Minnesota Department of Transportation
Office Memorandum

**District:** **Metro**
**Date:** 11/30/2023
**To:** Doug Carter, State Geometrics Engineer
**From:** John Chock, Project Design Engineer
**Subject:** **Design Memorandum – MN 36 from I-35W to .2 miles east of Edgerton St. With Design Exception(s)]**

**State Project Number(s) & T.H./Interstate Number(s): SP 6212-192 (MN 36)**
**Federal Aid Project Number(s): NA**
**FHWA Contact: Will Stein**
**County(s): Ramsey City(s): Roseville, Maplewood, & Little Canada**
**Type of Work: Grading, Bituminous surfacing, bituminous mill & overlay, drainage, and ADA Improvements**
**Project Termini: On MN 36 from I-35W to 1,200' east of Edgerton St**
**Project Reference Point 000+00.021 To Reference Point 006+00.011**
**This project is scheduled for an April 26, 2024 letting.**

**Scoping and Design Standards Form(s) Attached:**
Geometric PBPD Scoping & Process Form
Highway Design Standards Form
Ramp Design Standards Form

I recommend approval/concur with approval of the Design Exception(s) for the following bridge element(s) as documented in this Design Memo.

- ***Vertical Clearance***

Edward A. Lutgen Digitally signed by Edward Lutgen
Date: 2023.11.30 10:23:34 -06'00'

State Bridge Engineer Date

The Design Exceptions described in this Design Memo are recommended for approval by:

John Chock Digitally signed by John Chock
Date: 2023.11.30 07:53:22 -06'00'

John Chock, P.E. Date

I concur/approve: Scott Pedersen Digitally signed by Scott Pedersen
Date: 2023.11.30 08:43:08 -06'00'

District Engineer/Assistant District Engineer Date

Design Exceptions approved by:

Tom Styrbicki Digitally signed by Tom Styrbicki
Date: 2023.12.05 14:11:27 -06'00'

State Design Engineer Date

**PROJECT BACKGROUND**

The original scope, and primary purpose, of this project is to mill & overlay TH 36 from the junction with I-35W in Roseville to east of Edgerton Street in Maplewood / Little Canada. Secondary improvements include repairing / replacing existing drainage infrastructure, widening portions of the existing shoulders through the corridor to improve bus operations, constructing / reconstructing substandard or missing pedestrian facilities, and replacing signing that is at or near its expected service life.

In November 2021, the project scope was modified to include a geometric safety improvement at the TH 36 / I-35W / Cleveland Avenue Interchange. The goal of this change is to improve traffic safety operations for vehicles entering TH 36 EB from Cleveland Avenue. The existing acceleration lane from the SW loop does not provide adequate acceleration distance for vehicles to match mainline traffic speeds prior to merging onto TH 36 EB. This project proposes to lengthen the existing auxiliary lane that extends from the SE ramp to Fairview Avenue to improve the acceleration distance from the SW loop. The SE ramp at Cleveland Avenue will be re-aligned and added as a parallel acceleration lane that will ultimately merge into the existing EB auxiliary lane.

This design memo will only address the pavement rehabilitation portion of this project and will be FOR INFROMATIONAL PURPOSES ONLY. The proposed geometric improvements at TH 36 & Fairview Ave Interchange were addressed in a previous design Memo as well (EDOCS# 18177525).

**PROJECT INFORMATION**

**Highway Type**

( ) Two Lane Highway, Rural ( ) Multi-lane Divided Highway, Rural (High Speed)
( ) Two Lane Highway, Urban ( ) Multi-lane Divided Highway, Urban (High Speed
(X) Freeway, Rural ( ) Multi-lane Divided Highway, Urban (Low Speed)
( ) Freeway, Urban ( ) Multi-lane Undivided Highway, Urban (Low Speed)

**Functional Class** (X) Principal Arterial ( ) Minor Arterial ( ) Collector
Number of Lanes ( ) Two Lane ( ) Four Lane ( ) Six or eight lane
( ) Single-lane ramp ( ) Multi-lane ramp
Terrain: ( ) Level ( ) Rolling ( ) Mountainous

Traffic Volume: Current ADT (2021) 72,000 veh./day
Based on: ( ) actual counts, (X) traffic flow map, dated 02 / 25 / 2022
Forecast ADT: N/A (Not required for Preservation projects)

Access Control (X) Full ( ) Partial ( ) none
Design Speed 55 mph Posted Speed 55 mph MnPASS Buffer Width N/A

( ) Existing and Proposed Typical Sections are included in the appendix.
( ) Reduced layout is included in appendix.

**DESIGN STANDARDS**

Based on the criteria in Design Standards and Exceptions for Controlling Design Criteria, this project will be designed to MnDOT's New Construction / Reconstruction Standards.

**DESIGN EXCEPTIONS**

**List of Existing Design Exception(s):**

I. Lane Width (Proposed Exception – TH 36 EB Right Thru Lane over Bridge 9277)
- Standard: 12-feet
- Existing: 12-feet
- Proposed: 11-feet from Reference Point (RP) 000+00.135 to RP 000+00.330)

II. Ramp Pavement Width – Single Lane (Existing Exception - NW / NE / SW Loops at Cleveland Ave & TH 36)
- Standard: 22-feet
- Existing: 20-feet for NW / NE / SW Loops
- Proposed: 20-feet for NW / NE / SW Loops

III. Ramp Pavement Width (Existing Exception – SW Loop from TH 51 SB to TH 36 EB)
- Standard: 22 feet min.
- Existing: 17.5 feet
- Proposed: 17.5 feet

IV. Ramp Pavement Width (Existing Exception – SW Loop from TH 36 EB to Commerce St)
- Standard: 22 feet min.
- Existing: 15 feet
- Proposed: 15 feet

V. Ramp Acceleration Length (Existing Exception – NE Loop from Cleveland Ave NB to TH 36 WB)
- Standard: 670-feet (30mph entrance curve design speed to 55mph mainline design speed)
- Existing: 455-feet
- Proposed: 455-feet

VI. Ramp Acceleration Length (Existing Exception – NE Loop from TH 51 NB to TH 36 WB)
- Standard: 810 feet min. (20 mph loop design speed and 55 mph mainline design speed)
- Existing: 580 feet
- Proposed: 580 feet

VII. Ramp Acceleration Length (Existing Exception – SW Loop from TH 51 SB to TH 36 EB)
- Standard: 810 feet min. (20 mph loop design speed and 55 mph mainline design speed)
- Existing: 485 feet
- Proposed: 485 feet

VIII. Minimum Vertical Clearance – Trunk Highway Under Roadway Bridge
(Existing Exception – Bridge 9276, TH 36 WB) RP 000+00.360
- Standard: 16-feet 0-inches (Pavement reconstruction projects)
- Standard: 16-feet 4-inches (New bridge projects)
- Existing: 15.21-feet
- Proposed: 15.21-feet

IX. Minimum Vertical Clearance – Trunk Highway Under Roadway Bridge
(Existing Exception – Bridge 9277, TH 36 EB) RP 000+00.255
- Standard: 16-feet 0-inches (Pavement reconstruction projects)
- Standard: 16-feet 4-inches (New bridge projects)
- Existing: 15.17-feet
- Proposed: 15.17-feet

X. Minimum Vertical Clearance – Trunk Highway Under Roadway Bridge
(Existing Exception – Bridge 9012, TH 36 EB) RP 001+00.262
- Standard: 16-feet 0-inches (Pavement reconstruction projects)
- Standard: 16-feet 4-inches (New bridge projects)
- Existing: 14.9-feet
- Proposed: 14.9-feet

XI. Minimum Vertical Clearance – Trunk Highway Under Roadway Bridge
(Existing Exception – Bridge 9013, TH 36 EB) RP 001+00.273
- Standard: 16-feet 0-inches (Pavement reconstruction projects)
- Standard: 16-feet 4-inches (New bridge projects)
- Existing: 15.3-feet
- Proposed: 15.3-feet

XII. Minimum Vertical Clearance – Trunk Highway Under Roadway Bridge
(Existing Exception – Bridge 62035, TH 36 EB) RP 001+00.745
- Standard: 16-feet 0-inches (Pavement reconstruction projects)
- Standard: 16-feet 4-inches (New bridge projects)
- Existing: 15.9-feet
- Proposed: 15.9-feet

XIII. Minimum Vertical Clearance – Trunk Highway Under Roadway Bridge
(Existing Exception – Bridge 62006, TH 36 EB) RP 005+00.779
- Standard: 16-feet 0-inches (Pavement reconstruction projects)
- Standard: 16-feet 4-inches (New bridge projects)
- Existing: 14.8-feet
- Proposed: 14.8-feet

**Justification of Design Exception(s):**

I. Lane Width (Proposed Exception– TH 36 EB Right Thru Lane over Bridge 9277)

1. Alternatives considered:
   - Re-stripe the TH 36 EB right thru lane as an 11-foot lane over Bridge 9277. The adjacent acceleration lane over the bridge has minimal reaction distance (8-inches) to the face of the bridge rail. Re-striping the right thru lane at 11-feet will provide an additional 1-foot (1-foot 8-inches total) of reaction distance to the barrier. The existing condition reduces a 20’ ramp lane down to a 12-foot 8-inch acceleration lane, bordered by a bridge barrier, over a relatively short distance. The additional reaction distance provided to the acceleration lane on structure should improve driver comfort for vehicles entering TH 36 EB from the SW Loop.
   - Maintain existing 12-foot acceleration lane width which results in 0-feet 8-inches of reaction distance from the edge of lane to the face of bridge rail.
2. Cost comparison

- Restriping the right thru lane at a width of 11-feet instead of 12-feet results in no cost difference. TH 36 will be restriped with the mill & overlay portion of the project.

3. Comparison of safety performance
   - According to the Highway Safety Manual, the Crash Modification Factor (CMF) for a 1' lane width reduction (12-foot lane to 11-foot lane) is equal to 1.03, or a 3.0% increase for all crash severities on a freeway. However, providing additional reaction distance to the bridge barrier for vehicles in the adjacent acceleration lane may reduce the overall number and severity of crashes for this location.
4. Comparison of operational performance
   - According to the Highway Capacity Manual, reducing the existing 12-foot lane width to 11-feet will result in a 1.9 mph reduction in free-flow speed on rural and suburban multilane highways. Source: NCHRP Report 783 Section 2.2.4 (Based on Highway Capacity Manual Exhibit 11-8). The report does not detail the effects of short segments of reduced width travel lanes. The only basis for length is described as "Basic Freeway Segments". It is unclear if operational speed would be less than the average 1.9 mph reduction over a roadway segment less than 1000-feet.
5. Compatibility with adjacent sections of roadway (proposed versus adjacent sections of roadway)
   - The right thru lane prior to and after Bridge 9277 will continue to be 12-feet. The lane width exception is a result of the space limitation presented by the constrained bridge typical section. The overall length of the exception will be approximately 965'.
6. Any proposed mitigation measures (for proposed design)
   - Provide warning of lane width reduction.
   - Improve ability of drivers to stay within their travel lane through the use of enhanced pavement markings, delineations, lighting, and/or rumble strips.
7. Any other pertinent impacts (for proposed design):
   - The wider shoulder, created by narrowing the right thru lane, may offer authorized bus traffic additional room to navigate the auxiliary lane on structure and traffic entering from the SW Loop.

II, III, & IV. Ramp Pavement Width (Existing Exception - NW / NE / SW Loops at Cleveland Ave & TH 36, SW Loop from TH 51 SB to TH 36 EB, & SW Loop from TH 36 EB to Commerce St.)

1. Alternatives considered:
   - Reconstruct the loops from their existing width (15'-20") to meet the standard 22' width and maintaining the existing condition were the two alternatives considered.
2. Cost Comparison
   - The cost to reconstruct the ramp would be significant as there would be a need to haul in fill material so that ramp profile could be maintained for the full 22' width opposed to the width that is out there today. Each ramp would be approximately $225,000 to reconstruct versus the approx. $26,000 to mill & overlay the existing pavement structure. Maintaining the existing ramp pavement width would reduce the project cost by approximately $1 million.
3. Comparison of safety performance
   - From 2018 to 2022 there have been 5 crashes on the loop ramp from TH 51 SB to TH 36 EB, all property damage crashes. 3 of the crashes involved vehicles going too fast for conditions, 1 was a rear-end at the meter, and 1 involved a vehicle hitting guardrail that was sticking out into the lane.
   - From 2018 to 2022 there were 7 property damage crashes on the loop ramp from TH 36 EB to Commerce St. The crashes mostly involved vehicles going too fast for the ramp and running off the ramp.
4. Comparison of operational performance
   - Ramp pavement width does not have an effect on traffic operations in this corridor.

5. Compatibility with adjacent sections of roadway (proposed versus adjacent sections of roadway)
    - Ramp pavement width does not have an effect on traffic operations in this corridor and there are no definitive compatibility issues with mainline traffic.
6. Any proposed mitigation measures (for proposed design)
    - Improve ability of drivers to stay within their travel lane through the use of enhanced pavement markings, delineations, lighting, and/or rumble strips.
7. Any other pertinent impacts (for proposed design): None

V, VI, & VII. Ramp Acceleration Length (Existing Exception – NE Loop from Cleveland Ave NB to TH 36 WB, NE Loop from TH 51 NB to TH 36 WB, & SW Loop from TH 51 SB to TH 36 EB)

1. Alternatives considered:
    - Reconfigure interchange to increase auxiliary/acceleration lane length between the loop ramps.
    - Reconfigure interchange to create an acceleration lane that is separate from the auxiliary lane for the loop ramps (similar to I35W & 694 interchange).
    - Maintain the existing condition.
2. Cost Comparison
    - The cost to reconstruct the interchanges in either scenario would be quite significant due to the need to realign the loops/auxiliary lanes. Assuming no effects to the existing bridges, it would cost approximately $500,000 per location to reconstruct. The cost of maintaining the existing configuration and providing a mill & overlay is approximately $15,000 for these acceleration lanes. Maintaining the existing condition will help reduce the project cost by approximately $1.48 million.
3. Comparison of safety performance
    - From 2018 to 2022 the section of TH 36 at I35W does not have a critical crash rate index above 1 in the WB direction. Looking at the crashes further there were 3 property damage crashes involving the acceleration lane. The length of the acceleration lane does not seem to be causing a crash issue in the location.
    - From 2018 to 2022 the section of TH 36 at TH 51 does not have a critical crash rate index above 1 in the WB direction. There have been 2 property damage and 1 possible injury crash involving the acceleration lane. The length of the acceleration lane does not seem to be causing a crash issue in the location.
    - From 2018 to 2022 the section of TH 36 at TH 51 does not have a critical crash rate index above 1 in the EB direction. From 2018 to 2023 there were 5 property damage crashes involving the acceleration lane. The length of the acceleration lane does not seem to be causing a crash issue in the location.
4. Comparison of operational performance
    - A study is being done to look at how to improve the operations of this corridor. The interchanges from I-35W to Hamline are close together which causes operational issues due to close ramp spacing. The interchange type at TH 36 and TH 51 is also being evaluated to improve ramp spacing. This will not be addressed with this project. The deficient acceleration lane length does not anticipate to worsen the current operational performance.
5. Compatibility with adjacent sections of roadway (proposed versus adjacent sections of roadway)
    - Ramps at these locations will continue to be configured and operate like traditional cloverleaf interchanges.
    - The proposed acceleration lane length is compatible with adjacent section of the roadway.
6. Any proposed mitigation measures (for proposed design): None
7. Any other pertinent impacts (for proposed design): None

VIII, IX, X, XI, XII, & XIII. Minimum Vertical Clearance – Trunk Highway Under Roadway Bridge
(Existing Exception – Bridge 9276, TH 36 WB) RP 000+00.360
(Existing Exception – Bridge 9277, TH 36 EB) RP 000+00.255
(Existing Exception – Bridge 9012, TH 36 EB) RP 001+00.262
(Existing Exception – Bridge 9013, TH 36 EB) RP 001+00.273
(Existing Exception – Bridge 62035, TH 36 EB) RP 001+00.745
(Existing Exception – Bridge 62006, TH 36 EB) RP 005+00.779

1. Alternatives considered:
   - Reconstruct bridge with new profile and utilizing thinner beam structure to gain minimum vertical clearances.
   - Reconstruct TH 36 roadway profile under the bridge to gain minimum vertical clearances.
   - Maintaining the existing condition.
2. Cost Comparison
   - Reconstruction of the bridges would vary by bridge but would be approximately $6M-$8M per bridge and also include significant traffic impacts.
   - Reconstruction of the roadway profile would also vary by location but in general could be achieved with typical grading and paving operations. Each location would require approximately $400,000 to grade and pave to a new lower roadway profile in both directions of travel and would include significant traffic impacts.
   - Current solution of maintaining vehicle restrictions and existing conditions does not affect project cost ($0).
3. Comparison of safety performance
   - In the last 10 years there was one bridge hit within the project limits in 2015 at Edgerton. The bridge was hit due to a boom on the crane was too high that was being hauled.
   - According to NCHRP Report 783, “there are no operational or safety effects of insufficient vertical clearance except for increased travel times for vehicles taller than the available vertical clearances.”
4. Comparison of operational performance
   - Vertical Clearance does not seem to have an effect on operations.
   - According to NCHRP Report 783, “there are no operational or safety effects of insufficient vertical clearance except for increased travel times for vehicles taller than the available vertical clearances.”
5. Compatibility with adjacent sections of roadway (proposed versus adjacent sections of roadway) – The proposed condition is compatible with adjacent section of the roadway.
6. Any proposed mitigation measures (for proposed design)
   - Currently there are no proposed mitigation measures. However, the corridor will continue to be monitored and vertical clearance warning signs may be installed in the future if incidents increase at any of these locations.
7. Any other pertinent impacts (for proposed design): None

**LAYOUT STATUS**

( ) A geometric layout is not required for this project.

( X ) A Level 1 Geometric Layout (and profile) ( ) will be prepared for this project
( X ) has been prepared for this project

**The layout has received Mn/DOT:**

( ) Staff review and concurrence ( X ) Staff approval (approved 6/21/22)
SP 6212-192 Layout 1B SIGNED.pdf

**Municipal consent (layout approval) is required:** NO

If YES, Municipal consent has been obtained: YES_____ received on __/__/__
NO_____

**INTERSTATE/STRAHNET SYSTEM**

**NOTE**: In Minnesota the Interstate/STRAHNET system consists of all Interstate highways**,** TH 61 north of Duluth, and TH 10 from TH 24 to TH 371.

(X) This project does not involve work on the Interstate/STRAHNET system.

( ) This project involves work on the Interstate/STRAHNET system. At the completion of this project:

( ) All bridges will meet the 16-foot standard for vertical clearance over Interstate highways.

( ) All bridges over designated OSOW Super Load Corridors will meet the 16 feet 6 inch standard for vertical clearance.

( ) The vertical clearance of the bridge(s) **is less than 16 feet** and will remain unchanged. FHWA will be requested to coordinate with the Department of Defense/MTMCTEA at least three months before letting.

**TRAFFIC HANDLING DURING CONSTRUCTION**

While the SE Ramp is being reconstructed, traffic making the NB Cleveland to EB TH 36 movement, could be detoured through the interchange loops to make the connection, or could be routed to the TH 36/Fairview Avenue (CSAH 48) interchange via County Road B. Traffic making the SB Cleveland to EB TH 36 movement from the SW Loop could also be detoured to the Fairview Avenue Interchange via County Road B unless a detour route using the I-35W/County Road C interchange is deemed more appropriate.

Periodic shoulder closure, lane closure, and ramp closures will be necessary during the project for the mill & overlay work and are expected to follow the Metro District Lane Closure Manual.

**BICYCLE and PEDESTRIAN CONSIDERATIONS**

(X) Bicycles are legally permitted on this roadway.
( ) Preliminary layouts have been provided to the CO Bicycle/Pedestrian Section for comment.
( ) Improvements to bicycle/pedestrian access are planned for this project.
( ) Existing access for bicycles or pedestrians will be eliminated by this project.

# GEOMETRIC PERFORMANCE-BASED PRACTICAL DESIGN (PBPD) SCOPING & PROCESS FORM

## PERFORMANCE-BASED PRACTICAL DESIGN PROCESS

### Purpose and Need

1. Improve pavement quality throughout the length of the project (I-35W to Edgerton St) so that the traveling public has a smooth and quality ride on our facility.
2. Provide ADA improvements at existing interchanges to provide safe and efficient crossings for pedestrians in this section of MN 36.
3. Improve safety and operations of the loop ramp from SB 35W to EB 36 and also mainline TH 36 in this interchange area. Reduce crashes and congestion.

### Opportunities

1. Optimize shoulder widths between Cleveland Ave & Snelling Ave interchanges on EB MN 36 to facilitate heavy bus usage in this segment.
2. Optimize lane and shoulder widths in the immediate area to avoid doing any work to the existing bridge structure.

### Risks

1. Will likely need to reconstruct the shoulder pavement to widen for 12' bus shoulders instead of utilizing existing pavement.
2. Due to the modification in lane configuration, it will take some time for drivers to get used to the change. The hope is that they will more fully utilize the auxiliary lane coming from the loop ramp to get up to full speed and find an appropriate gap before merging with the freeway lanes which will help with better lane utilization and freeway operations.
3. There is some concern related to the number of overhead signs that will be required in this area due to the aux lane on the left side also ending in the same area as the accel lane from Cleveland Ave NB. Traffic will be merging from lanes on both sides in this area, but signing is comfortable they can make it work and it will be an improvement over existing conditions.

### Goals and Objectives

1. Improve pavement life through 3" mill and overlay
2. Improve ADA facilities to achieve ADA Standards
3. Improve transit mobility by providing bus shoulders on EB MN 36
4. Reduce crashes at the I35W/Cleveland Ave & TH 36 interchange, marginally improve congestion and freeway operations in the area.

**Safety Performance Outcomes Desired/Expectations**

1. Reduce bus encroachment into thru lane on EB MN 36 by providing a full width bus shoulder

2. Enhance the pedestrian experience at interchanges by updating pedestrian facilities to ADA Standards.

3. Reduction in crash rate at the I35W/Cleveland Ave & TH 36 interchange.

## DESIGN PARAMETERS

This project changes the lane configuration at the I35W/Cleveland Ave & TH 36 interchange to allow an existing auxiliary lane to start with a high-volume ramp movement rather than a lower volume local access ramp movement. See Design Memo for documentation of design exceptions. This project is designed to be a low-cost, high benefit improvement and it is understood due to a lack of freeway capacity in the area, there will still be congestion in this area upon completion of the project, but crashes should be reduced and lane utilization will improve, particularly in off peak times.

**Design year(s)**

2040

**Design/control vehicles**

WB-62 design and control vehicle.

**Traffic operational measures and parameters**

The Crash Modification Factor (CMF) for this type of improvement is 0.75, meaning we should expect to see at 25% reduction in crashes in this area once the project is completed.

**Design speeds**

55 mph – The design speed is based on the stopping sight distance value for the EB 36 crest vertical curve over Cleveland Ave and historical plan sets.

**Major cross-sectional features**

**Lane Widths / Overall Widths / Shoulder Widths – Normal Section**

- TH 36 EB & WB Existing Section
  (56-ft = 10’ Shld outside-12’ Thru-12’ Thru-4’ Shld inside)
- TH 36 EB Proposed Bus Shoulder Sections
  (56-ft = 12’ Shld outside -12’ Thru-12’ Thru-4’ Shld inside)

**Lane Widths / Overall Widths / Shoulder Widths – Normal Section at I35W/Cleveland**

- TH 36 EB Existing Section
  (56-ft = 10' Shld-12' Aux-12' Thru-12' Thru-10' Shld)
- TH 36 EB Proposed Aux + Parallel Accel Lane
  (78-ft = 10' Shld-12' Aux-12' Thru-12' Thru-12' Aux-12' Accel-8' Shld)

**Lane Widths / Overall Widths / Shoulder Widths – Restriped Segment Over Bridge 9277**

- TH 36 EB Proposed Re-Stripe - West of Bridge 9277
  (56-ft = 10' Shld-12' Aux-12' Thru-11' Thru-11' Shld)
- TH 36 EB Proposed Re-Stripe - East of Bridge 9277
  (60-ft = 10' Shld-12' Aux-12' Thru-11' Thru-15' Aux)

**Median width –** N/A

**Bridge widths –**

- Bridge #9276 40-ft : 2' shld – 12' thru – 12' thru – 10' Aux – 4' shld
- Bridge #9277 60-ft : 11.25' shld -12' Aux – 12' thru – 12' thru – 12.67' shld
- Bridge #62029 48-ft to 56-ft : 2' shld -14' to 16' Aux/Ramp – 0' to 10' Gore Area – 12' thru – 12' thru – 4' shld
- Bridge #62030 54-ft to 64-ft: 6' shld – 12' thru – 12' thru – 12' Aux – 8-18' ramp– 4' shld
- Bridge #62731 42-ft: 12' shld - 12' thru - 12' thru – 6' shld
- Bridge #62734 60-ft: 24' shld - 12' thru – 12' thru – 12' shld
- Bridge #62073 62-ft: 12' shld - 12' thru – 12' thru – 26' shld
- Bridge #62074 62-ft: 26' shld - 12' thru – 12' thru – 12' shld

**Roadside geometry-** Typically 1:4 cut slopes (1:3 max) on outside shoulders 1:6 cut slopes (or flatter) on inside shoulders

## Conceptual alignment and profile

No changes to TH 36. Partial adjustment of the SE Ramp alignment & profile at I35W/Cleveland and EB TH 36.

## Sight distances

N/A – No change to TH 36

## Vertical clearances

N/A – No change to TH 36

## Interchange/Intersection Improvements

Auxiliary lane extension at I35W/Cleveland Ave and EB TH 36. SE Ramp re-alignment (parallel accel. lane)

**Horizontal curves and/or modifications**

N/A – No change to TH 36

**Vertical curves and/or modifications**

N/A – No change to TH 36

**Superelevations and/or modifications**

N/A – No change to TH 36

**Turn lanes**

N/A – No change to TH 36

**Innovative Design or Best Practice**

We used the existing bridge width to complete this project which required flexible design with respect to lane and shoulder widths at I35W/Cleveland Ave & TH 36.

# Highway Design Standard Form

**If a proposed condition is a Design Exception put an asterisk (*) in front of the proposed condition.**

| Critical Design Element | Existing Condition, Minimum | Proposed Condition, Minimum | MnDOT Standard for New Construction/ Reconstruction | Reference Documents^ |
|---|---|---|---|---|
| Design Speed | Design Speed selected for this project is 55 mph. | | | TM 22-07-TS-02 |
| Lane Width | 12 ft | 12 ft | 11 ft min.<br>12 ft max. | FDG Chapter 4A Exhibit 4A-2 & PBPD Page 25-26 |
| Shoulder Width:<br>• Right<br>• Left | 10 ft paved<br>11.5 ft usable<br>4 ft paved<br>5.5 ft usable | 10 ft paved<br>11.5 ft usable<br>4 ft paved<br>5.5 ft usable | 10 ft paved<br>11.5 ft usable<br>4 ft paved<br>5.5 ft usable | FDG Chapter 4A |
| Design Loading Structural Capacity | N/A | N/A | All new bridges:<br>HL-93<br>Minimum design load | LRFD Bridge Design Manual, Article 3.4 (Scroll to Page 3.4) |
| # Stopping Sight Distance | 562 ft min | 562 ft min | 495 ft min. | Tables 2-5.08A & B (Chapter 2, Page 37) |
| Horizontal Curve, Radius | 3,396 ft min | 3,396 ft min | 960 ft min. | FDG Chapter 5 Exhibit 5B-4a |
| Maximum Grade | 3.5% maximum | 3.5% maximum | 3% desired max.<br>4% maximum | RDM Table 3-4.02A (Chapter 3, Page 3-4(2)) |
| Cross Slope | 0.015 ft/ft | 0.015 ft/ft | 0.015 – 0.020 ft/ft | FDG Chapter 4A |
| Superelevation | 0.04 ft/ft | 0.04 ft/ft | 0.08 ft/ft max. | RDM Chapter 3-3 |

| Critical Design Element | Existing Condition, Minimum | Proposed Condition, Minimum | MnDOT Standard for New Construction/ Reconstruction | Reference Documents^ |
|---|---|---|---|---|
| Vertical Clearance<br>• Highway under bridge | 15.17' (BR 9277)<br>15.21' (BR 9276)<br>14.9' (BR 9012)<br>15.3' (BR 9013)<br>15.9' (BR 62035)<br>16.9' (BR 62069)<br>17.0' (BR 62731)<br>17.0' (BR 62734)<br>16.4' (BR 62073)<br>17.9' (BR 62074)<br>17.7' (BR 62631)<br>17.0' (BR 62933)<br>16.3' (BR 62934)<br>14.8' (BR 62006) | *15.2' (BR 9277)<br>*15.2' (BR 9276)<br>*14.9' (BR 9012)<br>*15.3' (BR 9013)<br>*15.9' (BR 62035)<br>16.9' (BR 62069)<br>17.0' (BR 62731)<br>17.0' (BR 62734)<br>16.4' (BR 62073)<br>17.9' (BR 62074)<br>17.7' (BR 62631)<br>17.0' (BR 62933)<br>16.3' (BR 62934)<br>*14.8' (BR 62006) | 16 ft-4 in | LRFD Bridge Design Manual, Table 2.1.3.1 (Page 11) |
| • Railroad under bridge | N/A | N/A | 23 ft-0 in | |
| • Highway under sign or pedestrian bridge | N/A | N/A | 17 ft-4 in | |

**^ Reference Documents** include Facility Design Guide, LRFD Bridge Design Manual, Performance-Based Practical Design Process and Design Guidance, Road Design Manual, and Technical Memorandum.

**# Stopping sight distance** applies to horizontal and vertical alignments **except for sag vertical curves**.

*** An asterisk in front of the proposed condition indicates a Design Exception.**

# Ramp Design Standard Form

**Ramp Locations** **Ramp Types**

| Highway | Reference Point | Station | Intersecting Road | Ramp Alignment Name | Diagonal | Loop | Semi-Direct | Direct |
|---|---|---|---|---|---|---|---|---|
| EB 36 | | | Cleveland Ave | SWLP | | X | | |
| EB 36 | | | Cleveland Ave | SELEGNEW | X | | | |
| EB 36 | | | Cleveland Ave | SWLEG | X | | | |
| WB 36 | | | Cleveland Ave | NELEG | X | | | |
| WB 36 | | | Cleveland Ave | NELP | | X | | |
| WB 36 | | | Cleveland Ave | NWLP | | X | | |
| WB 36 | | | Snelling Ave | RAMPA5136 | X | | | |
| WB 36 | | | Snelling Ave | LOOPA3651 | | X | | |
| WB 36 | | | Snelling Ave | LOOPB3651 | | X | | |
| WB 36 | | | Snelling Ave | RAMPB3651 | X | | | |
| EB 36 | | | Snelling Ave | RAMPC3651 | X | | | |
| EB 36 | | | Snelling Ave | LOOPC3651 | | X | | |
| EB 36 | | | Snelling Ave | LOOPD3651 | | X | | |
| EB 36 | | | Snelling Ave | RAMPD3651 | X | | | |
| EB 36 | | | Commerce St | SWLOOP | | X | | |
| WB 36 | | | Hamline Ave | NELOOP | | X | | |
| WB 36 | | | Hamline Ave | NERAMP | X | | | |
| EB 36 | | | Lexington Ave | SWRAMP4 | X | | | |
| EB 36 | | | Lexington Ave | SERAMP4 | X | | | |
| WB 36 | | | Lexington Ave | NWRAMP4 | X | | | |
| WB 36 | | | Lexington Ave | NERAMP4 | X | | | |
| EB 36 | | | Dale St | SWRP3 | X | | | |
| EB 36 | | | Dale St | SERP4 | X | | | |
| WB 36 | | | Dale St | NWRP5 | X | | | |
| WB 36 | | | Dale St | NERP3 | X | | | |
| EB 36 | | | Rice St | RICESWRAMP | | | | X |
| EB 36 | | | Rice St | RICESERAMP | | | | X |
| WB 36 | | | Rice St | RICENWRAMP | X | | | |
| WB 36 | | | Rice St | RICENERAMP | X | | | |
| EB 36 | | | I-35E | 36RMPA | X | | | |
| EB 36 | | | I-35E | 36LOOPA | | X | | |
| EB 36 | | | I-35E | 36LOOPC | | X | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| EB 36 | | | I-35E | 3536SER | X | | | |
| WB 36 | | | I-35E | 36RMPB | X | | | |
| WB 36 | | | I-35E | 36LOOPB | | X | | |
| WB 36 | | | I-35E | 36LOOPD | | X | | |
| WB 36 | | | I-35E | 36RMPD | X | | | |
| EB 36 | | | Edgerton St | RAMPCEDG | X | | | |
| EB 36 | | | Edgerton St | RAMPDEDG | X | | | |
| WB 36 | | | Edgerton St | RAMPAEDG | X | | | |
| WB 36 | | | Edgerton St | RAMPBEDG | X | | | |

**Design Parameters:**
Drainage Type: ( X ) Urban (curb and gutter) ( X ) Rural (ditches)

Mainline Design Speed (Tech Memo 17-13-TS-06) **:** The Design Speed selected for the parent roadway is 55 mph.
(This speed will be used to look up the value for Ramp Design Speed)

Ramp Traffic Control: ( X ) Metered ( X ) Metered with HOV Bypass ( X ) Traffic Signal at ramp terminal ( X ) none

**Note: A "No" below indicates a Geometric Design Exception. In parenthesis, list ramp alignment names that require design exceptions.**

| Critical Design Elements | Do all ramps of each type meet MnDOT Standards for New Construction / Reconstruction? (Yes or No) | | MnDOT Standard for New Construction / Reconstruction | | MnDOT Road Design Manual or MnDOT LRFD Bridge Design Manual or Technical Memorandum |
|---|---|---|---|---|---|
| | Ramp - Loop | Ramp - Diagonal | Ramp - Loop | Ramp - Diagonal | |
| Ramp Design Speed | YES | YES | 20 mph minimum | 40 mph minimum | Table 6-3.04A (Scroll to page 48) |
| Ramp Pavement Width (Single Lane) | NO (NWLP) (SWLP) (NELP) (LOOPC3651) (SWLOOP) | YES | 22 ft min. | 18 ft min. | Table 6-3.04C (Scroll to page 50) |
| Ramp Acceleration Length[1] | NO (NELP) (LOOPB3651) (LOOPC3651) | YES | Length(s) meet(s) or exceeds required | Length(s) meet(s) or exceeds required | Tables 6-2.04B & C (Scroll to page 36) |

| Critical Design Elements | Do all ramps of each type meet MnDOT Standards for New Construction / Reconstruction? (Yes or No) | | MnDOT Standard for New Construction / Reconstruction | | MnDOT Road Design Manual or MnDOT LRFD Bridge Design Manual or Technical Memorandum |
|---|---|---|---|---|---|
| | **Ramp - Loop** | **Ramp - Diagonal** | **Ramp - Loop** | **Ramp - Diagonal** | |
| Deceleration Length[2] | YES | YES | length(s). | length(s). | Tables 6-2.03A & B (Scroll to page 27) |
| Stopping Sight Distance [3] | YES | YES | 115 ft min. | 360 ft min. | Tables 2-5.08A & B (Scroll to page 37) |
| Horizontal Curve Radius | YES | YES | 110 ft min. | 465 ft min. | RDM Section 6-3.04.01 |
| Maximum Grade | YES | YES | 8% maximum | 5% maximum | Table 6-3.04B (Scroll to page 49) |
| Cross Slope | YES | YES | 0.015 – 0.020 ft/ft | 0.015 - 0.020 ft/ft | RDM Chapter 4-3 |
| Superelevation | YES | YES | 0.08 ft/ft max. | 0.08 ft/ft max. | RDM Chapter 3-3 |
| Design Loading Structural Capacity | N/A | N/A | All new bridges to have HL-93 minimum design load | All new bridges to have HL-93 minimum design load | LRFD Bridge Design Manual, Section 3.4 |
| Vertical Clearance<br>Highway under bridge<br>Railroad under bridge<br>Highway under sign or pedestrian bridge | YES | YES | 16 ft-4 in<br>23 ft-0 in<br>17 ft-4 in | 16 ft-4 in<br>23 ft-0 in<br>17 ft-4 in | LRFD Bridge Design Manual, Table 2.1.3.1 (Page 11) |

[1] Measure **Ramp Acceleration Length** from the entrance terminal to the ramp terminal to the point where the taper reduces the ramp width to 12-feet. If a speed limiting horizontal curve is present, acceleration length is measured from the end of the limiting curve to the point where the taper reduces the ramp width to 12-feet.

[2] Measure **Ramp Deceleration Length** from the point where the taper increases the ramp width to 12-feet to the point of inintial curvature of the exit ramp (i.e. the beginning of the ramp exit curve).

[3] **Stopping sight distance** applies to horizontal and vertical alignments, not including for sag vertical curves.