary roadway. A temporary crossing and signals would be required. Excavation would occur at each of the substructure units to a depth of approximately 25 feet. Piling would be driven, then the railroad bridge substructure and superstructure would be constructed.

Stage two involves the construction of the underpass roadway. At the beginning of stage two, rail traffic would be shifted to the new bridge. Roadway traffic would remain on the temporary road. A new temporary rail crossing would be constructed and the temporary railroad signals would be moved. The remaining excavation would occur underneath the bridge to the roadway profile grade. The storm sewer system and roadway would be constructed. Traffic would then be shifted to the new roadway. The temporary roadway would be removed, cut slopes would be extended and restoration and finishing would occur.

FIGURE 25 - RAILROAD PROFILE, TEMPORARY RAILROAD SHOOFLY AND SPUR

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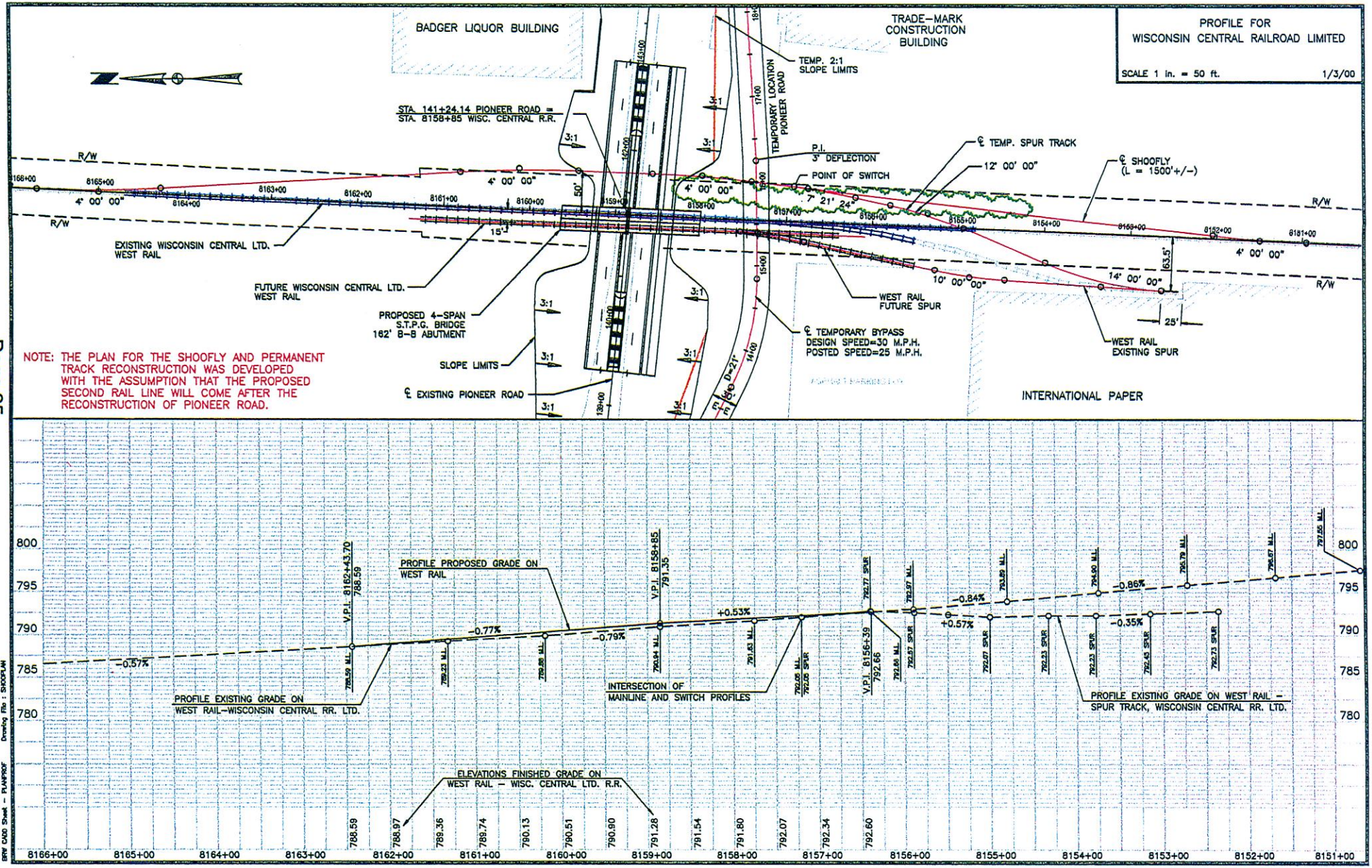

FIGURE 26-1 - TEMPORARY BYPASS ROADWAY FOR PIONEER ROAD

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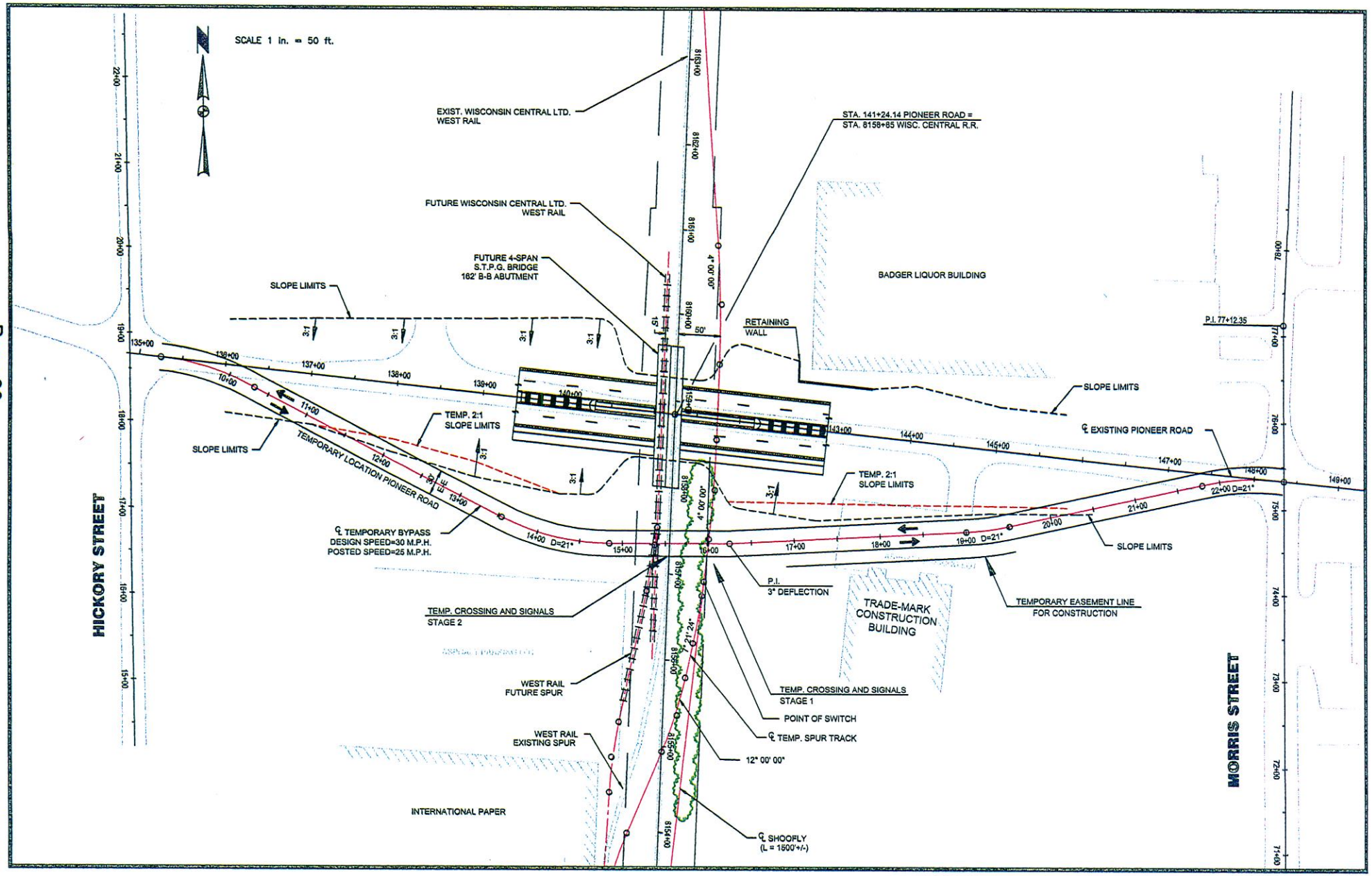

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FIGURE 26-2 - TEMPORARY SHOOFLY AND TEMPORARY BYPASS ROADWAY

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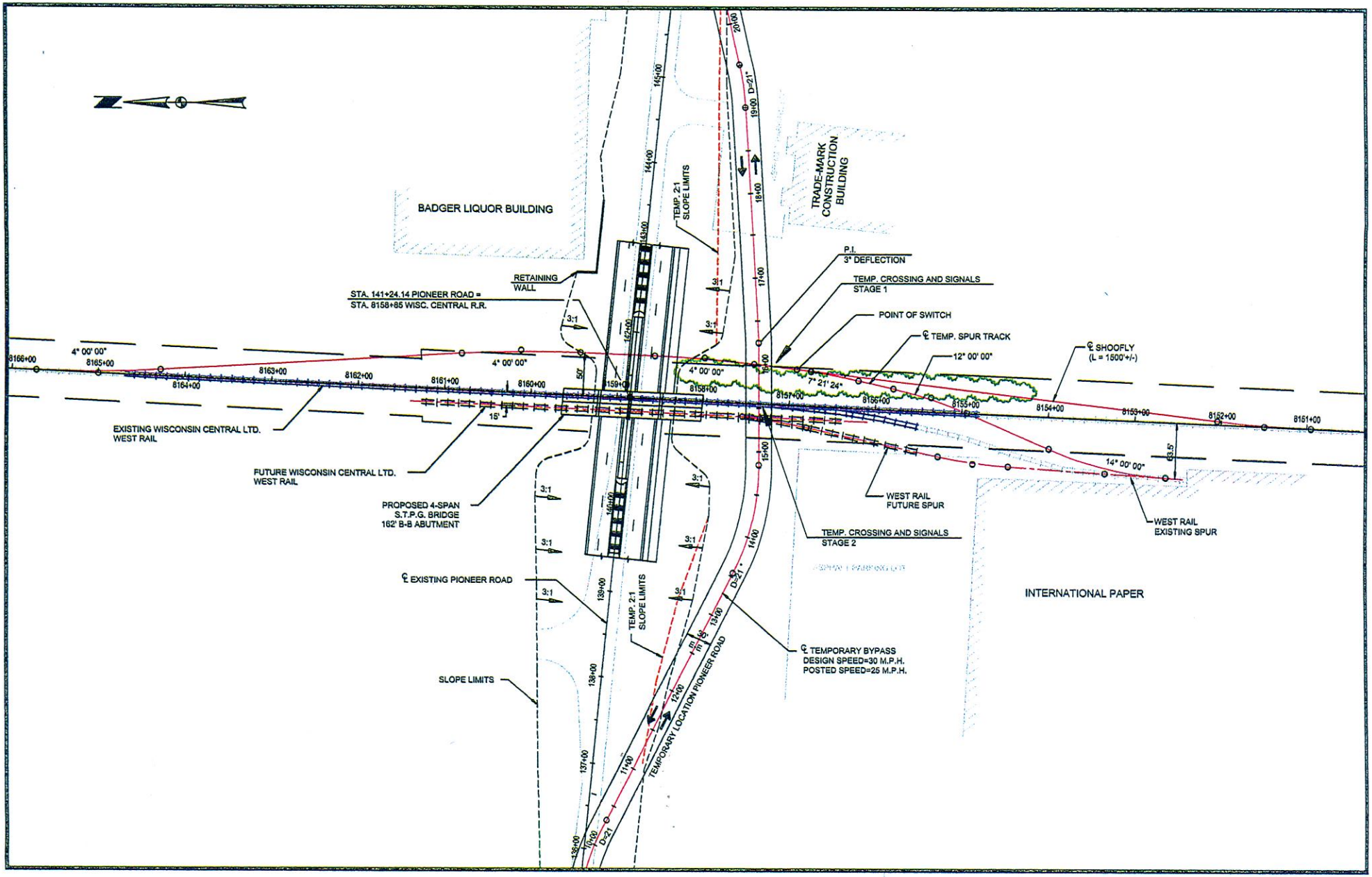

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