

APPENDIX F – GEOMETRIC DEFICIENCY ANALYSIS & CONDITION MAP CRITERIA

Appendix F presents a summary of the analysis of existing freeway conditions for WIS 441 located south and east of the Appleton metropolitan area. The 12-mile project corridor extends from US 10 at CTH CB on the west side of Appleton to the US 41/WIS 441 interchange east of Appleton and includes 10 interchanges.

US 10 is the only federal highway that is routed on the WIS 441 segment. This occurs between the US 10/US 41/WIS 441 interchange and Oneida Street, where US 10 disconnects from WIS 441. Traffic volumes on this freeway segment reach nearly 33,000 vehicles per day. Rapid traffic volume growth and outmoded design have resulted in operational and safety problems in recent years. The Wisconsin Department of Transportation (WisDOT) began this study to identify the extent of physical and operational deficiencies and to develop long term solutions in an effort to correct these problems.

The existing WIS 441 consists of a four-lane rural cross-section that has not been updated since the early 1990's. Over the past few decades, design policies and guidelines have been revised in response to highway safety research, economics, and changes in vehicle characteristics.

This analysis is based on the latest update of the WisDOT Facilities Development Manual (FDM), the 2001 American Association of State Highway and Transportation Officials (AASHTO) Policy on Geometric Design of Highways and Streets (GDHS), and the 2005 AASHTO Policy on Design Standards – Interstate System (AASHTO IH Policy). The report team developed corridor design criteria for WIS 441 and shared it with WisDOT in an early 2008 memorandum. **Exhibit F-1** presents these design criteria.

This analysis serves a number of objectives. First, it identifies substandard elements resulting from revised policies or design standards. Second, it highlights the areas where operational problems and crash frequency may be prevalent and identifies the problems that are attributable to geometric design. Third, it identifies features that currently meet only basic or minimum design standards and could be improved to full standard at a marginal cost.

The results of this analysis are intended to serve as background information for upcoming alternative development work and to provide perspective into the nature and extent of the system's conditions and problems. The analysis results do not provide recommendations for remedial action regarding any of the problems or conditions identified by the analysis.

Following are tables listing the criteria on which each roadway element was evaluated. This criteria list for each roadway element is set to establish a rating of GOOD, FAIR, or POOR. Following the criteria lists are **Exhibits F-2 through F-22** which are spreadsheets that show the evaluation of each roadway element and its corresponding rating based on the following criteria.

Description of Facility Features and Identification of Criteria for Rating those Features

A. Data Sources

WisDOT provided all as-built construction plans, pavement reports, structure reports, existing traffic volumes, crash data, and other supporting information. The UW-Madison Traffic Operations and Safety (TOPS) Lab and the City of Appleton supplied supplementary crash information. In order to conduct the evaluation, the report team also performed site visits and other select engineering methodologies.

B. Criteria for Rating Physical Conditions

The physical condition of three important facility elements was evaluated, specifically:

- Pavement condition
- Structure condition
- Drainage infrastructure condition

1. Pavement condition

Pavement Information File data obtained from WisDOT lists International Roughness Index (IRI) values indicative of pavement ride and Pavement Distress Index (PDI) values indicative of condition. Each index uses different distress indicators as identified by ASTM International and AASHTO.

Pavement conditions are rated GOOD, FAIR, or POOR based on an assessment using both IRI and PDI values, as well as individual distress indicators as described in **Table 1. Exhibit F-2** presents the analysis results of pavement conditions in the project area.

Table 1: Condition Criteria - Highway Pavement

Rating	Description
Good	Condition of pavement is generally good to excellent with no need for improvement. The IRI value is 2.0 or less and the PDI value is 45 or less. In addition to the PDI as a whole, for <u>Flexible Pavements</u> supplementary restrictions were considered on severities and extents for the following distress indicators: block, alligator, longitudinal or transverse cracking with severity and extent = 1 or less; rutting with severity = 0; transverse or longitudinal distortion severity = 0; For <u>Rigid Pavements</u> , the supplementary restrictions were considered for the following distress indicators: slab breakup severity = 0; transverse faulting with severity = 0.
Fair	Pavement is approaching a condition that may require improvement or rehabilitation. The IRI value is between 2.0 and 2.4 and the PDI value is between 45 and 75. In addition to the PDI as a whole, for <u>Flexible Pavements</u> supplementary restrictions were considered on severities and extents for the following distress indicators: block, alligator, longitudinal or transverse cracking with severity and extent = 2; rutting with severity = 1. For <u>Rigid Pavements</u> , the supplementary restrictions were considered for the following distress indicators: longitudinal joint distress with severity 2 or less; transverse faulting with severity = 1.
Poor	Pavement condition is critically in need of short-term improvement. The IRI value is greater than 2.4 or a combined PDI value is higher than 75. Also, high levels of severities and extents for distress indicators as defined in the other categories.

Pavement definitions:

- JRCP = Joint Reinforced Concrete Pavement
- JPCP = Jointed Plain Concrete Pavement
- AC = Asphaltic Concrete (i.e., asphalt or blacktop)

2. Structure condition

This study reviewed a total of 30 structures. Structures are rated GOOD, FAIR, or POOR based on an assessment of the condition of major structural elements and safety standards as described in **Table 2**. There were, however, exceptions to the following rules based on age and structural configuration type. **Exhibit F-3** presents the analysis for all structures in the studied corridor.

Table 2: Condition Criteria - Highway Structures

Rating	Description
Good	All bridge items are in good to excellent condition with no need for any level of repair. Safety conditions are equal to or exceed minimum standards. The Sufficiency Rating is 80 or higher and the Inventory Rating is equivalent to HS20 or above. The National Bridge Index (NBI) Deck Rating is 7 or higher.
Fair	Some minor structural repair is required. Safety conditions meet minimum adequacy. The Sufficiency Rating is between 50 and 80, the Inventory Rating is HS20 or above, or the NBI Deck Rating is either 5 or 6.
Poor	Minor repair is required for more than one item, or major repairs are required. The structure may be posted for live loads. Safety conditions do not meet current standards. The Sufficiency Rating is below 50 or the Inventory Rating is less than HS20. NBI Deck Rating is less than 5.

3. Drainage Infrastructure condition

Infrastructure for storm drainage are rated GOOD, FAIR, or POOR based on a subjective assessment by the county highway department maintenance personnel and inspection by the engineering team. Rating criteria noted in **Table 3** include a general assessment of drainage features for physical condition and for ability to collect, convey or distribute storm water during storm events consistent with the appropriate recurrence of such storm events. **Exhibit F-4** presents the analysis of drainage conditions within the study corridor.

Table 3: Condition Criteria - Drainage Infrastructure

Rating	Description
Good	All drainage features, or group of features, are in good to excellent condition with no need for repair, or need for only minor improvement.
Fair	Minor repair is required for some drainage features. Some drainage facilities should be "re-sized" to accommodate the appropriate design storm capacity associated with the drainage feature in order to prevent recurring flooding.
Poor	Major reconstruction or substantial repairs are necessary for more than one drainage facility to avoid recurring flooding.

C. Criteria for Rating Geometric Design Deficiencies

Guidelines and standards are intended to provide operation efficiency, comfort, safety, and convenience for motorists. Desired criteria and standards should be used where the social, economic, and environmental impacts are not critical. Typically, highways must meet the minimum criteria as set forth in the January 2005 edition of *A Policy on Design Standards Interstate System* by AASHTO for 13 controlling design items:

- Design Speed *
- Lane Width
- Shoulder Width
- Bridge Width
- Structural Capacity
- Horizontal Alignment *
- Vertical Alignment*
- Grade
- Stopping Sight Distance *
- Cross Slope
- Superelevation *
- Vertical Clearance
- Horizontal Clearance

*Criterion is related to design speed.

Several of the criteria are related to one another. For example: horizontal alignments include curves and the discussion for curves cannot be disassociated from the discussion of superelevation or horizontal stopping sight distances (SSD). Rather than individually evaluating every criterion listed above, the 13 criteria have been grouped based on their relationships with each other to provide clarity and a more efficient rating system without sacrificing completeness. As a result of these groupings, the roadway segments within the project corridor have been evaluated on criteria as identified in the following sections. The lowest rating received on a roadway segment for any of the criteria governs the rating on how that segment is assessed. For example: a roadway segment meets all the horizontal alignment and superelevation criteria but has a physical obstruction on the inside of a curve, which limits SSD to a value less than the minimum standard for the design speed. In this scenario, the segment along the full length of the horizontal curve would receive a POOR horizontal alignment rating since minimum horizontal SSD, a critical criterion, would not be met.

1. Horizontal Alignment

The study team used as-built plans for the entire study area to rate the horizontal alignment based on the following criteria:

- Degree of horizontal curvature
- Presence of compound curves or inflection angles
- Superelevation
- Horizontal SSD

Horizontal alignments for each roadway segment are rated GOOD, FAIR, or POOR based on an assessment described in **Table 4**. Analysis of horizontal alignment within the study corridor is presented in **Exhibit F-5**.

Table 4: Condition Criteria - Horizontal Alignment

Rating	Description
Good	Mainline roadway includes a tangent alignment or curves flatter than 2050 ft radii. The superelevation on a mainline curve meets equivalent design speed of 70 mph. Compound curves include radii ratios less than 1.5. Mainline inflection angles are less than 0.5-degree. Horizontal SSD exceed desired requirement of 730 ft.
Fair	Mainline roadway includes curve radii between 1660 ft and 2050 ft. The superelevation on a mainline curve meets equivalent design speed of 65 mph. Compound curves include radii ratios between 1.5 and 1.75. Mainline inflection angles are between 0.5 and 0.75 degrees. Horizontal SSD exceed minimum requirement of 730 ft.
Poor	Mainline roadway curves are sharper than 1660 ft radius. The superelevation on curves provides an equivalent design speed equal to or less than 60 mph. Mainline inflection angle exceeds a 0.75-degree angle. The central angle of a horizontal curve is less than 5 degrees. Compound curves include radii ratios of 1.75 or greater. Minimum horizontal SSD is not met.

2. Vertical Alignment

As-built plans were reviewed for the entire study area to rate vertical alignment. Ratings for all mainline roadways were determined from a combination of critical criteria:

- The degree of vertical curvature, or K-values, for crest and sag curves. Vertical SSD is an inherent criterion to the K-values, and therefore was evaluated by default.
- Grades

Vertical alignments for each roadway segment are rated GOOD, FAIR, or POOR based on an assessment described in **Table 5. Exhibit F-6** presents the vertical alignment analysis for the study corridor.

Table 5: Condition Criteria - Vertical Alignment

Rating	Description
Good	The equivalent design speed for the existing K-values on the mainline roadway meet or exceed 70 mph, with crest curves based on 2001 GDHS desired criteria and sag curves based on 2001 GDHS desired values. Continuous mainline grades are between 0.50% and 3.00%.
Fair	The equivalent design speeds for existing K-values on the mainline roadway equal 65 mph, with crest curves based on 2001 GDHS minimum criteria and sag curves based on 2001 GDHS minimum values. Continuous mainline grades are between 0.30% and 0.49%.
Poor	Equivalent design speeds for K-values on the mainline roadway are equal to or less than 60 mph. Mainline continuous grades exceed 3.00% or are flatter than 0.30%.

3. Vertical Clearance

As-built plans, bridge reports, and field surveys were used to determine vertical clearances. Clearance ratings are based on FDM Procedure 11-35-1, Attachment 8. Attachment 8 identifies minimum and desirable criteria which are the basis for new or replacement bridges.

Vertical clearances for each roadway segment are rated GOOD, FAIR, or POOR based on an assessment described in **Table 6**. **Exhibit F-7** presents an analysis of the vertical clearance for all bridges within the study corridor.

Table 6: Condition Criteria - Vertical Clearance

Rating	Description
Good	The minimum vertical clearance meets the “desirable” value noted in FDM Procedure 11-35-1, Attachment 8.
Fair	The minimum vertical clearance meets or exceeds the “minimum” clearance noted in FDM Procedure 11-35-1, Attachment 8, but is less than the “desirable” value.
Poor	Vertical clearance is substandard to Procedure 11-35-1, Attachment 8.

4. Cross Section

As-built plans were used to analyze cross-sectional features of the roadway segments. Ratings were determined from a combination of critical criteria:

- Lane width
- Shoulder width
- Bridge width, with considerations for the total width of all roadway lanes and shoulders
- Horizontal clearance. The horizontal clearance refers to the clear lateral dimension between the traveled way and any obstruction along the traveled way, including barriers. For roadways with rural sections, see FDM Procedure 11-15-1, Table 1. For roads with urban sections (without shoulders), the horizontal clearance will be the lateral clearance or the urban safety section, as defined in FDM Procedure 11-20-1, Table 5.
- Cross Slope (excluding superelevated roadway segments)
- Median width. This is not a controlling criterion. However, it was added to the evaluation matrix, because cross-median crash (CMC) occurrences are more frequent whenever median widths are relatively narrow.

Cross sectional features for each roadway segment are rated GOOD, FAIR, or POOR based on an assessment described in **Table 7**. Mainline and bridge cross-sectional analyses are presented in **Exhibits F-8 and F-9**, respectively.

Table 7: Condition Criteria - Cross Section

Rating	Description
Good	Mainline roadway lane widths are 12 ft wide. Clear and paved shoulder width dimensions meet FDM criteria, including a paved width of 12 ft on mainline when the DDHV for trucks exceed 250 vehicles per hour (vph). Bridge widths meet or exceed roadway approach dimensions. Clear zones meet FDM requirements. Cross slopes are 2% (2 to 3% on auxiliary lanes). Medians include a barrier or exceed 60 ft width without barrier.
Fair	Same criteria as above, except 10 ft paved shoulders are provided in place of 12 ft shoulders where trucks exceed 250 vph. Cross slopes are 1.5% to 2.0%, except on auxiliary lanes.
Poor	Mainline roadway lane width is less than standard. Shoulder widths are less than standard (except 10 ft mainline shoulders in place of 12 ft will be considered FAIR). Substandard clear zone. Cross slopes other than those noted in GOOD or FAIR ratings. Medians without barrier are less than 60 ft or with barrier are less than 26 ft.

D. Criteria for Rating Other Geometric Conditions Affecting Operations

1. Ramp Design

Ramp design refers to the geometric conditions and criteria noted in previous sections (Section C, Subsections 1, 2, and 4). Additionally, the ramp entrance/exit location with regard to the mainline (left vs. right side) and ramp length were considered.

Each ramp roadway segment is rated GOOD, FAIR, or POOR based on an assessment described in **Table 8**. Analysis for ramp design is presented in **Exhibits F-10 through F-14**.

Table 8: Ramp Design Criteria

Rating	Description
Good	<p>The superelevation on a ramp curve meets the appropriate equivalent design speed for the ramp segment.</p> <p>Horizontal SSD exceeds minimum requirements for the ramp segment.</p> <p>The equivalent design speed for the K-value on a ramp segment meets or exceeds appropriate equivalent design speed for the specified ramp segment, with crest curves based on 2001 GDHS desired criteria and sag curves based on 2001 GDHS minimum values.</p> <p>Ramp grades are between 5.0% and 0.50% continuous.</p> <p>Single-lane ramps are 15 ft wide and multi-lane ramps include 12 ft minimum lane width.</p> <p>Ramp shoulders include a rural section and meet FDM standards.</p> <p>Ramps enter or exit from the mainline on the right side.</p> <p>Ramp lengths meet AASHTO deceleration and acceleration distances for the expected speed changes, including room for ~150 ft storage on exit ramps which approach stop or signal conditions.</p> <p>Ramp entrance and exit “taper” styles meet FDM design criteria, or enter and leave from auxiliary lanes.</p>
Fair	<p>The superelevation on a ramp curve meets the advisory speed or the appropriate equivalent design speed for the ramp segment.</p> <p>Horizontal SSD exceeds minimum requirements for the ramp segment.</p> <p>The equivalent design speed for the K-values on a ramp segment meets or exceeds the advisory speed or the appropriate design speed for the specified ramp segment, with crest curves based on 2001 GDHS minimum criteria and sag curves based on 2001 GDHS minimum values.</p> <p>Ramp minimum continuous grades are between 0.30% and 0.50%.</p> <p>Single-lane ramps are 15 ft wide and multi-lane ramps include 11 ft minimum lane width.</p> <p>Ramp shoulders include a rural section and meet FDM standards.</p> <p>Ramps with an urban section include non-sloping curbs where ramp segment design speed is 40 mph or less.</p> <p>Ramps enter or exit from the mainline on right side.</p> <p>Ramp entrance and exit “taper” styles don’t meet FDM design criteria, but meet AASHTO GDHS acceleration and deceleration criteria, including room for ~100 ft storage on exit ramps which approach stop or signal conditions.</p>
Poor	<p>The superelevation on a ramp curve does not meet equivalent design speed for advisory speed or appropriate ramp segment design speed.</p> <p>Minimum horizontal SSD criterion does not meet minimum requirements.</p> <p>Equivalent design speed for a K-value on a ramp is less than the advisory speed limit or appropriate ramp segment design speed, based on 2001 GDHS minimum values.</p> <p>Ramp grades exceed 5.0% or minimum continuous grades are flatter than 0.30%.</p> <p>Ramp lanes or shoulders are less than minimum standards, including urban sections with inappropriate curb styles. Ramps enter or exit mainline roadway on the left side.</p> <p>Ramp lengths do not meet AASHTO GDHS acceleration and deceleration criteria.</p> <p>Ramp “taper” designs are severely substandard.</p>

2. Route Continuity

Route continuity refers to the provision of a directional path along the length of a designated route. The principle of route continuity simplifies the driving task in that it reduces lane changes, simplifies signage, delineates the through lane, and reduces the driver’s search for directional signing.

Route continuity for each segment of WIS 441 is rated GOOD, FAIR, or POOR based on an assessment described in **Table 9**. Route continuity analysis for the study corridor is presented in **Exhibit F-15**.

Table 9: Route Continuity Criteria

Rating	Description
Good	A route enters the study area roadway without the need to turn off the highway and onto another. The route is carried on the highway across all lanes along the roadway.
Fair	Not applicable.
Poor	Drivers need to turn off one “through” highway onto another highway. Or, drivers must drive on a specific lane (or two) within a roadway segment to follow a marked route.

3. Lane Balance at Exits and Entrances

The principles of lane balance address the desire to facilitate access/egress to the freeway while minimizing disruption to through traffic that is created by excessive weaving. A discussion of lane balance and the basic number of lanes is found in the 2001 AASHTO GDHS, pages 815 to 818, including exhibits illustrating compliance with the lane balance and basic number of lanes principles.

Lane balance for each segment of WIS 441 is rated GOOD, FAIR, or POOR based on an assessment described in **Table 10**. **Exhibit F-15** presents lane balance analysis for the project area.

Table 10: Lane Balance Criteria

Rating	Description
Good	Ramp terminals are designed in accordance with proper lane balance and with basic number of lanes principles.
Fair	Not applicable.
Poor	Ramp terminals are not designed in accordance with proper lane balance. Ramp terminals or highway routes do not comply with basic number of freeway lanes.

4. Access Control

Access Control or interchange spacing for freeways refers to sufficient distance between ramp entry and the successive ramp exit. As distances increase, it is easier for drivers to merge, weave, and diverge along the roadway segment. Required distances are based on FDM Procedure 11-5-5, Figure 2, Table 2.

Access Control for crossroads refers to the distance from the ramp terminal to the nearest side road intersection. Required distances are based on FDM Procedure 11-5-5, Figure 2, Table 1.

Access Control distances for the mainline and side roads are rated GOOD, FAIR, or POOR based on an assessment described in **Table 11**. Mainline access control and side-road access control for the study corridor are presented in **Exhibits F-15 and F-16**, respectively.

Table 11: Access Control Criteria

Rating	Description
Good	WIS 441: access control distance is greater than 2640 feet Crossroads: access control distance is greater than 1320 feet
Fair	WIS 441: access control distance is greater than 1500 feet, but less than 2640 feet Crossroads: access control distance is greater than 1000 feet, but less than 1320 feet
Poor	WIS 441: access control distance is less than 1500 feet Crossroads: access control distance is less than 1000 feet

5. Freeway Guide Signing

An evaluation of freeway guide signing was performed since urban freeway operations are dependent on an effective and well-organized signing system. The criteria for guide signs are based on the following:

- Organization of signing. This criterion addresses the spacing sequence of signs in advance of exits and the placement of signs at exit gores.
- Uniformity of message display. The guidelines for the design of signing systems are found in the Manual of Uniform Traffic Control Devices (MUTCD). This criterion addresses the number of signs and messages displayed at any one location.

Freeway guide signing for each segment of the WIS 441 study area is rated GOOD, FAIR, or POOR based on an assessment described in **Table 12**. Signing analysis for the study corridor is presented in **Exhibit F-17**.

Table 12: Signing Criteria

Rating	Description
Good	Signs are in very good condition. Two advance signs and a gore sign are provided at each ramp exit. Special "Exit Only" signs are provided at lane drops. No more than four message units are displayed per sign location, with signs conveying the correct messages. Signing within the roadway segment meets MUTCD standards and "guidance" principals. Signs are located properly.
Fair	Signs are in acceptable condition. One advance sign and a gore sign is provided at ramp exit. Special "Exit Only" signs are provided at lane drops. No more than five message units are displayed per sign location, with signs conveying the correct messages. Signing within the roadway segment meets MUTCD standards. Signs locations do not meet guidelines, but are acceptable.
Poor	Signs are in need of repair or replacement. Poor advance signing or a gore sign is not provided at ramp exit. "Exit Only" signs are missing at lane drops. More than five message units are displayed per sign location. Appropriate signage is missing, signs are missing important information, convey incorrect messages, are at incorrect locations, or do not meet MUTCD standards.

E. Criteria for Rating Crash Experience

The rating technique established for presentation purposes describes the results of the crash analysis in terms of GOOD, FAIR, and POOR. A rating of GOOD is assigned to any roadway segment with a crash rate less than the respective statewide average. A FAIR rating applies when the crash rate is up to 30% past the statewide average, and a POOR rating is applied when the rate is greater than 1.3 times the statewide average.

1. Freeway segments (including ramps)

For evaluation and comparison purposes, Wisconsin statewide averages for rural interstate freeways formed the basis for the rating criteria. Currently, the statewide experience for these highways includes a total crash rate of 56 crashes per hundred million vehicle miles traveled (HMVMT).

Along with crash rate, the severity rate was calculated for the freeway segments. There are no known standards for rating the severity rate; therefore, engineering judgment was used to determine the scale.

Safety performance is rated GOOD, FAIR, or POOR based on an assessment described in **Table 13**. Analysis of mainline safety and mainline ramp safety in the project corridor are presented in **Exhibits F-18 and F-19**, respectively.

Table 13: Safety Performance Criteria - Freeway Segments (Including Ramps)

Rating	Description
Good	5 yr. avg. Crash Rate of less than 56 HMVMT and a Severity Crash Rate of less than 0.3
Fair	5 yr. avg. Crash Rate between 56 and 73 HMVMT or a Severity Crash Rate between 0.3 and 0.5
Poor	5 yr. avg. Crash Rate greater than 73 HMVMT or a Severity Crash Rate greater than 0.5

2. Ramp Terminal Intersections

For evaluation and comparison purposes, Wisconsin statewide averages for urban intersections formed the basis of the rating criteria. Based on a recent Wisconsin Traffic Operations and Safety Laboratory (TOPS) study, the average crash rate for Wisconsin urban intersections is 0.96 crashes per million entering vehicles (MEV). Adding 30% to the average rate and rounding to the nearest tenth will establish the rating criteria.

The safety performance was rated GOOD, FAIR, or POOR based on an assessment described in **Table 14**. Ramp terminal safety analysis for the project area is presented in **Exhibit F-20**.

Table 14: Safety Performance Criteria - Ramp Terminal Intersections

Rating	Description
Good	5 yr. avg. Crash Rate of less than 1.0 MEV
Fair	5 yr. avg. Crash Rate between 1.0 and 1.3 MEV
Poor	5 yr. avg. Crash Rate greater than 1.3 MEV

F. Criteria for Rating Level of Service

Level of service (LOS) refers to the overall quality of traffic flow at an intersection or mainline section and is measured in seconds of delay per vehicle during hours of peak volume. Levels range from very good, represented by LOS A, to very poor, represented by LOS F.

1. Mainline Roadway, including Weave Sections

Mainline roadway LOS is largely a function of the volume of traffic across all lanes. Highway operations are rated GOOD, FAIR, or POOR based on an assessment described in **Table 15**. Level of service analysis for the roadway mainline is presented in **Exhibit F-21**.

Table 15: Operations Criteria - Highway

Rating	Description
Good	Existing peak hour operations at LOS C or better
Fair	Existing peak hour operations at LOS D
Poor	Existing peak hour operations at LOS E or LOS F

2. Ramp Terminal Intersections

Level of service at an intersection is a function of the volume and pattern of traffic, the number and arrangement of turning lanes, and the type of traffic control employed. The Highway Capacity Manual (HCM) measures level of service based on whether the intersection is signalized or un-signalized (stop sign).

The intersections operations were rated GOOD, FAIR, or POOR based on an assessment described in **Tables 16 and 17**. Level of service analysis for the ramp terminal intersections is presented in **Exhibit F-22**.

Table 16: Operations Criteria – Signalized Intersection

Rating	Description
Good	Existing peak hour operations at LOS C or better, or equivalent to an average vehicle delay less than 35 seconds.
Fair	Existing peak hour operations at LOS D or an average vehicle delay between 35 and 55 seconds.
Poor	Existing peak hour operations at LOS E or LOS F, or an average vehicle delay of 55 or more seconds.

Table 17: Operations Criteria – Un-signalized Intersection

Rating	Description
Good	Existing peak hour operations at LOS C or better, or equivalent to an average vehicle delay less than 15 seconds.
Fair	Existing peak hour operations at LOS D or an average vehicle delay between 15 and 35 seconds.
Poor	Existing peak hour operations at LOS E or LOS F, or an average vehicle delay of 35 or more seconds.

Exhibit F-1

TABLE A
ROADWAY DESIGN CRITERIA

ITEM	REFERENCE	FREEWAY MAINLINE		SYSTEM INTERCHANGES & RAMPS		SERVICE INTERCHANGES & RAMPS	
		Full Standard	Minimum Standard	Full Standard	Minimum Standard	Full Standard	Minimum Standard
DESIGN SPEED - V (MPH)	AASHTO IH Policy & FDM 11-10-1, 11-15-1, 11-30-1 & 11-44-1	70 mph	70 mph	Directional ramps: 60 mph Loop ramps: 30 mph (see Notes 1 & 2)	Directional ramps: 60 mph Loop ramps: 30 mph (see Notes 1 & 2)	55 mph (See Note 1)	55 mph (See Note 1)
DESIGN VEHICLE	WisDOT policy	WB-65	WB-65	WB-65	WB-65	WB-65	WB-65
EXISTING POSTED SPEED	FDM 11-10-1	65 mph	65 mph	Varies	Varies	Varies	Varies
DESIGN HOURLY VOLUME FACTOR (K)	FDM 11-5-3; GDHS, pp. 59-62;	K30	K30	Weekday a.m. & p.m. peak hours	Weekday a.m. & p.m. peak hours	Weekday a.m. & p.m. peak hours	Weekday a.m. & p.m. peak hours
LEVEL OF SERVICE (see Note 3)	AASHTO IH Policy & FDM 11-5-3;	LOS C min for 20 Yrs	LOS C min for 20 years	Same as Mainline	Same as Mainline	Same as Mainline	Same as Mainline
MINIMUM STOPPING SIGHT DISTANCE (based on design speeds noted above) (see Note 4)	FDM 11-10-5, Figures 1,3 & 4; Table 2	730 feet	730 feet	See FDM, 2001 GDHS values	See FDM, 2001 GDHS values	See FDM, 2001 GDHS values	See FDM, 2001 GDHS values
MINIMUM DECISION SIGHT DISTANCE (based on design speeds noted above) (see Note 4)	Table 3 (Prop Rev FDM 11-10-5)	1105 feet	1105 feet	See Table 3	See Table 3	See Table 3	See Table 3
HORIZONTAL ALIGNMENT							
MINIMUM RADII OF CURVE (based on design speeds noted above) (see Note 5)	FDM 11-10-5 Figure 9; FDM 11-30-1	2050 feet	2050 feet	See FDM	See FDM	See FDM	See FDM
COMPOUND CURVATURE (Ratio of Radii for Increasing Curvature - flatter radius to sharper radius) (see Note 6)	GDHS, pp. 201-202	1.5:1 desirable max	1.75:1 absolute max	1.5:1 desirable max	1.75:1 absolute max	1.75:1 desirable max	2:1 absolute max
MAXIMUM SUPERELEVATION RATE (see Note 7)	FDM 11-10-5 Figure 9	6% Superelevation table	6% Superelevation table	6% Superelevation table	6% Superelevation table	6% Superelevation table	6% Superelevation table
SUPERELEVATION TRANSITION (see Note 8)	FDM 11-10-5 Figure 9	See FDM	See FDM	See FDM	See FDM	See FDM	See FDM
VERTICAL ALIGNMENT							
MAXIMUM GRADE	FDM 11-10-5, Figure 2	3%	3%	5%	5%	5%	5%
MINIMUM CONTINUOUS GRADE (see Note 9)	FDM 11-10-5, p.22	0.5% desirable minimum	0.3% absolute minimum	0.5% desirable minimum	0.3% absolute minimum	0.5% desirable minimum	0.3% absolute minimum
MINIMUM K VALUE FOR CREST VERTICAL CURVES (based on design speeds noted above) (see Note 10)	Table 4 (Prop Rev FDM 11-10-5)	See Table 4	See Table 4	See Table 4	See Table 4	See Table 4	See Table 4
MINIMUM K VALUE FOR SAG VERTICAL CURVES (based on design speeds noted above) (see Notes 10 & 11)	Table 4 (Prop Rev FDM 11-10-5)	See Table 4	See Table 4	See Table 4	See Table 4	See Table 4	See Table 4
MINIMUM VERTICAL CLEARANCE							
CLEAR OVER FREEWAY, EXPRESSWAY OR STH ARTERIAL	FDM 11-35-1, Attachment 8	16'-9" desirable	16'-4" min.	16'-9" desirable	16'-4" min.	16'-9" desirable	16'-4" min.
CLEAR OVER ARTERIAL CTH OR LOCAL RD WITH INTERCHANGE (see Note 12)	FDM 11-35-1, Attachment 8	16'-9" desirable	16'-3" min.	16'-9" desirable	16'-3" min.	16'-9" desirable	16'-3" min.
CLEAR OVER ARTERIAL CTH OR LOCAL RD WITHOUT INTERCHANGE (see Note 13)	FDM 11-35-1, Attachment 8	15'-3" desirable	14'-9" min.	15'-3" desirable	14'-9" min.	15'-3" desirable	14'-9" min.
CLEAR OVER RAILROAD (see Note 14)	FDM 11-35-1, Attachment 8	23'-3 1/2" max.	23'-0" min.	23'-3 1/2" max.	23'-0" min.	23'-3 1/2" max.	23'-0" min.
CLEAR UNDER PEDESTRIAN BRIDGE-- ARTERIAL CTH, EXPRESSWAYS & FREEWAYS (see Notes 15 & 16)	FDM 11-35-1, Attachment 8; AASHTO IH Policy, p. 5	17'-9" desirable	17'-4" min.	17'-9" desirable	17'-4" min.	17'-9" desirable	17'-4" min.
CLEAR UNDER SIGN BRIDGE-- FREEWAY, EXPRESSWAY OR ARTERIAL STH (see Note 17)	FDM 11-35-1, Attachment 8; AASHTO IH Policy, p. 5	18'-4" desirable	18'-0" min.	18'-4" desirable	18'-0" min.	18'-4" desirable	18'-0" min.
STRUCTURAL CAPACITY							
STRUCTURAL CAPACITY	FDM 11-44-1, Bridge Manual Ch 3, Sec 3.1; New AASHTO Load and Resistance Factor Design Specification (LRFD), Chapter 17	HL-93	HS-20 / Rated Oper Cap Safely Serv Sys for 20yr / in or added to 6-year Imp Prog	HL-93	HS-20 / Rated Oper Cap Safely Serv Sys for 20yr / in or added to 6-year Imp Prog	HL-93	HS-20 / Rated Oper Cap Safely Serv Sys for 20yr / in or added to 6-year Imp Prog

Exhibit F-1 Continued

ITEM	REFERENCE	FREEWAY MAINLINE		SYSTEM INTERCHANGES & RAMPS		SERVICE INTERCHANGES & RAMPS	
		Full Standard	Minimum Standard	Full Standard	Minimum Standard	Full Standard	Minimum Standard
CROSS SECTION ELEMENTS							
LANE WIDTH (see Note 18)	FDM 11-15-1, Fig. 1; AASHTO IH Policy, p. 3	12'	12'	N/A	N/A	N/A	N/A
* 1-LANE RAMP	FDM 11-30-5, p. 1	N/A	N/A	15'	15'	15'	15'
* 2-LANE RAMP	FDM 11-30-5, p. 1	N/A	N/A	24'	24'	24'	24'
TOTAL SHOULDER WIDTHS (RIGHT / LEFT) (see Note 18)	FDM 11-15-1, Fig. 1; FDM 11-44-1, page 3; AASHTO IH Policy, p. 3	4-lane: 12' / 6'; 6-lane: 12' / 12'	4-lane: 10' / 6'; 6-lane: 10' / 10'	N/A	N/A	N/A	N/A
* 1-LANE RAMP (see Note 19)	FDM 11-15-1, Fig. 7; FDM 11-30-1, Figures 2 & 3	N/A	N/A	8' / 4'	8' / 4'	8' / 4'	8' / 4'
* 2-LANE RAMP (see Note 20)	FDM 11-30-1, Figures 2 & 3; GDHS, pp. 838-840	N/A	N/A	10' / 6'	10' / 6'	8' / 4'	8' / 4'
* 3-LANE RAMP (see Note 21)	FDM 11-30-1, Figures 2 & 3; GDHS, pp. 838-840	N/A	N/A	10' / 10'	10' / 10'	8' / 4'	8' / 4'
PAVED SHOULDER WIDTHS (RIGHT / LEFT) (see Notes 22 & 23)	FDM 11-15-1, Figures 1 & 5; AASHTO IH Policy, p. 3	4-lane: 12' / 4'; 6-lane: 12' / 12'	4-lane: 10' / 4'; 6-lane: 10' / 10'	N/A	N/A	N/A	N/A
* 1-LANE RAMP (see Note 19)	FDM 11-15-1, Figures 5 & 7; FDM 11-30-1, Figures 2 & 3	N/A	N/A	8' / 4'	8' / 4'	5' / 3'	5' / 3'
* 2-LANE RAMP (see Note 20)	FDM 11-30-1, Figures 2 & 3; GDHS, pp. 838-840	N/A	N/A	10' / 6'	10' / 6'	5' / 3'	5' / 3'
* 3-LANE RAMP (see Note 21)	FDM 11-30-1, Figures 2 & 3; GDHS, pp. 838-840	N/A	N/A	10' / 10'	10' / 10'	5' / 3'	5' / 3'
NORMAL BRIDGE SHOULDER WIDTHS (RIGHT / LEFT)	FDM 11-44-1, p. 4; FDM 11-35-1; AASHTO IH Policy, p. 5; GDHS, Exhibit 10-67, p. 839	See total shoulder widths from previous page. Also see Notes 23 & 24.	10' / 3.5'	See total shoulder widths from previous page. Also see Note 24.	See total shoulder widths from previous page. Also see Note 24.	See total shoulder widths from previous page. Also see Note 24.	See total shoulder widths from previous page. Also see Note 24.
MAJOR LONG BRIDGE SHOULDER WIDTHS (RIGHT/LEFT) (see Note 25)	FDM 11-44-1, p. 4; FDM 11-35-1; AASHTO IH Policy, p. 5; GDHS, Exhibit 10-67, p. 839	See total shoulder widths from previous page. Also see Notes 23, 24 & 25.	3.5' / 3.5'	See total shoulder widths from previous page. Also see Note 24 & 25.	3.5' / 3.5'	See total shoulder widths from previous page. Also see Note 24 & 25.	3.5' / 3.5'
BRIDGE CURBS & PARAPETS – MAINLINE	FDM 11-44-1; Bridge Manual	Current Design Criteria	No curbs more than 6" wide, Parapet meets NCHRP 350 TL-3 Criteria	Current Design Criteria	No curbs more than 6" wide, Parapet meets NCHRP 350 TL-3 Criteria	Current Design Criteria	No curbs more than 6" wide, Parapet meets NCHRP 350 TL-3 Criteria
BRIDGE CURBS & PARAPETS – AT SIDEROADS OVER MAINLINE (see Note 26)	FDM 11-44-1; Bridge Manual	Current Design Criteria	No curbs more than 9" wide. Parapet meets appropriate NCHRP 350 TL-3 criteria based on posted speed.	Current Design Criteria	No curbs more than 9" wide. Parapet meets appropriate NCHRP 350 TL-3 criteria based on posted speed.	Current Design Criteria	No curbs more than 9" wide. Parapet meets appropriate NCHRP 350 TL-3 criteria based on posted speed.
MEDIAN WIDTH (for mainline locations not on structures)	FDM 11-15-1(Offset plus barrier width)	60' min. without barrier; 26' with single-faced concrete barrier (both sides)	60' min. without barrier; 26' with single-faced concrete barrier (both sides)	N/A	N/A	N/A	N/A
CURBS	FDM 11-20-1, p. 5; 11-44-1	No curbs	4" sloped mountable at outside edge of shoulder	No curbs	4" sloped mountable at outside edge of shoulder	No curbs	4" sloped mountable at outside edge of shoulder
LATERAL CLEARANCE ALONG ROADWAY (see Note 27)	FDM 11-15-1, Page 9 (table 1); AASHTO IH Policy, p. 4; AASHTO Roadside Design Guide	Finished shoulder width (w/ roadside barrier); finished shoulder width + 2' (w/o roadside barrier).	Finished shoulder width (w/ roadside barrier); finished shoulder width + 2' (w/o roadside barrier).	Finished shoulder width (w/ roadside barrier); finished shoulder width + 2' (w/o roadside barrier).	Finished shoulder width (w/ roadside barrier); finished shoulder width + 2' (w/o roadside barrier).	Finished shoulder width (w/ roadside barrier); finished shoulder width + 2' (w/o roadside barrier).	Finished shoulder width (w/ roadside barrier); finished shoulder width + 2' (w/o roadside barrier).
LATERAL CLEARANCE ACROSS STRUCTURE (see Note 27)	FDM 11-35-1, Fig. 1, 2, 3, 5 and 7; AASHTO IH Policy, p. 5; AASHTO Roadside Design Guide	Finished shoulder width	10' / 6'	Finished shoulder width	8' / 4'	Finished shoulder width	8' / 4'
LATERAL CLEARANCE UNDER STRUCTURE (see Note 27)	FDM 11-35-1, Fig. 1, 2, 3, 5 and 7; AASHTO IH Policy, p. 5; AASHTO Roadside Design Guide	For lateral distance to fixed object of 2.5' or less, provide vertical wall concrete barrier. For lateral distance to fixed object between 2.5' and 4', provide safety shape concrete barrier. (see note 28)	For lateral distance to fixed object of 2.5' or less, provide vertical wall concrete barrier. For lateral distance to fixed object between 2.5' and 4', provide safety shape concrete barrier. (see note 28)	For lateral distance to fixed object of 2.5' or less, provide vertical wall concrete barrier. For lateral distance to fixed object between 2.5' and 4', provide safety shape concrete barrier. (see note 28)	For lateral distance to fixed object of 2.5' or less, provide vertical wall concrete barrier. For lateral distance to fixed object between 2.5' and 4', provide safety shape concrete barrier. (see note 28)	For lateral distance to fixed object of 2.5' or less, provide vertical wall concrete barrier. For lateral distance to fixed object between 2.5' and 4', provide safety shape concrete barrier. (see note 28)	For lateral distance to fixed object of 2.5' or less, provide vertical wall concrete barrier. For lateral distance to fixed object between 2.5' and 4', provide safety shape concrete barrier. (see note 28)
NORMAL PAVEMENT CROSS SLOPE	FDM 11-20-1, p. 1, FDM 11-15-1, p. 2 & FDM 11-44-1	2%	1.5%	2%	1.5%	2%	1.5%
NORMAL SHOULDER CROSS SLOPE (see Note 29)	FDM 11-15-1, p. 2 & 11-44-1	4%	2%	4%	2%	4%	2%
SUPERELEVATED SHOULDER CROSS SLOPE (LOW SIDE)	FDM 11-15-1, pp. 2-3	Match pavement superelevation, 4% minimum	Match pavement superelevation, 4% minimum	Match pavement superelevation, 4% minimum	Match pavement superelevation, 4% minimum	Match pavement superelevation, 4% minimum	Match pavement superelevation, 4% minimum
SUPERELEVATED SHOULDER CROSS SLOPE (HIGH SIDE)	FMD 11-15-1, pp. 2-3	See Note 30	See Note 30	See Note 30	See Note 30	See Note 30	See Note 30
MAXIMUM CROSS SLOPE BREAK (Pavement to Pavement)	FDM 11-10-5, p. 21,	5%	5%	5%	5%	5%	5%
MAXIMUM CROSS SLOPE BREAK (Pavement to Shoulder)	FDM 11-10-5, p. 21,	8%	8%	8%	8%	8%	8%
FORESLOPES WITHOUT TRAFFIC BARRIER (see Note 31)	FDM 11-15-1, Fig. 7; AASHTO Roadside Design Guide	6:1 to clear zone, 3:1 max. beyond	4:1 max, or 3:1 max w/ adequate recovery area to meet clear zone requirements	6:1 to clear zone, 3:1 max. beyond	4:1 max, or 3:1 max w/ adequate recovery area to meet clear zone requirements	6:1 to clear zone, 3:1 max. beyond	4:1 max, or 3:1 max w/ adequate recovery area to meet clear zone requirements
CLEAR ZONE DISTANCES	FDM 11-15-1, Fig. 10; FDM 11-44-1; AASHTO Roadside Design Guide; AASHTO IH Policy, p. 4	Refer to FDM	30 feet	Refer to FDM	Refer to FDM	Refer to FDM	Refer to FDM

Exhibit F-1 Continued

ITEM	REFERENCE	FREEWAY MAINLINE		SYSTEM INTERCHANGES & RAMPS		SERVICE INTERCHANGES & RAMPS	
		Full Standard	Minimum Standard	Full Standard	Minimum Standard	Full Standard	Minimum Standard
ENTRANCE RAMP DESIGN							
ENTRANCE RAMP - TERMINAL DESIGN	Use FDM 11-30-1, Fig. 1	N/A	N/A	See Note 32	See Note 32	See Note 32	See Note 32
ENTRANCE RAMP - LANE DROP TAPER (Parallel Type Only)	Use FDM 11-30-1, Fig. 1	N/A	N/A	See Note 33	See Note 33	See Note 33	See Note 33
ENTRANCE RAMP - LANE DROP TAPER (Taper Style Design Only)	FDM 11-30-1 Figure 3; GDHS pg. 845-847	N/A	N/A	70:1	50:1	70:1	50:1
ENTRANCE RAMP - AUXILIARY LANE LENGTH (Parallel Type Only)	GDHS pp. 814-816; ITE Freeway and Interchange Geometric Design Handbook, p. 127 (Figure 4-12)	N/A	N/A	2500 feet--See Note 34	2500 feet--See Note 34	2500 feet--See Note 34	2500 feet--See Note 34
EXIT RAMP DESIGN							
EXIT RAMP - TERMINAL DESIGN	FDM 11-30-1 Figure 2; GDHS pp. 849-852	N/A	N/A	See Note 35	See Note 35	See Note 35	See Note 35
EXIT RAMP - DIVERGENCE TAPER RATE	FDM 11-30-1, Figure 2; GDHS pp. 849-852	N/A	N/A	See Note 36	See Note 36	See Note 36	See Note 36
EXIT RAMP - AUXILIARY LANE LENGTH (Parallel Type Only)	GDHS pp. 814-816; ITE Freeway and Interchange Geometric Design Handbook, p. 127 (Figure 4-12)	N/A	N/A	2500 feet--See Note 34	2500 feet--See Note 34	2500 feet--See Note 34	2500 feet--See Note 34
EXIT RAMP - LENGTH IN ADVANCE OF STOP CONDITION	GDHS, Exhibits 10-71 and 10-73	N/A	N/A	N/A	N/A	Deceleration length in advance of queue.	Deceleration length in advance of queue.
DESIGN AT RAMP CROSS STREET TERMINALS	FDM 11-30-1, Figures 4, 5 and 6	N/A	N/A	N/A	N/A	Refer to FDM	Refer to FDM
LANE ARRANGEMENTS							
BASIC NUMBER OF LANES	GDHS, pp 810-811	See Note 37	See Note 37	See Note 37	See Note 37	See Note 37	See Note 37
LANE BALANCE (see Note 38)	GDHS pg. 811-817; ITE Freeway and Interchange Geometric Design Handbook, pp. 126, 260-262	Applies to design of all ramp terminals	Applies to design of all ramp terminals	Applies to design of all ramp terminals	Applies to design of all ramp terminals	Applies to design of all ramp terminals	Applies to design of all ramp terminals
ROUTE CONTINUITY	GDHS Exhibit 10-46	See Note 39	See Note 39	N/A	N/A	N/A	N/A
AUXILIARY LANES	GDHS, pp. 814-818	Add and drop on the right. Terminate properly.	Add and drop on the right. Terminate properly.	N/A	N/A	N/A	N/A
RAMP TERMINAL SPACING	ITE Freeway and Interchange Geometric Design Handbook, p. 127 (Figure 4-12); AASHTO IH Policy, p. 4	N/A	N/A	Variable--see reference; also see Note 40 for minimum interchange spacing	Variable--see reference; also see Note 40 for minimum interchange spacing	Variable--see reference; also see Note 40 for minimum interchange spacing	Variable--see reference; also see Note 40 for minimum interchange spacing
LANE DROP TAPER	GDHS, p. 818	70:1	50:1	N/A	N/A	N/A	N/A
LANE ADD TAPER	GDHS, Exhibit 10-52, p. 816	300 feet typical (@25:1 for 12 feet)	300 feet typical (@25:1 for 12 feet)	N/A	N/A	N/A	N/A
ACCESS CONTROL							
ACCESS CONTROL	FDM 11-5-5 & 11-44-1	Full Access Control	Full Access Control	Full Access Control	Full Access Control	Full Access Control	Full Access Control
INTERCHANGES	AASHTO IH Policy, p. 4	N/A	N/A	Full System	Full System (See Note 41)	Full Service	Full Service (See Note 41)
LOCKED GATES	FHWA Policy	See Note 42	See Note 42	See Note 42	See Note 42	See Note 42	See Note 42

Exhibit F-1 Continued

References:

GDHS '04: A Policy on Geometric Design of Highways and Streets (a.k.a. AASHTO Green Book)
GDHS '01: A Policy on Geometric Design of Highways and Streets (a.k.a. AASHTO Green Book)
GDHS '90: A Policy on Geometric Design of Highways and Streets (a.k.a. AASHTO Green Book)
FDM: Facilities Development Manual (WisDOT)
Intelligent Transportation Systems Design Manual (WisDOT)
A Policy on Design Standards - Interstate System, 2005 (AASHTO)
MUTCD: Manual on Uniform Traffic Control Devices, 2003 Edition
State of Wisconsin Bridge Manual
AASHTO Roadside Design Guide, 2006
Highway Capacity Manual, 2000
ITE Freeway and Interchange Geometric Design Handbook, 2005 edition

Notes:

1. The selected design speed at the point where the ramp taper is 12 feet from the edge of mainline will be at least 80% of the adjacent mainline speed. Design speeds on ramps may require proration of speeds in 10 mph increments.
2. Wherever prudent and reasonable, maintain mainline design speed between major merge and diverge areas (i.e. system split, forks) of two freeways.
3. Highway Capacity Manual (HCM) methodologies required. Level of service analysis requires using 30th highest hour (K30). K100 may be used to evaluate sensitivity. Additional traffic modeling studies to validate HCM results are desirable.
4. Proposed FDM standards were used. These standards are anticipated to be adopted in 2008. The are the same standards that were used in the evaluation of USH 41. See separate attachment (Exhibit A) for standards on stopping sight and decision sight distances.
5. Based on e max = 6% superelevation tables.
6. Compound curves are not preferred and should be avoided. If used, compound curve guidelines based on travel in direction of sharper curve. For the acceleration condition (i.e. travel in direction of sharper to flatter curve), the absolute max ratio is not as critical and may be exceeded. For exit ramps, first compound curve should be flatter curve, and adequate deceleration length should be accommodated. For entrance ramps, second compound curve should be flatter due to acceleration needs. Avoid compound curves that require transition from normal crown to reverse crown or greater superelevation.
7. WisDOT policy is 6% maximum superelevation rate. FHWA would allow superelevation rates exceeding 6%, up to 8% max. Due to complexity of interchange designs and limited ROW availability, 8% maximum superelevation may be used for ramps and will be documented as a design exception.
8. Superelevation transition lengths may be lengthened to provide smoother, less-abrupt transition or meet existing superelevation transition conditions.
9. Applicable to bridges with parapets or other curbed sections. Flatter longitudinal gradient may be acceptable on rural, normal cross slope roadway sections. Superelevation transitions should be evaluated along flat longitudinal gradients.
10. The ramp vertical alignment, or K-value, shall meet or exceed the selected design speed utilized for the horizontal alignment and superelevation.
11. For sag vertical curves, the "comfort criteria" can be used on lighted roadways.
12. For non-arterial vertical clearance, desirable/minimum clearance for new construction may be reduced to 15'-9" and 15'-3" respectively
13. Vertical clearances also apply to non-arterial CTH, STH or local roads without interchanges.
14. Consult with the region railroad coordinator if the overpassing or underpassing facility is either a railroad or a "rails-to-trails" trail; or if a structure is owned by a railroad company. Discuss with Bureau of Rail & Harbors if < 23' vertical clearance is acceptable for existing conditions.
15. Clearance under pedestrian structures may be reduced to 17'-3" minimum for arterials and CTHs.
16. Vertical clearance under pedestrian bridge for non-arterials does not apply for this study.
17. Vertical clearance under sign bridge for arterial CTH and local roads & non-arterials do not apply for this study.
18. Wider lanes may be necessary on sharp curves. See GDHS, Exhibit 10-67 p. 839. Shoulder widths may need to be increased on structures to accommodate horizontal sight distance or request exception to standards.

19. Consideration should be given to widening the ramp shoulder(s) if additional width is needed for future rehabilitation staging needs, frequency of maintenance vehicles (including maintenance for lighting), distressed vehicles alongside long barrier (i.e. bridge) sections, increased sight distance, etc... Wider pullout embankment sections for additional shoulder width may be desirable for added safety and comfort adjacent to the ends of long ramp bridges. If wider shoulder widths are selected, the shoulder dimensions and reasons for the wider shoulders shall be documented in the DSR.
20. Use 12-foot right shoulder (12 feet paved) if truck DHV > 250 along ramp.
21. Use 12-foot left and right shoulders (12 feet paved) if truck DHV > 250 along ramp.
22. Offset of 12' is to be provided to face of barrier or curb. A minimum 10' offset will be provided in isolated locations such as at sign bridges or on structures. Consider constructing total shoulder width one foot wider than paved shoulder width for added stability. See GDHS, Exhibit 10-67, p. 839 if barriers placed along edge of paved shoulder.
23. Use a 12-foot paved shoulder (right) on 4-lane freeways if truck traffic >250 DHV. Use 12-foot paved shoulders (left & right) on 6-lane freeways if truck traffic > 250 DHV. All bridges having three or more travel lanes in the same direction, including long bridges, should have 12-foot shoulders.
24. Full-width shoulders are preferred for safety and operations when constructing/replacing structures.
25. Long bridge defined as 200' length or greater. Long bridges may have a lesser width and need to be analyzed individually. Adequate sight distance may be dependent on shoulder width for structures located on curves. Minimum 4 foot shoulders required for new long bridges.
26. Side road overpasses/underpasses need to be evaluated for adequacy. Parapet meeting NCHRP 350 TL-2 criteria may be acceptable for posted speeds 40 mph and under. Concrete parapet preferred on structures.
27. Lateral clearance (a.k.a. operational offset distance) is defined as an obstruction free area beginning at the edge of driving lane and extending a distance not to interfere with the operation of the roadway.
28. To the extent practicable, the piers and abutments of overcrossing structures should be designed to provide a horizontal clearance equal to the clear recovery area. On 4R projects, it is most important to provide full shoulder width. May need fillet concrete barrier between bridge columns so column is flush with face of concrete barrier.
29. AASHTO allows 2% shoulder cross slope. Construction techniques typically create a 2% monolithic paved shoulder. Use 2% on all structures.
30. WisDOT policy allows high-side shoulder to slope in direction of superelevated roadway. Shoulder cross slope typically matches roadway slope. Shoulder cross slope could be 2% at high side for flatter curves.
31. A recoverable slope is one on which most motorists can generally stop their vehicles or slow them enough to return to the roadway safely. Foreslopes of 6:1 or flatter are considered recoverable. Slopes as steep as 4:1 are considered recoverable if they are also relatively smooth. Foreslopes of 3:1 are not considered recoverable, but are usually traversable if they are relatively smooth. Barrier railing is usually warranted for foreslopes steeper than 3:1.
32. The parallel type of entrance ramp terminal is preferred.
33. A 50:1 taper is required within the length of the parallel entrance ramp. Provide a downstream merge taper of 360 feet (@ 30:1 taper).
34. Existing auxiliary lanes could be shorter and still provide adequate functionality and operational efficiency if traffic demands do not create weaving and other safety issues. Traffic capacity modeling may be required to justify shorter auxiliary lanes. Weaving segment lengths are measured from where ramps are 12' from the edge of the mainline.
35. The taper type of exit ramp terminal is preferred. WisDOT current design practices uses the tangent tapered exit ramp design versus the curvilinear tapered design. Parallel exit ramp designs are suitable for high-queueing ramps as well as other geometric conditions. Dual lane system ramps will be designed on a case by case basis considering the speed and traffic volume to be accommodated.
36. Tangential tapered design divergence angles typically ranges between 2 and 5 degrees. WisDOT current practice is 12.5:1 exit taper (= 4 degrees, 34 minutes).
37. Based on level-of-service, operational and safety analyses. Does not include auxiliary lanes.
38. See ITE Freeway and Interchange Handbook for lane balance formulas.
39. USH 441, when converted to interstate, will be considered the mainline and will control route continuity.
40. From A Policy on Design Standards Interstate System, a general rule of thumb for minimum interchange spacing is 1 mile in urban areas and 3 miles in rural areas.
41. Partial interchanges must be justified to remain
42. Locked gate access points are primarily used to emergency, maintenance or land access needs. Locked gate locations must be approved based on the Interstate access justification criteria and the IAJR process.
43. All loop and directional ramps were analyzed under the "System Interchange & Ramp" criteria. Diamond interchanges ramps were analyzed under "Service Interchange & Ramp" criteria.

TABLE B
STOPPING SIGHT DISTANCE

Design Speed (V) (mph)	Perception/Reaction		Braking		Stopping Sight Dist. (S)	
	Time (t) (sec)	Distance (ft)	Deceleration Rate (a) (ft/sec ²)	Distance (ft)	Computed (ft)	Rounded for Design (ft)
30	2.5	110	11.15	87	197	200
35	2.5	128	11.15	119	247	250
40	2.5	147	11.15	155	302	305
45	2.5	165	11.15	196	361	360
50	2.5	183	11.15	242	425	425
55	2.5	202	11.15	293	495	495
60	2.5	220	11.15	349	569	570
65	2.5	238	11.15	409	648	645
70	2.5	257	11.15	475	731	730

Stopping Sight Distance: $S = 1.467 \times 2.5V + (1.467V)^2/2a$

TABLE C
DECISION SIGHT DISTANCE - AVOIDANCE MANEUVER 'C'

Design Speed (V) (mph)	Decision Sight Dist. (D)		Rounded for Design (ft)
	Time (t) (sec)	Computed Distance (ft)	
30	10.2	449	450
35	10.2	524	525
40	10.2	598	600
45	10.2	673	675
50	10.2	748	750
55	10.7	863	865
60	11.2	986	990
65	11.0	1049	1050
70	10.8	1104	1105

Decision Sight Distance for Avoidance Maneuver 'C': $D = 1.467 \times t \times V$
Value for t allowed between 10.2 and 11.2

TABLE D
VERTICAL CURVE DESIGN

Design Speed (V) (mph)	Stopping Sight Dist. (S) (ft)	Decision Sight Distance (D) Avoidance Maneuver C (ft)	Rate of Vertical Curvature, K			
			Crest Curve		Sag Curve	
			Minimum	Desirable	Headlights	Comfort
30	200	450	31	94	37	19
35	250	525	48	128	49	26
40	305	600	70	167	64	34
45	360	675	98	212	79	44
50	425	750	136	261	96	54
55	495	865	185	347	115	65
60	570	990	245	455	136	77
65	645	1050	314	511	157	91
70	730	1105	401	566	181	105

Crest Curves: Values from proposed FDM 11-10-05, not yet approved
Sag Curves (Headlight Criteria): $K = S^2/(400 + 3.5S)$
Sag Curves (Comfort Criteria): $K = V^2/46.5$

Source: NCHRP Report 400, 1997 (Transportation Research Board)

Exhibit F-2

PHYSICAL CONDITIONS - PAVEMENT																	
Segment	Cum. Mile (From)	Cum. Mile (To)	Hwy & Direction	From Feature	To Feature	Length of Segment (mi)	Surface Year	Pavement Type	Flexible or Rigid	IRI Rating	PDI Rating	Long. Crack Severity	Trans. Crack Severity	Slab Break- up	Trans Fault Severity	Overall (OA) Rating	Comments
2	0.61	1.10	441 NB	(WIS 441) USH 41 NB Gore	WIS 441 Gore at USH 10	0.49	1975	JRCP	Rigid	2.824	48					Poor	IRI, PDI (ramp section from 41 NB)
2	1.10	1.19	441 NB	(US 10) WIS 441 Gore	R. Kampo Bridge Begin	0.09	1975	AC over RIGID	Rigid	2.395						Fair	IRI
2	1.19	1.81	441 NB	(US 10) R. Kampo Bridge Begin	R. Kampo Bridge End	0.62	1991	AC over FLEX	Flexible	2.170	32	1	1	1	2	Fair	IRI, Slab Break-up 10% w ith 2-3 blocks
2 & 3	1.81	2.07	441 NB	(US 10) R. Kampo Bridge End	CTH P NW Loop	0.26	1991	AC over FLEX	Flexible	2.170	32	1	1	1	2	Fair	IRI, Slab Break-up 10% w ith 2-3 blocks
3	2.07	2.16	441 NB	(US 10) CTH P NW Loop	End Median Barrier	0.09	1991	JPCP w / dow els	Rigid	2.427	2	1	1	1	2	Poor	IRI, Slab Break-up 10% w ith 2-3 blocks
3	2.16	3.03	441 NB	(US 10) End Median Barrier	CTH AP	0.87	1991	JPCP w / dow els	Rigid	2.427	2	1	1	1	2	Poor	IRI, Slab Break-up 10% w ith 2-3 blocks
3 & 4	3.03	4.00	441 NB	(US 10) CTH AP	WIS 47	0.97	1991	JPCP w / dow els	Rigid	2.159	31	1	1	1	2	Poor	IRI, Slab Break-up 10% w ith 2-3 blocks
4 & 5	4.00	4.83	441 NB	(US 10) WIS 47	US 10 Gore	0.83	1991	JPCP w / dow els	Rigid	1.985	7	0	1	0	1	Fair	Trans crack severity
5	4.83	5.01	441 NB	(US 10) Gore	WIS 441 NB (E JCT)	0.18	1983	JPCP w/o dow els	Rigid	3.939	16	0	0	0	0	Poor	IRI
5 & 6	5.01	6.25	441 NB	(WIS 441) NB E JCT	Maintenance X-Over	1.42	1993	JPCP w / dow els	Rigid	1.922	5	0	0	0	0	Good	Slab Break-up 10% w ith 2-3 blocks
6 & 7	6.25	7.69	441 NB	(WIS 441) Maintenance X-Over	CTH KK	1.44	1993	JPCP w / dow els	Rigid	2.001	5	0	1	0	1	Fair	IRI
7	7.69	7.92	441 NB	(WIS 441) CTH KK	CTH KK On-Ramp	0.23	1993	JPCP w / dow els	Rigid	1.843	5	0	1	0	1	Fair	Trans crack severity
7	7.92	8.70	441 NB	(WIS 441) CTH KK On-Ramp	CTH CE	0.78	1993	JPCP w / dow els	Rigid	1.843	5	0	1	0	1	Fair	Trans crack severity
7	8.70	8.91	441 NB	(WIS 441) CTH CE	CTH CE Gore	0.21	1993	JPCP w / dow els	Rigid	2.096	5	1	0	0	1	Fair	IRI
7 & 8	8.91	9.11	441 NB	(WIS 441) CTH CE Gore	Begin Median Barrier	0.20	1993	JPCP w / dow els	Rigid	2.096	5	1	0	0	2	Poor	IRI
8	9.11	9.89	441 NB	(WIS 441) Begin Median Barrier	Fox River Bridge Begin	0.78	1993	JPCP w / dow els	Rigid	2.096	5	2	0	0	1	Fair	IRI
8	9.89	10.69	441 NB	(WIS 441) Fox River Bridge Begin	CTH OO	0.80	1993	JPCP w / dow els	Rigid	2.222	11	0	0	0	1	Fair	IRI, Slab Break-up 10% w ith 2-3 blocks
8	10.69	10.86	441 NB	(WIS 441) CTH OO	CTH OO On-Ramp	0.17	1993	JPCP w / dow els	Rigid	2.017	5	0	1	0	1	Fair	IRI
8 & 9	10.86	11.26	441 NB	(WIS 441) CTH OO On-Ramp	US 41 NB Exit-Ramp	0.40	1993	JPCP w / dow els	Rigid	2.017	5	0	1	0	1	Fair	IRI
9 & 10	11.26	11.49	441 NB	(WIS 441) US 41 NB Exit-Ramp	US 41 SB Exit-Ramp	0.23	1993	JPCP w / dow els	Rigid	2.017	5	0	0	0	1	Fair	IRI
10	0.00	0.47	441 SB	(WIS 441) US 41 SB Exit-Ramp	US 41 NB Gore	0.47	1993	JPCP w / dow els	Rigid	2.159	5	0	0	0	1	Fair	IRI (ramp section from 41 SB)
10	0.47	0.50	441 SB	(WIS 441) US 41 NB Gore	US 41 On-Ramp	0.03	1993	JPCP w / dow els	Rigid	2.159	5	0	1	0	1	Fair	IRI
10 & 9	0.50	0.90	441 SB	(WIS 441) US 41 On-Ramp	CTH OO Exit-Ramp Gore	0.40	1993	JPCP w / dow els	Rigid	2.159	5	1	0	0	2	Poor	IRI
9 & 8	0.90	1.01	441 SB	(WIS 441) CTH OO Exit-Ramp Gore	CTH OO	0.11	1993	JPCP w / dow els	Rigid	2.159	5	0	0	0	2	Poor	IRI
8	1.01	1.81	441 SB	(WIS 441) CTH OO	Fox River Bridge End	0.80	1993	JPCP w / dow els	Rigid	2.348	5	0	0	0	0	Fair	IRI
8	1.81	2.59	441 SB	(WIS 441) Fox River Bridge End	End Median Barrier	0.78	1993	JPCP w / dow els	Rigid	2.348	5	0	0	0	0	Fair	IRI
8	2.59	2.79	441 SB	(WIS 441) End Median Barrier	CTH CE Exit-Ramp	0.20	1993	JPCP w / dow els	Rigid	2.348	5	0	0	0	0	Fair	IRI
8 & 7	2.79	3.00	441 SB	(WIS 441) CTH CE Exit-Ramp	CTH CE	0.21	1993	JPCP w / dow els	Rigid	2.348	5	0	0	0	0	Fair	IRI
7	3.00	3.78	441 SB	(WIS 441) CTH CE	CTH KK Exit-Ramp	0.78	1993	JPCP w / dow els	Rigid	2.222	2	0	0	0	1	Fair	IRI
7	3.78	4.01	441 SB	(WIS 441) CTH KK Exit-Ramp	CTH KK	0.23	1993	JPCP w / dow els	Rigid	2.222	2	0	0	0	1	Fair	IRI
7 & 6	4.01	5.43	441 SB	(WIS 441) CTH KK	Telulah Ave. Bridge Over	1.42	1993	JPCP w / dow els	Rigid	2.175	5	0	1	2	1	Fair	IRI, Slab Break-up 40% w ith 2-3 blocks
6 & 5	5.43	6.87	441 SB	(WIS 441) Telulah Ave. Bridge Over	US 10 W (E JCT)	1.44	1993	JPCP w / dow els	Rigid	1.922	14	0	1	2	1	Fair	Slab Break-up 30% w ith 2-3 blocks
5	6.87	6.87	441 SB	(WIS 441) US 10 Connector	US 10 W (E JCT)	0.33	1983	JPCP w/o dow els	Rigid	3.718	7	1	0	0	0	Poor	IRI (ramps at Oneida St)
5 & 4	6.87	7.72	441 SB	(US 10) WIS 441 SB (E JCT)	WIS 47	0.85	1991	JPCP w / dow els	Rigid	2.080	2	1	0	0	0	Fair	IRI
4 & 3	7.72	8.70	441 SB	(US 10) WIS 47	CTH AP	0.98	1991	JPCP w / dow els	Rigid	2.206	19	0	0	0	0	Fair	IRI
3	8.70	9.56	441 SB	(US 10) CTH AP	Begin Median Barrier	0.86	1991	JPCP w / dow els	Rigid	2.522	19	0	0	0	1	Poor	IRI
3	9.56	9.66	441 SB	(US 10) Begin Median Barrier	CTH P NW Loop	0.10	1991	JPCP w / dow els	Rigid	2.522	19	0	0	0	0	Poor	IRI
3 & 2	9.66	9.91	441 SB	(US 10) CTH P NW Loop	R. Kampo Bridge Begin	0.25	1991	AC over FLEX	Flexible	1.886	24	0	0	0	1	Good	
2	9.91	10.53	441 SB	R. Kampo Bridge Begin	R. Kampo Bridge End	0.62	1991	AC over FLEX	Flexible	1.886	24	0	0	0	0	Good	
2	10.53	10.81	441 SB	(US 10) R. Kampo Bridge End	US 41NB Exit-Ramp	0.28	1997	AC over FLEX	Flexible	2.328		0	0	0	0	Fair	IRI
2	10.81	11.63	441 SB	(US 10) US 41 NB Exit-Ramp	US 41 SB Gore	0.82	1975	JPCP w/o dow els	Rigid	2.618		0	0	0	0	Poor	IRI (ramp section on to 41 SB)



Exhibit F-3

PHYSICAL CONDITIONS - STRUCTURES																
Segment	Cum. Mile	Structure Number	Bridge Location (STA)	Feature Carried	Feature Under	Year Built	Length X Deck Width	# of Spans	Girder Type	Sub-structure Rating	Super-structure Rating	Suff. Rating	Inventory Rating (HS __)	NBI Deck Rating	OA Rating	Comments
1	0.29 NB	B-70-0157	35+30	US 10 EB	COLDSPRING RD	1997	159.1x55.0	3	CONT CONC	8	8	99.0	22	8	Good	
1	11.44 SB	B-70-0158	35+30	US 10 WB	COLDSPRING RD	1997	159.1x44.5	3	CONT CONC	8	8	81.0	22	8	Good	
2	0.90 NB	B-70-0079	67+50	US 10 EB	US 41	1975	376.1x92.8-109.8	3	CONT STEEL	6	7	86.4	22	6	Fair	NBI < desirable rating of 7
2	1.03 NB	B-70-0078	74+00	US 10 EB	CN RR & N. LAKE ST	1975	330.8x88.0	5	36" ROLLED STEEL	7	7	87.2	17	7	Poor	HS < minimum rating of 20
2	1.36 NB	B-70-0076	74+00 LT	RAMP - SB 441 TO NB 41	CN RR & W. B-M BEACH RD	1975	333.0x33.7	5	STEEL PLATE 42" WEB	7	7	95.0	19	6	Poor	HS < minimum rating of 20
2	1.19 NB	B-70-0061	97+71	WIS 441 NB & SB	LITTLE LAKE BUTTE DE MORTS	1975	3255.7x68.8	18	CONT STEEL	6	7	64.1	14	8	Poor	HS < minimum rating of 20
3	1.89 NB	B-70-0068	118+50	WIS 441 NB & SB	TAYCO ST	1975	125.2x87.3	3	45" PRESTRESS CONC	7	8	88.6	17	6	Poor	HS < minimum rating of 20
3	2.07 NB	B-70-0108	128+00	WIS 441 NB	NW RAMP & NW LOOP	1990	171.1x40.0	2	54" PRESTRESS CONC	8	8	89.5	21	7	Good	
3	9.66 SB	B-70-0109	128+01	WIS 441 SB	NW RAMP & NW LOOP	1990	170.5x40.0	2	54" PRESTRESS CONC	8	8	85.1	21	7	Good	
3	2.62 NB	B-70-0110	156+50	CTH P (RACINE RD)	WIS 441 NB & SB	1990	298.6x60	2	CONT STEEL	7	7	96.1	25	7	Good	
3	3.03 NB	B-70-0111	178+65	WIS 441 NB	CTH AP (MIDWAY RD)	1990	201.2x40.0	2	54" PRESTRESS CONC	8	8	87.5	23	7	Good	
3	8.70 SB	B-70-0112	178+98	WIS 441 SB	CTH AP (MIDWAY RD)	1990	212.2x40.0	2	54" PRESTRESS CONC	8	8	87.5	24	7	Good	
4	3.98 NB	B-70-0113	230+96	WIS 441 NB	WIS 47 (APPLETON RD)	1990	165.8x40.0	2	45" PRESTRESS CONC	8	8	99.0	23	7	Good	
4	7.72 SB	B-70-0114	230+94	WIS 441 SB	WIS 47 (APPLETON RD)	1990	165.8x40.0	2	45" PRESTRESS CONC	8	8	99.0	23	7	Good	
5	4.99 NB	B-70-0115	283+25	WIS 441 NB	US 10 (ONEIDA ST)	1993	168.8x43.0	2	45" PRESTRESS CONC	8	8	100.0	21	7	Good	
5	6.69 SB	B-70-0116	283+25	WIS 441 SB	US 10 (ONEIDA ST)	1993	168.8x43.0	2	45" PRESTRESS CONC	8	8	100.0	21	7	Good	
5	5.56 NB	B-08-0033	312+50	CARPENTER ST PED BRG	WIS 441 NB & SB	1992	164.5x12.0	2	CONT CONC	8	8	N/A	N/A	7	Good	
6	6.25 NB	B-08-0024	348+87	TELULAH AVENUE	WIS 441 NB & SB	1992	207.3x46.0	2	54" PRESTRESS CONC	7	8	94.0	23	7	Good	
6	7.09 NB	B-08-0025	394+21	WIS 441 NB	S. LAKE PARK RD	1993	139.1x43.0	3	45" PRESTRESS CONC	7	7	100.0	23	7	Good	
6	4.58 SB	B-08-0026	394+21	WIS 441 SB	S. LAKE PARK RD	1993	139.1x43.0	3	45" PRESTRESS CONC	7	7	100.0	23	7	Good	
7	7.69 NB	B-08-0027	425+53	WIS 441 NB	CTH KK (E. CALUMET ST)	1993	163.6x43.0	2	45" PRESTRESS CONC	7	7	99.0	21	7	Good	
7	4.01 SB	B-08-0028	425+53	WIS 441 SB	CTH KK (E. CALUMET ST)	1993	163.6x43.0	2	45" PRESTRESS CONC	6	7	99.0	21	7	Good	
7 & 8	8.32 NB	B-44-0137	465+75	WIS 441 NB & SB	DRAINAGEWAY	1991	N/A	N/A	BOX CULVERT	N/A	N/A	90.0	20	N/A	Good	
8	8.70 NB	B-44-0122	486+50	WIS 441 NB	CTH CE (E. COLLEGE AVE)	1992	182.8x43.0	2	45" PRESTRESS CONC	8	8	100.0	22	7	Good	
8	3.00 SB	B-44-0123	486+50	WIS 441 SB	CTH CE (E. COLLEGE AVE)	1992	182.8x43.0	2	45" PRESTRESS CONC	8	8	100.0	22	7	Good	
8	9.15 NB	B-44-0124	509+20	FOX RIVER VALLEY RR	WIS 441 NB & SB	1992	150.0x20.0	2	STEEL GIRDERS	8	8	N/A	N/A	8	Good	
8	9.36 NB	B-44-0125	520+47	CTH Z (KIMBERLY AVE)	WIS 441 NB & SB	1992	165.6x58.0	2	45" PRESTRESS CONC	8	8	83.0	22	7	Good	
9	9.89 NB	B-44-0126	552+23	WIS 441 NB & SB	FOX RIVER / WIS 96 / RR	1989	1629.3x87.0	11	48" & 72" STEEL GIRDERS	7	7	85.0	29	7	Good	
9	10.69 NB	B-44-0127	591+60	WIS 441 NB	CTH OO (NORTHLAND AVE)	1993	186.8x43.0	2	54" PRESTRESS CONC	7	8	100.0	21	7	Good	
9	1.01 SB	B-44-0128	591+60	WIS 441 SB	CTH OO (NORTHLAND AVE)	1993	186.8x43.0	2	54" PRESTRESS CONC	7	8	100.0	21	7	Good	
10	11.46 NB	B-44-0129	630+00	WIS 441 NB	US 41 NB & SB	1993	233.33x43.0	2	CONT STEEL	8	8	99.0	27	7	Good	
10	0.30 SB	B-44-0130	630+00	WIS 441 SB	US 41 NB & SB	1993	239.33x43.0	2	CONT STEEL	8	8	99.0	28	8	Good	

Exhibit F-4

PHYSICAL CONDITIONS - DRAINAGE INFRASTRUCTURE									
Segment	Feature From	Feature To	County	Surface Drainage	Leads	Trunklines	Outfalls	OA Rating	Comments
1	CTH CB	US 41 (SW interchange)	Winnebago	Good	Good	Good	Good	Good	
2	US 41 (SW interchange)	CTH P (Racine St)	Winnebago	Good	Good	Good	Good	Good	
3	CTH P (Racine St)	CTH AP (Midw ay Rd)	Winnebago	Good	Good	Good	Good	Good	
3	CTH AP (Midw ay Rd)	WIS 47 (Appleton Rd)	Winnebago	Good	Good	Good	Good	Good	
4	WIS 47 (Appleton Rd)	US 10 (Oneida St)	Winnebago	Good	Good	Good	Good	Good	
5	US 10 (Oneida St)	CTH KK (Calumet St)	Calumet	Fair	Good	Good	Good	Fair	flat ditch profiles & minor standing w ater
7	CTH KK (Calumet St)	CTH CE (College Ave)	Outagamie	Fair	Good	Good	Good	Fair	flat ditch profiles & minor standing w ater
8	CTH CE (College Ave)	Fox River	Outagamie	Fair	Good	Good	Good	Fair	flat ditch profiles & minor standing w ater
9	Fox River	CTH OO (Northland Ave)	Outagamie	Good	Good	Good	Good	Good	
10	CTH OO (Northland Ave)	US 41 (NE interchange)	Outagamie	Good	Good	Good	Good	Good	

Exhibit F-5

MAINLINE GEOMETRIC DESIGN - HORIZONTAL ALIGNMENT																					
Segment	Cum. Mile (From)	Cum. Mile (To)	Hw y & Dir	From (Sta)	To (Sta)	Alignment Feature	Req'd Design Speed (mph)	Compound Curve Radii Ratio	Existing Curve Radius (feet)	Existing SE (%)	Existing SE Transition (T, feet)	Existing SE Runout (L, feet)	Req'd SE (%)	Req'd SE Transition (T, feet)	Req'd SE Runout (L, feet)	Equivalent Speed under Existing Cond (emax=6%)	SE Transition meets standards? (Yes/No)	Available Horizontal SSD (feet)	Equivalent Speed under Existing SSD (mph)	OA Rating	Comments
3	2.26	2.33	441 NB	139+72.25	146+34.87	Curve	70	0	1,145.92	6.0	> 165	165	-	-	-	55	No	690	65	Poor	radius < 1340 ft & deficient 6% emax speed
3	2.68	2.97	441 NB	162+47.72	174+87.44	Curve	70	0	1,637.02	5.3	> 165	165	-	-	-	55	No	800	70	Poor	radius < 2050 ft & deficient 6% emax speed
3	3.03	3.43	441 NB	179+13.97	197+34.06	Curve	70	0	1,145.92	6.0	> 165	165	-	-	-	55	No	1050	70	Poor	radius < 1340 ft & deficient 6% emax speed
5	4.90	5.12	441 NB	276+95.44	289+58.20	Curve	70	0	11,459.16	2.0	> 190	190	2.0	121	61	65	Yes	1500	70	Fair	6% emax speed = 65 < design speed of 70
5	5.42	5.62	441 NB	306+25.97	315+70.39	Curve	70	0	11,459.16	2.0	> 190	190	2.0	121	61	65	Yes	1650	70	Fair	6% emax speed = 65 < design speed of 70
5 & 6	5.99	6.28	441 NB	334+70.93	350+27.53	Curve	70	0	3,819.72	4.0	> 285	285	4.6	197	137	65	Yes	900	70	Fair	6% emax speed = 65 < design speed of 70
6 & 7	7.05	7.90	441 NB	391+06.69	440+09.57	Curve	70	0	3,819.72	4.1	> 197	190	4.6	197	137	65	Yes	1300	70	Fair	6% emax speed = 65 < design speed of 70
8	8.51	8.88	441 NB	472+63.97	497+86.77	Curve	70	0	22,918.31	-	-	-	NC	NC	NC	70	Yes	1500	70	Good	
8	9.17	9.25	441 NB	510+17.55	514+61.14	Curve	70	0	11,459.16	-	-	-	2.0	121	61	60	No	1300	70	Poor	6% emax speed = 60 < req'd min of 65
8	9.39	9.51	441 NB	522+86.52	528+80.75	Curve	70	0	5,729.58	3.0	> 190	190	3.3	160	100	65	Yes	1100	70	Fair	6% emax speed = 65 < design speed of 70
8 & 9	9.70	9.79	441 NB	540+09.37	545+59.43	Curve	70	0	17,188.73	-	-	-	NC	NC	NC	70	Yes	1500	70	Good	
9	10.35	10.47	441 NB	565+45.47	575+04.04	Curve	70	0	22,918.31	-	-	-	NC	NC	NC	70	Yes	1550	70	Good	
9	10.63	10.95	441 NB	586+95.48	605+66.51	Curve	70	0	22,918.31	-	-	-	NC	NC	NC	70	Yes	1500	70	Good	
10	11.49	11.54	441 NB	632+92.13	635+03.30	Curve	70	0	1,209.92	5.9	> 165	165	-	-	-	55	No	1200	70	Poor	radius < 1340 ft & deficient 6% emax speed
10	-0.22	0.00	441 SB	634+92.13	632+92.13	Curve	70	0	1,145.92	5.9	> 165	165	-	-	-	50	No	1200	70	Poor	radius < 1340 ft & deficient 6% emax speed
9	0.59	1.08	441 SB	609+29.11	587+17.09	Curve	70	0	22,918.31	-	-	-	NC	NC	NC	70	Yes	1500	70	Good	
9	1.25	1.49	441 SB	578+48.51	565+45.47	Curve	70	0	22,918.31	-	-	-	NC	NC	NC	70	Yes	1550	70	Good	
8 & 9	1.87	1.97	441 SB	545+59.43	540+09.37	Curve	70	0	17,172.73	-	-	-	NC	NC	NC	70	Yes	1500	70	Good	
8	2.18	2.30	441 SB	528+82.42	522+86.52	Curve	70	0	5,713.58	3.0	> 190	190	3.3	160	100	65	Yes	1100	70	Fair	6% emax speed = 65 < design speed of 70
8	2.34	2.46	441 SB	519+04.28	513+97.84	Curve	70	0	17,188.73	-	-	-	NC	NC	NC	70	Yes	1300	70	Good	
8	2.66	3.18	441 SB	490+76.99	472+63.97	Curve	70	0	22,982.31	-	-	-	NC	NC	NC	70	Yes	1500	70	Good	
6 & 7	3.65	4.64	441 SB	447+50.45	391+06.69	Curve	70	0	3,755.72	4.1	> 199	190	4.6	199	139	60	No	1260	70	Poor	6% emax speed = 60 < req'd min of 65
5 & 6	5.43	5.69	441 SB	350+27.53	334+70.93	Curve	70	0	3,755.72	4.0	> 285	285	4.6	199	139	60	No	900	70	Poor	6% emax speed = 60 < req'd min of 65
5	6.12	6.30	441 SB	315+70.39	306+25.97	Curve	70	0	11,395.15	2.0	> 190	190	2.0	121	61	65	Yes	1650	70	Fair	6% emax speed = 65 < design speed of 70
5	6.61	6.80	441 SB	289+58.20	276+95.44	Curve	70	0	11,523.16	2.0	> 190	190	2.0	121	61	65	Yes	1500	70	Fair	6% emax speed = 65 < design speed of 70
3	8.33	8.70	441 SB	198+58.66	179+17.44	Curve	70	0	1,206.23	6.0	> 165	165	-	-	-	55	No	1080	70	Poor	radius < 1340 ft & deficient 6% emax speed
3	8.78	9.01	441 SB	174+87.44	162+47.72	Curve	70	0	1,589.02	5.3	> 165	165	-	-	-	50	No	750	70	Poor	radius < 2050 ft & deficient 6% emax speed
3	9.34	9.47	441 SB	146+34.87	139+72.25	Curve	70	0	1,193.92	6.0	> 165	165	-	-	-	55	No	720	65	Poor	radius < 1340 ft & deficient 6% emax speed
2 & 3	9.50	9.80	441 SB	136+03.05	120+40.63	Curve	70	0	1,091.35	6.0	> 165	165	-	-	-	50	No	750	70	Poor	radius < 1340 ft & deficient 6% emax speed

Exhibit F-6

MAINLINE GEOMETRIC DESIGN - VERTICAL ALIGNMENT																
Segment	Cum. Mile (From)	Cum. Mile (To)	Direction	From (Sta)	To (Sta)	Alignment Feature	VPI Station	Profile Grade (%)	Curve Length (ft)	K-Value	Equivalent V (MPH in Crest) (Max) (Des)	Equivalent V (MPH in Sag)	Design Speed (MPH)	OA Rating	Comments	
2	1.78	1.96	NB	113+57	120+50	Grade	-	-0.91	-	-	-	-	70	Good		
2 & 3	1.96	2.04	NB	120+50	126+00	Sag	123+25	-	550	233	-	70+	70	Good		
3	2.04	2.05	NB	126+00	126+90	Grade	-	1.45	-	-	-	-	70	Good		
3	2.05	2.22	NB	126+90	135+40	Crest	131+15	-	850	215	55	45	70	Poor	K value less than min. value of 401	
3	2.22	2.26	NB	135+40	139+50	Grade	-	-2.50	-	-	-	-	70	Good		
3	2.26	2.31	NB	139+50	145+00	Sag	142+25	-	550	276	-	70+	70	Good		
3	2.31	2.47	NB	145+00	152+50	Grade	-	-0.51	-	-	-	-	70	Good		
3	2.47	2.72	NB	152+50	161+50	Sag	157+00	-	900	662	-	70+	70	Good		
3	2.72	2.78	NB	161+50	164+50	Grade	-	0.85	-	-	-	-	70	Good		
3	2.78	2.92	NB	164+50	171+50	Sag	168+00	-	700	329	-	70+	70	Good		
3	2.92	2.97	NB	171+50	175+00	Grade	-	2.98	-	-	-	-	70	Good		
3	2.97	3.15	NB	175+00	184+50	Crest	179+75	-	950	226	55	45	70	Poor	K value less than min. value of 401	
3	3.15	3.15	NB	184+50	184+50.01	Grade	-	-1.22	-	-	-	-	70	Good		
3	3.15	3.25	NB	184+50	193+50	Sag	189+00	-	900	882	-	70+	70	Good		
3	3.25	3.27	NB	193+50	195+00	Grade	-	-0.20	-	-	-	-	70	Poor	Profile grade less than abs. min. value of .3%	
3 & 4	3.27	3.65	NB	195+00	210+00	Sag	202+50		1500	1415	-	70+	70	Good		
4	3.65	3.87	NB	210+00	220+00	Grade	-	0.86	-	-	-	-	70	Good		
4	3.87	3.93	NB	220+00	227+00	Sag	223+50	-	700	654	-	70+	70	Good		
4	3.93	3.93	NB	227+00	227+00.01	Grade	-	1.93	-	-	-	-	70	Good		
4	3.93	4.06	NB	227+00	236+00	Crest	231+50	-	900	318	65	50	70	Poor	K value less than min. value of 401	
4	4.06	4.06	NB	236+00	236+00.01	Grade	-	-0.90	-	-	-	-	70	Good		
4	4.06	4.14	NB	236+00	240+00	Sag	238+00	-	400	374	-	70+	70	Good		
4	4.14	4.19	NB	240+00	244+00	Grade	-	0.17	-	-	-	-	70	Poor	Profile grade less than abs. min. value of .3%	
4	4.19	4.32	NB	244+00	252+00	Crest	248+00	-	800	1404	70+	70+	70	Good		
4	4.32	4.36	NB	252+00	255+00	Grade	-	-0.40	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
4 & 5	4.36	4.52	NB	255+00	263+00	Sag	259+00	-	800	1587	-	70+	70	Good		
5	4.52	4.62	NB	263+00	268+00	Grade	-	0.10	-	-	-	-	70	Poor	Profile grade less than abs. min. value of .3%	
5	4.62	4.89	NB	268+00	276+00	Sag	272+00	-	800	422	-	70+	70	Good		
5	4.89	4.93	NB	276+00	278+60	Grade	-	2.00	-	-	-	-	70	Good		
5	4.93	5.14	NB	278+60	291+40	Crest	285+00	-	1280	346	65	50	70	Poor	K value less than min. value of 401	
5	5.14	5.17	NB	291+40	293+00	Grade	-	-1.70	-	-	-	-	70	Good		
5	5.17	5.38	NB	293+00	304+50	Sag	298+75	-	1150	561	-	70+	70	Good		
5	5.38	5.68	NB	304+50	318+50	Grade	-	0.35	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
5	5.68	5.82	NB	318+50	326+50	Crest	322+50	-	800	20000	70+	70+	70	Good		
5	5.82	5.89	NB	326+50	330+00	Grade	-	0.31	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
5 & 6	5.89	6.15	NB	330+00	344+00	Crest	337+00	-	1400	2029	70+	70+	70	Good		
6	6.15	6.19	NB	344+00	346+00	Grade	-	-0.38	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
6	6.19	6.25	NB	346+00	349+00	Sag	347+50	-	300	588	-	70+	70	Good		
6	6.25	6.34	NB	349+00	354+00	Grade	-	0.13	-	-	-	-	70	Poor	Profile grade less than abs. min. value of .3%	
6	6.34	6.53	NB	354+00	364+00	Crest	359+00	-	1000	2174	70+	70+	70	Good		
6	6.53	6.80	NB	364+00	378+50	Grade	-	-0.33	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
6	6.80	6.97	NB	378+50	387+50	Sag	383+00	-	900	333	-	70+	70	Good		
6	6.97	6.97	NB	387+50	387+50.01	Grade	-	2.37	-	-	-	-	70	Good		
6	6.97	7.15	NB	387+50	397+50	Crest	-	-	1000	226	55	45	70	Poor	K value less than min. value of 401	
6 & 7	7.15	7.26	NB	397+50	403+00	Grade	-	-2.05	-	-	-	-	70	Good		
7	7.26	7.41	NB	403+00	411+00	Sag	407+00	-	800	497	-	70+	70	Good		
7	7.41	7.47	NB	411+00	414+00	Grade	-	-0.44	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
7	7.47	7.58	NB	414+00	420+00	Sag	417+00		600	444	-	70+	70	Good		
7	7.58	7.59	NB	420+00	420+25	Grade	-	0.91	-	-	-	-	70	Good		
7	7.59	7.75	NB	420+25	429+25	Crest	424+75	-	900	335	65	50	70	Poor	K value less than min. value of 401	
7	7.75	8.02	NB	429+25	445+50	Grade	-	-1.78	-	-	-	-	70	Good		

Exhibit F-6 Continued

MAINLINE GEOMETRIC DESIGN - VERTICAL ALIGNMENT																
Segment	Cum. Mile (From)	Cum. Mile (To)	Direction	From (Sta)	To (Sta)	Alignment Feature	VPI Station	Profile Grade (%)	Curve Length (ft)	K-Value	Equivalent V (MPH in Crest) (Max) (Des)		Equivalent V (MPH in Sag)	Design Speed (MPH)	OA Rating	Comments
7	8.02	8.17	NB	445+50	454+50	Sag	450+00	-	900	662	-	-	70+	70	Good	
7	8.17	8.34	NB	454+50	465+00	Grade	-	-0.42	-	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%
7 & 8	8.34	8.54	NB	465+00	477+00	Sag	471+00	-	1200	619	-	-	70+	70	Good	
8	8.54	8.57	NB	477+00	478+50	Grade	-	1.52	-	-	-	-	-	70	Good	
8	8.57	8.80	NB	478+50	491+50	Crest	485+00	-	1300	325	65	50	-	70	Poor	K value less than min. value of 401
8	8.80	9.03	NB	491+50	503+00	Grade	-	-2.48	-	-	-	-	-	70	Good	
8	9.03	9.15	NB	503+00	509+00	Crest	506+00	-	600	288	60	50	-	70	Poor	K value less than min. value of 401
8	9.15	9.28	NB	509+00	516+00	Grade	-	-0.40	-	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%
8	9.28	9.43	NB	516+00	524+00	Sag	520+00	-	800	471	-	-	70+	70	Good	
8	9.43	9.46	NB	524+00	526+00	Grade	-	1.30	-	-	-	-	-	70	Good	
8	9.46	9.58	NB	526+00	532+00	Crest	529+00	-	600	750	70+	70+	-	70	Good	
8	9.58	9.76	NB	532+00	542+00	Grade	-	0.50	-	-	-	-	-	70	Good	
8 & 9	9.76	9.93	NB	542+00	551+00	Sag	546+50	-	900	372	-	-	70+	70	Good	
9	9.93	9.95	NB	551+00	552+25	Grade	-	2.92	-	-	-	-	-	70	Good	
9	9.95	10.23	NB	552+25	567+25	Crest	559+75	-	1500	277	60	50	-	70	Poor	K value less than min. value of 401
9	10.23	10.29	NB	567+25	570+00	Grade	-	-2.50	-	-	-	-	-	70	Good	
9	10.29	10.49	NB	570+00	581+00	Sag	575+50	-	1100	262	-	-	70+	70	Good	
9	10.49	10.51	NB	581+00	581+75	Grade	-	1.71	-	-	-	-	-	70	Good	
9	10.51	10.77	NB	581+75	595+75	Crest	588+75	-	1400	411	70+	55	-	70	Fair	K value less than desirable value of 566
9	10.77	10.81	NB	595+75	597+75	Grade	-	-1.70	-	-	-	-	-	70	Good	
9 & 10	10.81	11.16	NB	597+75	615+75	Sag	606+75	-	1800	553	-	-	70+	70	Good	
10	11.16	11.27	NB	615+75	621+60	Grade	-	1.55	-	-	-	-	-	70	Good	
10	11.27	11.46	NB	621+60	631+60	Crest	626+60	-	1000	379	65	55	-	70	Poor	K value less than min. value of 401
10	11.46	11.55	NB	631+60	636+00	Grade	-	-1.09	-	-	-	-	-	70	Good	
10	0.20	0.27	SB	636+00	632+00	Grade	-	-1.09	-	-	-	-	-	70	Good	
10	0.27	0.35	SB	632+00	622+00	Crest	627+00	-	1000	382	65	55	-	70	Poor	K value less than min. value of 401
10	0.35	0.47	SB	622+00	616+00	Grade	-	1.53	-	-	-	-	-	70	Good	
9 & 10	0.47	0.81	SB	616+00	598+00	Sag	607+00	-	1800	556	-	-	70+	70	Good	
9	0.81	0.85	SB	598+00	596+00	Grade	-	-1.71	-	-	-	-	-	70	Good	
9	0.85	1.18	SB	596+00	582+00	Crest	589+00	-	1400	411	70+	55	-	70	Fair	K value less than desirable value of 566
9	1.18	1.20	SB	582+00	581+00	Grade	-	1.70	-	-	-	-	-	70	Good	
9	1.20	1.41	SB	581+00	570+00	Sag	575+50	-	1100	262	-	-	70+	70	Good	
9	1.41	1.46	SB	570+00	567+25	Grade	-	-2.50	-	-	-	-	-	70	Good	
9	1.46	1.75	SB	567+25	552+25	Crest	559+75	-	1500	277	60	50	-	70	Poor	K value less than min. value of 401
9	1.75	1.77	SB	552+25	551+00	Grade	-	2.92	-	-	-	-	-	70	Good	
8 & 9	1.77	1.93	SB	551+00	542+00	Sag	546+50	-	900	372	-	-	70+	70	Good	
8	1.93	2.12	SB	542+00	532+00	Grade	-	0.50	-	-	-	-	-	70	Good	
8	2.12	2.24	SB	532+00	526+00	Crest	529+00	-	600	750	70+	70+	-	70	Good	
8	2.24	2.28	SB	526+00	524+00	Grade	-	1.30	-	-	-	-	-	70	Good	
8	2.28	2.43	SB	524+00	516+00	Sag	520+00	-	800	471	-	-	70+	70	Good	
8	2.43	2.55	SB	516+00	509+00	Grade	-	-0.40	-	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%
8	2.55	2.67	SB	509+00	503+00	Crest	506+00	-	600	288	60	50	-	70	Poor	K value less than min. value of 401
8	2.67	2.89	SB	503+00	491+50	Grade	-	-2.48	-	-	-	-	-	70	Good	
8	2.89	3.15	SB	491+50	478+50	Crest	485+00	-	1300	325	65	50	-	70	Poor	K value less than min. value of 401
8	3.15	3.18	SB	478+50	477+00	Grade	-	1.52	-	-	-	-	-	70	Good	
7 & 8	3.18	3.41	SB	477+00	465+00	Sag	471+00	-	1200	594	-	-	70+	70	Good	
7	3.41	3.63	SB	465+00	453+50	Grade	-	-0.50	-	-	-	-	-	70	Good	
7	3.63	3.93	SB	453+50	437+26.97	Sag	449+00	-	900	662	-	-	70+	70	Good	
7	3.93	4.08	SB	437+26.97	429+25	Grade	-	-1.86	-	-	-	-	-	70	Good	
7	4.08	4.10	SB	429+25	420+25	Crest	424+75	-	900	327	65	50	-	70	Poor	K value less than min. value of 401

Exhibit F-6 Continued

MAINLINE GEOMETRIC DESIGN - VERTICAL ALIGNMENT																
Segment	Cum. Mile (From)	Cum. Mile (To)	Direction	From (Sta)	To (Sta)	Alignment Feature	VPI Station	Profile Grade (%)	Curve Length (ft)	K-Value	Equivalent V (MPH in Crest) (Max) (Des)	Equivalent V (MPH in Sag)	Design Speed (MPH)	OA Rating	Comments	
7	4.10	4.10	SB	420+25	420+00	Grade	-	0.89	-	-	-	-	70	Good		
7	4.10	4.21	SB	420+00	414+00	Sag	417+00	-	600	488	-	70+	70	Good		
7	4.21	4.27	SB	414+00	411+00	Grade	-	-0.34	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
7	4.27	4.42	SB	411+00	403+00	Sag	407+00	-	800	457	-	70+	70	Good		
6 & 7	4.42	4.53	SB	403+00	397+50	Grade	-	-2.09	-	-	-	-	70	Good		
6	4.53	4.71	SB	397+50	387+50	Crest	392+50	-	1000	242	55	45	70	Poor	K value less than min. value of 401	
6	4.71	4.71	SB	387+50.01	387+50	Grade	-	2.04	-	-	-	-	70	Good		
6	4.71	4.88	SB	387+50	378+50	Sag	383+00	-	900	380	-	70+	70	Good		
6	4.88	5.16	SB	378+50	364+00	Grade	-	-0.33	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
6	5.16	5.35	SB	364+00	354+00	Crest	359+00	-	1000	2174	70+	70+	70	Good		
6	5.35	5.43	SB	354+00	349+00	Grade	-	0.13	-	-	-	-	70	Poor	Profile grade less than abs. min. value of .3%	
6	5.43	5.48	SB	349+00	346+00	Sag	347+50	-	300	588	-	70+	70	Good		
6	5.48	5.52	SB	346+00	344+00	Grade	-	-0.38	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
5 & 6	5.52	5.78	SB	344+00	330+00	Crest	337+00	-	1400	2029	70+	70+	70	Good		
5	5.78	5.85	SB	330+00	326+50	Grade	-	0.31	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
5	5.85	6.00	SB	326+50	318+50	Crest	322+50	-	800	20000	70+	70+	70	Good		
5	6.00	6.26	SB	318+50	304+75	Grade	-	0.35	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
5	6.26	6.51	SB	304+75	291+75	Sag	298+25	-	1300	616	-	70+	70	Good		
5	6.51	6.52	SB	291+75	291+40	Grade	-	-1.76	-	-	-	-	70	Good		
5	6.52	6.77	SB	291+40	278+60	Crest	285+00	-	1280	339	65	50	70	Poor	K value less than min. value of 401	
5	6.77	6.87	SB	278+60	276+50	Grade	-	2.02	-	-	-	-	70	Good		
5	6.87	7.03	SB	276+50	268+00	Sag	272+25	-	850	444	-	70+	70	Good		
5	7.03	7.13	SB	268+00	263+00	Grade	-	0.10	-	-	-	-	70	Poor	Profile grade less than abs. min. value of .3%	
4 & 5	7.13	7.28	SB	263+00	255+00	Sag	259+00	-	800	1587	-	70+	70	Good		
4	7.28	7.34	SB	255+00	252+00	Grade	-	-0.40	-	-	-	-	70	Fair	Profile grade less than desirable value of .5%	
4	7.34	7.50	SB	252+00	244+00	Crest	248+00	-	800	1404	70+	70+	70	Good		
4	7.50	7.57	SB	244+00	240+25	Grade	-	0.17	-	-	-	-	70	Poor	Profile grade less than abs. min. value of .3%	
4	7.57	7.66	SB	240+25	235+75	Sag	238+00	-	450	421	-	70+	70	Good		
4	7.66	7.66	SB	235+75.01	235+75	Grade	-	-0.90	-	-	-	-	70	Good		
4	7.66	7.79	SB	235+75	227+25	Crest	231+50	-	850	292	60	50	70	Poor	K value less than min. value of 401	
4	7.79	7.79	SB	227+25.01	227+25	Grade	-	2.01	-	-	-	-	70	Good		
4	7.79	7.95	SB	227+25	217+75	Sag	222+50	-	950	766	-	70+	70	Good		
4	7.95	8.25	SB	217+75	203+25	Grade	-	0.77	-	-	-	-	70	Good		
4	8.25	8.32	SB	203+25	199+25	Sag	201+25	-	400	400	-	70+	70	Good		
3 & 4	8.32	8.40	SB	199+25	195+00	Grade	-	-0.23	-	-	-	-	70	Poor	Profile grade less than abs. min. value of .3%	
3	8.40	8.55	SB	195+00	187+00	Sag	191+00	-	800	784	-	70+	70	Good		
3	8.55	8.59	SB	187+00	185+30	Grade	-	-1.25	-	-	-	-	70	Good		
3	8.59	8.78	SB	185+30	174+80	Crest	180+05	-	1050	235	55	45	70	Poor	K value less than min. value of 401	
3	8.78	8.84	SB	174+80	171+85	Grade	-	3.22	-	-	-	-	70	Poor	Profile grade more than maximum value of 3%	
3	8.84	8.99	SB	171+85	163+85	Sag	167+85	-	800	315	-	70+	70	Good		
3	8.99	9.04	SB	163+85	161+25	Grade	-	0.68	-	-	-	-	70	Good		
3	9.04	9.17	SB	161+25	152+25	Sag	156+75	-	900	744	-	70+	70	Good		
3	9.17	9.25	SB	152+25	146+65	Grade	-	-0.53	-	-	-	-	70	Good		
3	9.25	9.33	SB	146+65	139+65	Sag	143+15	-	700	355	-	70+	70	Good		
3	9.33	9.46	SB	139+65	132+75	Grade	-	-2.50	-	-	-	-	70	Good		
3	9.46	9.69	SB	132+75	126+25	Crest	129+50	-	650	141	50	35	70	Poor	K value less than min. value of 401	
3	9.75	9.75	SB	123+50.02	123+50.01	Grade	-	2.12	-	-	-	-	70	Good		
2 & 3	9.69	9.80	SB	126+25	120+75	Sag	123+50	-	550	179	-	65	70	Poor	K value less than min. value of 181	
2	9.80	10.63	SB	120+75	113+57	Grade	-	-0.96	-	-	-	-	70	Good		

Exhibit F-7

MAINLINE GEOMETRIC DESIGN - VERTICAL CLEARANCES										
Segment	Cum. Mile	Structure Number	Bridge Location (STA)	Feature Carried	Feature Under	Desirable Vertical Clearance (ft)	Minimum Vertical Clearance (ft)	Actual Vertical Clearance (ft)	OA Rating	Comments
1	0.29 NB	B-70-0157	35+30	US 10 EB	Coldspring Rd.	15.25	14.75	16.21	Good	
1	11.44 SB	B-70-0158	35+30	US 10 WB	Coldspring Rd.	15.25	14.75	15.81	Good	
2	0.90 NB	B-70-0079	67+50	US 10 EB	US 41	16.75	16.33	17.43	Good	
2	1.03 NB	B-70-0078	74+00	US 10 EB	CN RAILROAD	15.25	14.75	26.42	Good	
2	1.03 NB	B-70-0078	74+00	US 10 EB	N. LAKE ST	23.30	23.00	23.75	Good	
2	1.03 NB	B-70-0078	74+00 RT	RAMP - NB 41 TO NB 441	CN RAILROAD	23.30	23.00	25.83	Good	
2	1.03 NB	B-70-0078	74+00 RT	RAMP - NB 41 TO NB 441	N. LAKE ST	23.30	23.00	29.08	Good	
2	1.36 NB	B-70-0076	74+00 LT	RAMP - SB 441 TO NB 41	CN RAILROAD	23.30	23.00	28.08	Good	
2	1.36 NB	B-70-0076	74+00 LT	RAMP - SB 441 TO NB 41	W. BUTTE MORTS BEACH RD	15.25	14.75	28.08	Good	
2	1.19 NB	B-70-0061	97+71	WIS 441 NB & SB	LITTLE LAKE BUTTE DE MORTS	N/A	N/A	N/A	Good	
2	1.89 NB	B-70-0068	118+50	WIS 441 NB & SB	TAYCO ST	15.25	14.75	14.50	Poor	14.50' < 14.75' MIN
3	2.07 NB	B-70-0108	128+00	WIS 441 NB	NW RAMP & NW LOOP	16.75	16.33	16.95	Good	
3	9.66 SB	B-70-0109	128+01	WIS 441 SB	NW RAMP & NW LOOP	16.75	16.33	17.05	Good	
3	2.62 NB	B-70-0110	156+50	CTH P (RACINE ST)	WIS 441 NB & SB	16.75	16.33	16.24	Poor	16.24' < 16.33' MIN
3	3.03 NB	B-70-0111	178+65	WIS 441 NB	CTH AP (MIDWAY RD)	16.75	16.25	16.60	Fair	16.60' < 16.75' DES
3	8.70 SB	B-70-0112	178+98	WIS 441 SB	CTH AP (MIDWAY RD)	16.75	16.25	18.46	Good	
4	3.98 NB	B-70-0113	230+96	WIS 441 NB	WIS 47 (APPLETON RD)	16.75	16.33	16.71	Fair	16.71' < 16.75' DES
4	7.72 SB	B-70-0114	230+94	WIS 441 SB	WIS 47 (APPLETON RD)	16.75	16.33	16.62	Fair	16.62' < 16.75' DES
5	4.99 NB	B-70-0115	283+25	WIS 441 NB	US 10 (ONEIDA ST)	16.75	16.33	16.70	Fair	16.70' < 16.75' DES
5	6.69 SB	B-70-0116	283+25	WIS 441 SB	US 10 (ONEIDA ST)	16.75	16.33	16.80	Good	
5	5.56 NB	B-08-0033	312+50	CARPENTER ST PED BRG	WIS 441 NB & SB	17.75	17.25	16.90	Poor	16.90' < 17.25' MIN
6	6.25 NB	B-08-0024	348+87	TELULAH AVE	WIS 441 NB & SB	16.75	16.33	16.09	Poor	16.09' < 16.33' MIN
6	7.09 NB	B-08-0025	394+21	WIS 441 NB	S. LAKE PARK RD	15.25	14.75	15.90	Good	
6	4.58 SB	B-08-0026	394+21	WIS 441 SB	S. LAKE PARK RD	15.25	14.75	15.40	Good	
7	7.69 NB	B-08-0027	425+53	WIS 441 NB	CTH KK (CALUMET ST)	16.75	16.25	16.70	Fair	16.70' < 16.75' DES
7	4.01 SB	B-08-0028	425+53	WIS 441 SB	CTH KK (CALUMET ST)	16.75	16.25	16.70	Fair	16.70' < 16.75' DES
8	8.70 NB	B-44-0122	486+50	WIS 441 NB	CTH CE (COLLEGE AVE)	16.75	16.25	16.50	Fair	16.50' < 16.75' DES
8	3.00 SB	B-44-0123	486+50	WIS 441 SB	CTH CE (COLLEGE AVE)	16.75	16.25	16.73	Fair	16.73' < 16.75' DES
8	9.15 NB	B-44-0124	509+20	FOX RIVER VALLY RR	WIS 441 NB & SB	16.75	16.33	16.57	Fair	16.57' < 16.75' DES
8	9.36 NB	B-44-0125	520+47	CTH Z (KIMBERLY AVE)	WIS 441 NB & SB	16.75	16.33	16.74	Fair	16.74' < 16.75' DES
9	9.89 NB	B-44-0126	552+23	WIS 441 NB & SB	FOX RIVER	N/A	N/A	N/A	Good	
9	9.89 NB	B-44-0126	552+23	WIS 441 NB & SB	WIS 96 (WISCONSIN AVE)	16.75	16.33	27.90	Good	
9	9.89 NB	B-44-0126	552+23	WIS 441 NB & SB	C. & NW. TRANS. CO. RR	23.30	23.00	23.45	Good	
9	10.69 NB	B-44-0127	591+60	WIS 441 NB	CTH OO (NORTHLAND AVE)	16.75	16.25	16.75	Good	
9	1.01 SB	B-44-0128	591+60	WIS 441 SB	CTH OO (NORTHLAND AVE)	16.75	16.25	17.00	Good	
10	11.46 NB	B-44-0129	630+00	WIS 441 NB	US 41 NB & SB	16.75	16.33	16.80	Good	
10	0.30 SB	B-44-0130	630+00	WIS 441 SB	US 41 NB & SB	16.75	16.33	16.50	Fair	16.50' < 16.75' DES

Exhibit F-8

MAINLINE GEOMETRIC DESIGN - CROSS SECTIONS																													
Segment	Cum. Mile (From)	Cum. Mile (To)	Direction	From (Sta)	To (Sta)	Number of Lanes	Mainline Lane Width (feet)	Shoulder Width (ft)		Paved Shoulder Width (ft)		Shoulder & Lane Rating	Median Barrier (Yes/No)	Median Width (feet)	Curbs Present and Meet Standards?		Normal Crown Slope (%)	Normal Shoulder Slope (%)	SE Shoulder slope (%)	Max. Cross Slope Break (%)		Median, Curbs, Slopes, & SE Rating	Foreslope ratio	Other barrier present to protect hazard other than slope?	Clear Zone Distance Available (feet)	Clear Zone Slopes & Distances Rating	OA Rating	Comments	
								Median	Shoulder	Median	Shoulder				Median	Outside				pvt to pvt	pvt to shldr								
3	2.09 NB	2.18 NB	NB	129+00	133+60	2	12	4	8	4	6	Poor	Yes	-	Yes	NA	2.0	4.0	6.0	4.0	2.0	Fair	4	YES	40.0	Fair	Poor	cross slope break > 5, shoulder widths less than required	
3	9.64 SB	9.55 SB	SB	129+00	133+60	2	12	4	8	4	6	Poor	Yes	-	Yes	NA	2.0	4.0	6.0	4.0	2.0	Fair	4	YES	40.0	Fair	Poor	cross slope break > 5, shoulder widths less than required	
3, 4, & 5	2.18 NB	4.89 NB	NB	133+60	275+00	2	12	6	8	3	6	Poor	No	48	NA	NA	2.0	4.0	6.0	4.0	2.0	Poor	4	NO	40.0	Fair	Poor	shoulder widths less than required, median width less than required	
3, 4, & 5	9.55 SB	6.85 SB	SB	133+60	275+00	2	12	6	8	3	6	Poor	No	48	NA	NA	2.0	4.0	6.0	4.0	2.0	Poor	4	NO	40.0	Fair	Poor	shoulder widths less than required, median width less than required	
5	4.94 NB	4.97 NB	NB	279+50	282+41	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	paved shoulder widths less than required	
5	6.76 SB	6.71 SB	SB	279+50	282+41	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	paved shoulder widths less than required	
5	5.01 NB	5.06 NB	NB	284+09	287+00	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	paved shoulder widths less than required	
5	6.66 SB	6.61 SB	SB	284+09	287+00	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	paved shoulder widths less than required	
5 & 6	5.06 NB	6.96 NB	NB	287+00	387+00	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	shoulder width, paved shoulder width less than required	
5 & 6	6.61 SB	4.72 SB	SB	287+00	387+00	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	shoulder width, paved shoulder width less than required	
6	6.96 NB	7.02 NB	NB	387+00	390+50	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	3.6	NO	38.0	Fair	Poor	shoulder width, paved shoulder width less than required	
6	4.72 SB	4.65 SB	SB	387+00	390+50	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	3.6	NO	38.0	Fair	Poor	shoulder width, paved shoulder width less than required	
6	7.02 NB	7.08 NB	NB	390+50	393+51	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	paved shoulder widths less than required	
6	4.65 SB	4.59 SB	SB	390+50	393+51	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	paved shoulder widths less than required	
6	7.08 NB	7.1 NB	NB	393+51	394+91	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	5.9	4.0	2.0	Good	4	NO	50.0	Fair	Poor	cross slope break > 5, shoulder widths less than required	
6	4.59 SB	4.57 SB	SB	393+51	394+91	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	5.9	4.0	2.0	Good	4	NO	24.0	Poor	Poor	cross slope break > 5, shoulder widths less than required, clear zone dist < 32'	
6	7.1 NB	7.16 NB	NB	394+91	398+00	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	paved shoulder widths less than required	
6	4.57 SB	4.52 SB	SB	394+91	398+00	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	paved shoulder widths less than required	
6 & 7	7.16 NB	7.61 NB	NB	398+00	421+50	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	5.9	4.0	2.0	Good	3.6	NO	38.0	Fair	Poor	cross slope break > 5, shoulder widths less than required	
6 & 7	4.52 SB	4.11 SB	SB	398+00	421+50	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	5.9	4.0	2.0	Good	3.6	NO	38.0	Fair	Poor	cross slope break > 5, shoulder widths less than required	
7	7.61 NB	7.67 NB	NB	421+50	424+71	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	paved shoulder widths less than required	
7	4.11 SB	4.06 SB	SB	421+50	424+71	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	38.0	Fair	Poor	paved shoulder widths less than required	
7	7.7 NB	7.75 NB	NB	426+34	429+30	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	paved shoulder widths less than required, clear zone dist < 32'	
7	4.03 SB	3.98 SB	SB	426+34	429+30	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	paved shoulder widths less than required, clear zone dist < 32'	
7 & 8	7.75 NB	8.63 NB	NB	429+30	482+50	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	shoulder widths less than required, clear zone dist < 32'	
7 & 8	3.98 SB	3.07 SB	SB	429+30	482+50	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	24.0	Poor	Poor	shoulder widths less than required, clear zone dist < 32'	
8	8.63 NB	8.68 NB	NB	482+50	485+49	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	paved shoulder widths less than required, clear zone dist < 32'	
8	3.07 SB	3.02 SB	SB	482+50	485+49	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	paved shoulder widths less than required, clear zone dist < 32'	
8	8.7 NB	8.72 NB	NB	486+32	487+32	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	shoulder width, paved shoulder widths less than required, clear zone dist < 32'	
8	3 SB	2.98 SB	SB	486+32	487+32	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	shoulder width, paved shoulder widths less than required, clear zone dist < 32'	
8	8.72 NB	8.78 NB	NB	487+32	490+30	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	paved shoulder widths less than required, clear zone dist < 32'	
8	2.98 SB	2.93 SB	SB	487+32	490+30	2	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	paved shoulder widths less than required, clear zone dist < 32'	
8	8.78 NB	8.96 NB	NB	490+30	499+60	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	shoulder width, paved shoulder widths less than required, clear zone dist < 32'	
8	2.93 SB	2.75 SB	SB	490+30	499+60	2	12	6	8	3	6	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	24.0	Poor	Poor	shoulder width, paved shoulder widths less than required, clear zone dist < 32'	
8	8.96 NB	9.1 NB	NB	499+60	506+50	3	12	6	10	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	paved shoulder widths less than required, clear zone dist < 32'	
8	2.75 SB	2.62 SB	SB	499+60	506+50	2	12	10	6	3	8	Poor	No	64	NA	NA	2.0	4.0	4.0	4.0	2.0	Good	4	NO	30.0	Fair	Poor	shoulder width, paved shoulder width less than required, clear zone dist < 32'	
8	9.1 NB	9.3 NB	NB	506+50	517+20	2	12	4	10	4	8	Poor	Yes	-	Yes	NA	2.0	4.0	4.0	4.0	2.0	Fair	4	NO	30.0	Fair	Poor	median shoulder width, paved shoulder width less than required, clear zone dist < 32'	
8	2.62 SB	2.38 SB	SB	506+50	519+24	2	12	4	10	4	8	Poor	Yes	-	Yes	NA	2.0	4.0	4.0	4.0	2.0	Fair	4	NO	30.0	Fair	Poor	median shoulder width, paved shoulder width less than required, clear zone dist < 32'	
8	9.3 NB	9.71 NB	NB	517+20	539+40	2	12	4	10	4	10	Poor	Yes	-	Yes	Yes	2.0	4.0	4.0	4.0	2.0	Fair	3	YES	24.0	Fair	Poor	median shoulder width less than required	
8	2.38 SB	2 SB	SB	519+24	539+40	2	12	4	10	4	10	Poor	Yes	-	Yes	Yes	2.0	4.0	4.0	4.0	2.0	Fair	3	YES	24.0	Fair	Poor	median shoulder width less than required	
8 & 9	9.71 NB	9.79 NB	NB	539+40	543+28	2	12	4	10	4	10	Poor	Yes	-	Yes	Yes	2.0	4.0	4.0	4.0	2.0	Fair	NA	YES	NA	Poor	Poor	median shoulder width less than required	
9	9.79 NB	9.84																											

Exhibit F-9

MAINLINE GEOMETRIC DESIGN - BRIDGE CROSS SECTIONS																	
Segment	Cum. Mile	Structure Number	Bridge Location (STA)	Feature Carried	Feature Under	Bridge Length X Deck Width	Number of Spans	Mainline Lane Width	w idth less than road w idth? (Yes/No)	Cross road lane w idth OK? (Yes/No)	parapets on mainline meet current standards?	curbs and parapets on cross road meet current standards? (Yes/No)	Lateral clearance on structure - Median	Lateral clearance on structure - Outside	clearance under structure OK? (Yes/No)	OA Rating	Comments
2	0.90 NB	B-70-079	67+50	US 10 EB	US 41	376.1x92.8-109.8	3	12	No	Yes	Yes	Yes	8	8	Yes	Poor	8' < 10' min (outside)
2	1.03 NB	B-70-078	74+00	US 10 EB	CN RAILROAD	330.8x88.0	5	12	No	NA	Yes	N/A	8	12	Yes	Fair	
2	1.03 NB	B-70-078	74+00	US 10 EB	N. LAKE ST	330.8x88.0	5	12	No	Yes	Yes	N/A	8	12	Yes	Fair	
2	1.03 NB	B-70-078	74+00 RT	RAMP - NB 41 TO NB 441	CN RAILROAD	368.3x33.7	5	15	No	NA	Yes	N/A	8	8	Yes	Poor	8' < 10' min (outside)
2	1.03 NB	B-70-078	74+00 RT	RAMP - NB 41 TO NB 441	N. LAKE ST	368.3x33.7	5	15	No	Yes	Yes	N/A	8	8	Yes	Poor	8' < 10' min (outside)
2	1.36 NB	B-70-076	74+00 LT	RAMP - SB 441 TO NB 41	CN RAILROAD	333.0x33.7	5	15	No	NA	Yes	N/A	8	8	Yes	Poor	8' < 10' min (outside)
2	1.36 NB	B-70-076	74+00 LT	RAMP - SB 441 TO NB 41	W. BUTTE MORTS BEACH RD	333.0x33.7	5	15	No	Yes	Yes	Yes	8	8	Yes	Poor	8' < 10' min (outside)
2	1.19 NB	B-70-061	97+71	WIS 441 NB & SB	LITTLE LAKE BUTTE DE MORTS	3255.7x68.8	18	12	No	NA	Yes	N/A	5	1.9	N/A	Poor	1.9' < 3.5' min (outside, long bridge)
2	1.89 NB	B-70-068	118+50	WIS 441 NB & SB	TAYCO ST	125.2x87.3	3	12	No	Yes	Yes	Yes	3.4	10	Yes	Poor	3.4' < 3.5' min (median)
3	2.07 NB	B-70-108	128+00	WIS 441 NB	NW RAMP & NW LOOP	171.1x40.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
3	9.66 SB	B-70-109	128+01	WIS 441 SB	NW RAMP & NW LOOP	170.5x40.0	2	12	No	Yes	Yes	Yes	8	8	Yes	Poor	8' < 10' min (outside)
3	2.62 NB	B-70-110	156+50	WIS 441 NB & SB	CTH P (RACINE ST)	298.6x60	2	12	No	Yes	Yes	Yes	12	12	Yes	Fair	
3	3.03 NB	B-70-111	178+65	WIS 441 NB	CTH AP (MIDWAY RD)	201.2x40.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
3	8.70 SB	B-70-112	178+98	WIS 441 SB	CTH AP (MIDWAY RD)	212.2x40.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
4	3.98 NB	B-70-113	230+96	WIS 441 NB	WIS 47 (APPLETON RD)	165.8x40.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
4	7.72 SB	B-70-114	230+94	WIS 441 SB	WIS 47 (APPLETON RD)	165.8x40.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
5	4.99 NB	B-70-115	283+25	WIS 441 NB	US 10 (ONEIDA ST)	168.8x43.0	2	12	No	Yes	Yes	Yes	5.8	10.1	Yes	Fair	
5	6.69 SB	B-70-116	283+25	WIS 441 SB	US 10 (ONEIDA ST)	168.8x43.0	2	12	No	Yes	Yes	Yes	6.1	9.8	Yes	Poor	9.8' < 10' min (outside)
5	5.56 NB	B-08-033	312+50	CARPENTER ST PED BRG	WIS 441 NB & SB	164.5x12.0	2	NA	No	Yes	NA	Yes	N/A	N/A	Yes	Fair	
6	6.25 NB	B-08-024	348+87	TELULAH AVENUE	WIS 441 NB & SB	207.3x46.0	2	16	No	Yes	Yes	Yes	N/A	4	Yes	Poor	4' < 10' min (outside)
6	7.09 NB	B-08-025	394+21	WIS 441 NB	S. LAKE PARK RD	139.1x43.0	3	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
6	4.58 SB	B-08-026	394+21	WIS 441 SB	S. LAKE PARK RD	139.1x43.0	3	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
7	7.69 NB	B-08-027	425+53	WIS 441 NB	CTH KK (CALUMET ST)	163.6x43.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
7	4.01 SB	B-08-028	425+53	WIS 441 SB	CTH KK (CALUMET ST)	163.6x43.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
8	8.70 NB	B-44-122	486+50	WIS 441 NB	CTH CE (COLLEGE AVE)	182.8x43.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
8	3.00 SB	B-44-123	486+50	WIS 441 SB	CTH CE (COLLEGE AVE)	182.8x43.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
8	9.15 NB	B-44-124	509+20	FOX RIVER VALLY RR	WIS 441 NB & SB	150.0x20.0	2	NA	NA	Yes	NA	Yes	N/A	N/A	No	Poor	steep backslopes, curb & gutter on WIS 441
8	9.36 NB	B-44-125	520+47	CTH Z (KIMBERLY AVE)	WIS 441 NB & SB	165.6x58.0	2	12	No	Yes	Yes	Yes	N/A	N/A	Yes	Good	
9	9.89 NB	B-44-126	552+23	WIS 441 NB & SB	FOX RIVER	1629.3x87.0	11	12	No	NA	Yes	N/A	6	10	N/A	Fair	
9	9.89 NB	B-44-126	552+23	WIS 441 NB & SB	WIS 96 (WISCONSIN AVE)	1629.3x87.0	11	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
9	9.89 NB	B-44-126	552+23	WIS 441 NB & SB	C. & NW. TRANS. CO. RR	1629.3x87.0	11	12	No	NA	Yes	N/A	6	10	Yes	Fair	
9	10.69 NB	B-44-127	591+60	WIS 441 NB	CTH OO (NORTHLAND AVE)	186.8x43.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
9	1.01 SB	B-44-128	591+60	WIS 441 SB	CTH OO (NORTHLAND AVE)	186.8x43.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
10	11.46 NB	B-44-129	630+00	WIS 441 NB	US 41 NB & SB	233.33x43.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	
10	0.30 SB	B-44-130	630+00	WIS 441 SB	US 41 NB & SB	239.33x43.0	2	12	No	Yes	Yes	Yes	6	10	Yes	Fair	

Exhibit F-10

RAMP GEOMETRIC DESIGN - HORIZONTAL ALIGNMENT																								
Segment	Cum. Mile	Ramp Location	Ramp Description	Ramp Type	Ramp Station (From)	Ramp Station (To)	Curve Design Speed (MPH)	Compound Curve Radii Ratio	Curve Radius (ft)	Radius Deficient using emax 6%?	Available Horizontal SSD (feet)	Equivalent Speed, SSD (ft)	HORIZ. RATING (CC ratio, Rad & SSD)	Comments	Req'd SE (%)	Req'd SE Transition (T, feet)	Req'd SE Runout (L, feet)	Existing SE (%)	Existing SE Transition (T, feet)	Existing SE Runout (L, feet)	Equivalent Speed under Existing Cond (emax=6%)	SE Transition meets standards?	S.E. RATING (SE & Transition)	Comments
2	1.96 NB	CTH P (SW ramp)	NB off	Directional	123+02.36	128+02.36	60	0	1909.86	No	1350	60	Good		5.4	199	146	4.5	NA	NA	50	Yes	Poor	deficient SE
2	1.96 NB	CTH P (SW ramp)	NB off	Directional	128+99.34	138+88.48	60	1.50	2864.79	No	1350	60	Good		4.4	172	119	2.3	NA	NA	35	Yes	Poor	deficient SE
3	9.30 SB	CTH P (NW ramp)	SB off	Directional	119+85.60	124+46.30	60	0	429.26	Yes	1400	60	Poor	deficient R	NC	NA	NA	6.0	NA	NA	35	NC	Poor	deficient SE
3	9.30 SB	CTH P (NW ramp)	SB off	Directional	114+52.29	117+50.73	60	6.70	2876.79	No	870	60	Poor	CC ratio > 2.0 max	4.4	171	118	2.3	< 171	100	35	No	Poor	deficient SE & transition
3	9.30 SB	CTH P (NW ramp)	SB off	Directional	128+57.50	134+94.95	60	0	540.87	Yes	540	55	Poor	deficient R & SSD	NC	NA	NA	6.0	NA	NA	40	NC	Poor	deficient SE
3	9.30 SB	CTH P (NW ramp)	SB off	Directional	134+94.98	137+60.15	60	1.51	818.51	Yes	570	60	Poor	deficient R	NC	NA	NA	6.0	NA	150	45	NC	Poor	deficient SE
3	9.30 SB	CTH P (NW ramp)	SB off	Directional	141+50.00	145+00.00	60	0	2291.83	No	1100	60	Good		5.5	188	135	4.5	> 188	165	55	Yes	Fair	5mph deficient SE
3	9.52 SB	CTH P (NW loop)	SB on	Loop	114+71.67	117+72.20	30	0	2896.79	No	1300	60	Good		NC	72	36	2.0	NA	NA	35	NC	Good	
3	9.52 SB	CTH P (NW loop)	SB on	Loop	120+07.06	124+46.30	30	0.14	409.26	No	300	35	Good		5.5	137	101	6.0	NA	NA	35	Yes	Good	
3	9.52 SB	CTH P (NW loop)	SB on	Loop	128+57.50	130+61.75	30	1.27	520.87	No	700	60	Good		5.0	127	91	6.0	NA	NA	40	Yes	Good	
3	9.52 SB	CTH P (NW loop)	SB on	Loop	130+61.75	135+10.05	30	0.55	286.48	No	390	45	Good		6.0	145	109	6.0	NA	NA	30	Yes	Good	
3	9.52 SB	CTH P (NW loop)	SB on	Loop	135+10.05	140+10.05	30	1.00	286.48	No	390	45	Good		6.0	145	109	6.0	NA	NA	30	Yes	Good	
3	9.52SB	CTH P (NW loop)	SB on	Loop	140+10.05	141+60.05	30	1.74	498.22	No	800	60	Fair	CC ratio > 1.50 des	5.1	129	93	6.0	NA	NA	35	Yes	Good	
3	9.52 SB	CTH P (NW loop)	SB on	Loop	141+60.05	143+10.05	30	1.54	768.94	No	570	60	Fair	CC ratio > 1.50 des	4.2	77	113	6.0	NA	NA	45	Yes	Good	
3	2.33 NB	CTH P (NE ramp)	NB on	Directional	125+77.99	130+44.62	60	0	381.97	Yes	360	45	Poor	deficient R & SSD	NC	NA	NA	5.0	NA	130	25	NC	Poor	deficient SE
3	2.33 NB	CTH P (NE ramp)	NB on	Directional	133+10.16	141+00.00	60	0	1702.21	No	960	60	Good		5.7	206	153	4.3	NA	NA	45	Yes	Poor	deficient SE
3	2.33 NB	CTH P (NE ramp)	NB on	Directional	141+00.00	143+00.00	60	2.23	763.94	Yes	900	60	Poor	deficient R & CC ratio > 2.0 max	NC	NA	NA	6.0	NA	NA	45	NC	Poor	deficient SE
3	8.8 SB	CTH AP (SW ramp)	SB On	Diamond	176+50.05	178+68.53	55	0.00	818.51	Yes	600	60	Poor	deficient R	NC	NA	NA	3.0	NA	100	20	NC	Poor	deficient SE
3	8.8 SB	CTH AP (SW ramp)	SB On	Diamond	170+00.00	174+01.73	55	1.00	818.51	Yes	660	60	Poor	deficient R	NC	NA	NA	5.6	NA	150	40	NC	Poor	deficient SE
3	2.91 NB	CTH AP (SE ramp)	NB Off	Diamond	167+00.01	172+12.00	55	0	3819.72	No	600	60	Good		3.2	134	83	3.3	> 165	165	55	Yes	Good	
3	8.46 SB	CTH AP (NW ramp)	SB Off	Diamond	180+06.63	183+25.15	55	0	954.93	Yes	660	60	Poor	deficient R	NC	NA	NA	3.8	NA	100	30	NC	Poor	deficient SE
3	8.46 SB	CTH AP (NW ramp)	SB Off	Diamond	183+25.15	194+79.48	55	1.50	1432.39	No	600	60	Good		5.7	195	144	4.1	< 195	125	40	No	Poor	deficient SE & transition
3	8.46 SB	CTH AP (NW ramp)	SB Off	Diamond	194+79.48	195+09.45	55	1.50	2148.59	No	600	60	Good		4.7	172	121	6.0	> 172	165	70	Yes	Good	
3	3.27 NB	CTH AP (NE ramp)	NB On	Diamond	184+47.69	193+00.00	55	0	763.94	Yes	600	60	Poor	deficient R	NC	NA	NA	3.0	NA	150	20	NC	Poor	deficient SE
4	3.82 NB	WIS 47 (SW ramp)	NB Off	Diamond	217+50.00	231+19.91	55	0	2864.79	No	960	60	Good		4.0	154	103	3.5	> 154	150	50	Yes	Fair	5mph deficient SE
4	4.17 NB	WIS 47 (SE ramp)	NB On	Diamond	230+71.84	243+00.00	55	0	2864.79	No	900	60	Good		4.0	154	103	4.0	> 165	165	55	Yes	Good	
4	7.48 SB	WIS 47 (NE ramp)	SB Off	Diamond	230+58.48	244+50.00	55	0	2864.79	No	975	60	Good		4.0	154	103	3.5	> 154	150	50	Yes	Fair	5mph deficient SE
5	6.87 SB	US 10 (NW ramp)	SB On	Diamond	269+50.00	283+45.81	55	0	2864.79	No	900	60	Good		4.0	154	103	4.0	> 165	165	55	Yes	Good	
5	4.83 NB	US 10 (SW ramp)	NB Off	Diamond	270+50.00	283+54.04	55	0	3819.72	No	900	60	Good		3.2	134	83	3.5	> 150	150	55	Yes	Good	
5	5.20 NB	US 10 (SE ramp)	NB On	Diamond	283+39.93	300+00.00	55	0	2864.79	No	1000	60	Good		4.0	154	103	4.0	> 165	165	55	Yes	Good	
5	6.48 SB	US 10 (NE ramp)	SB Off	Diamond	282+69.82	296+50.00	55	0	2864.79	No	675	60	Good		4.0	154	103	3.5	> 150	150	50	Yes	Fair	5mph deficient SE
7	4.25 SB	CTH KK (SW ramp)	SB On	Diamond	409+50	423+50	55	0	1432.39	No	540	55	Good		5.7	195	144	5.5	> 195	165	55	Yes	Good	
7	7.48 NB	CTH KK (SE ramp)	NB Off	Diamond	412+03	426+51	55	0	3819.72	No	990	60	Good		3.2	134	83	2.5	> 134	125	45	Yes	Poor	deficient SE
7	7.48 NB	CTH KK (SE ramp)	NB Off	Diamond	412+03	426+51	55	0	11459.16	No	900	60	Good		NC	NA	NA	RC	NA	175	65	NC	Good	
7	3.81 SB	CTH KK (NW ramp)	SB Off	Diamond	426+00	438+89.11	55	0	1145.92	No	750	60	Good		6.0	202	151	5.9	> 202	165	55	Yes	Good	
7	7.92 NB	CTH KK (NE ramp)	NB On	Diamond	426+15.00	440+09.56	55	0	7639.44	No	900	60	Good		NC	103	52	RC	> 150	150	50	NC	Fair	5mph deficient SE
8	3.18 SB	CTH CE (SW ramp)	SB On	Diamond	472+63.97	486+35	55	0	2864.79	No	900	60	Good		4.0	154	103	3.5	> 154	150	50	Yes	Fair	5mph deficient SE
8	8.51 NB	CTH CE (SE ramp)	NB Off	Diamond	472+63.97	486+00.90	55	0	1909.86	No	750	60	Good		5.0	178	127	4.5	> 178	150	50	Yes	Fair	5mph deficient SE
8	2.81 SB	CTH CE (NW ramp)	SB Off	Diamond	486+60	498+50	55	0	2864.79	No	750	60	Good		4.0	154	103	3.5	> 154	150	50	Yes	Fair	5mph deficient SE
8	8.90 NB	CTH CE (NE ramp)	NB On	Diamond	486+55	498+00	55	0	1273.24	No	600	60	Good		5.8	200	149	5.3	> 200	150	50	Yes	Fair	5mph deficient SE
8	8.90 NB	CTH CE (NE ramp)	NB On	Diamond	486+55	498+00	55	0	763.94	Yes	900	60	Poor	deficient R	5.5	155	114	4.2	< 155	100	30	No	Poor	deficient SE & transition
9	1.17 SB	CTH OO (SW ramp)	SB On	Diamond	580+00	591+94	55	0	1145.92	No	700	60	Good		5.7	184	136	5.9	> 225	225	50	Yes	Fair	5mph deficient SE
9	1.17 SB	CTH OO (SW ramp)	SB On	Diamond	580+00	591+94	55	0	763.94	Yes	900	60	Poor	deficient R	5.5	155	114	4.3	> 155	150	30	Yes	Poor	deficient SE
9	10.47 NB	CTH OO (SE ramp)	NB Off	Diamond	576+50	591+03.98	55	0	11459.16	No	1200	60	Good		NC	NA	NA	NC	NA	NA	55	NC	Good	
9	0.83 SB	CTH OO (NW ramp)	SB Off	Diamond	591+88.69	603+00	55	0	1637.02	No	600	60	Good		3.8	120	78	3.8	> 190	190	40	Yes	Poor	deficient SE
9	10.85 NB	CTH OO (NE ramp)	NB On	Diamond	591+80.35	604+00	55	0	2291.83	No	770	60	Good		4.6	167	116	4.5	> 240	240	55	Yes	Good	
10	0.41 SB	US 41 (SW ramp)	NB 41 to SB 441	Directional	622+00	638+42.25	60	0	954.93	Yes	810	60	Poor	deficient R	NC	NA	NA	5.9	NA	150	50	NC	Poor	deficient SE
10	11.26 NB	US 41 (SE ramp)	NB 441 to NB 41	Directional	618+15.42	640+16.30	60	0	954.93	Yes	1020	60	Poor	deficient R	NC	NA	NA	5.9	NA	150	50	NC	Poor	deficient SE
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	Loop	632+92.13	635+03.30	30	0	1209.92	No	750	60	Good		NC	NA	NA	5.9	NA	165	55	NC	Good	
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	Loop	635+03.30	637+26.76	30	1.98	609.67	No	720	60	Poor	deficient CC ratio > 1.75 max	NC	NA	NA	5.9	NA	NA	40	NC	Good	
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	Loop	637+26.76	642+97.78	30	1.67	365.56	No	600	60	Fair	CC ratio > 1.75 max	NC	NA	NA	5.9	NA	NA	30	NC	Good	
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	Loop	642+97.78	645+17.17	30	0.61	603.11	No	660	60	Good		NC	NA	NA	5.9	NA	165	40	NC	Good	
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	Loop	895+47.6	889+41.83	30	0.74	818.51	No	390	45	Good		NC	NA	NA	5.9	NA	125	45	NC	Good	
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	Loop	889+41.83	887+91.93	30	0.71	1145.92	No	900	60	Good		NC	NA	NA	5.9	NA	125	55	NC	Good	
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	Loop	901+08.88	899+58.88	30	0	818.51	No	600	60	Good		4.1	111	74	5.9	> 130	130	35	Yes	Good	
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	Loop	899+58.88	898+08.88	30	1.64	498.22	No	540	55	Fair	CC ratio > 1.50 des	5.1	129	93	5.9	NA	NA	45	Yes	Good	
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	Loop	898+08.88	892+08.88	30	1.65	301.56	No	510	55	Fair	CC ratio > 1.50 des	6.0	145	109	5.9	NA	NA	30	Yes	Good	
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	Loop	641+81.48	636+92.13	30	1.00	301.56	No	510	55	Good		6.0	145	109	5.9	NA	NA	30	Yes	Good	
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	Loop	636+92.13	634+92.																		

Exhibit F-11

RAMP GEOMETRIC DESIGN - VERTICAL ALIGNMENT																		
Segment	Cum. Mile	Ramp Location	Ramp Description	Ramp Station (From)	Ramp Station (To)	Design Speed (mph)	Alignment Feature	VPI Station	Critical Grade (%)	Approach Grade (%)	Exit Grade (%)	Curve Length (feet)	K-Value	Equivalent V (mph in Crest)		Equivalent V (mph in Sag)	VERTICAL RATING	Comments
														MAX	DES	MAX		
2	1.96 NB	CTH P (SW ramp)	NB off	119+00	119+50	60	Grade		-0.33			-	-	-	-	-	Fair	critical grade < 0.5% desirable
2	1.96 NB	CTH P (SW ramp)	NB off	119+50	121+50	60	Sag	120+50		-0.33	0.82	200	174	-	-	65	Good	
2	1.96 NB	CTH P (SW ramp)	NB off	121+50	122+00	60	Grade		0.82			-	-	-	-	-	Good	
2	1.96 NB	CTH P (SW ramp)	NB off	122+00	127+00	60	Crest	122+50		0.82	-3.86	500	107	45	30	-	Poor	design speed > max speed for crest
2	1.96 NB	CTH P (SW ramp)	NB off	127+00	129+00	60	Grade		-3.86			-	-	-	-	-	Good	
2	1.96 NB	CTH P (SW ramp)	NB off	129+00	133+00	60	Sag	132+00		-3.86	0.38	400	94	-	-	45	Poor	design speed > max speed for sag
2	1.96 NB	CTH P (SW ramp)	NB off	133+00	133+50	60	Grade		0.38			-	-	-	-	-	Fair	critical grade < 0.5% desirable
2	1.96 NB	CTH P (SW ramp)	NB off	133+50	135+00	60	Crest	134+00		0.38	-0.42	150	188	55	40	-	Poor	critical grade < 0.5% desirable
2	1.96 NB	CTH P (SW ramp)	NB off	135+00	139+75	60	Grade		-0.42			-	-	-	-	-	Fair	critical grade < 0.5% desirable
2	1.96 NB	CTH P (SW ramp)	NB off	139+75	140+75	60	Sag	140+50		-0.42	1	100	70	-	-	40	Poor	design speed > max speed for sag
2	1.96 NB	CTH P (SW ramp)	NB off	140+75	141+25	60	Grade		1			-	-	-	-	-	Good	
3	9.3 SB	CTH P (NW ramp)	SB off	---	148+50	60	Grade		-0.26			-	-	-	-	-	Poor	critical grade < 0.3% minimum
3	9.3 SB	CTH P (NW ramp)	SB off	148+50	146+25	60	Sag	147+37.5		-0.26	-1.64	225	163	-	-	65	Good	
3	9.3 SB	CTH P (NW ramp)	SB off	146+25	146+00	60	Grade		-1.64			-	-	-	-	-	Good	
3	9.3 SB	CTH P (NW ramp)	SB off	146+00	137+00	60	Crest	141+50		-1.64	0.69	900	386	65	55	-	Fair	design speed > desired speed for crest
3	9.3 SB	CTH P (NW ramp)	SB off	137+00	128+00	60	Grade		0.69			-	-	-	-	-	Good	
3	9.3 SB	CTH P (NW ramp)	SB off	128+00	124+00	60	Sag	126+00		0.69	-1.75	400	164	-	-	65	Good	
3	9.3 SB	CTH P (NW ramp)	SB off	124+00	120+00	60	Crest	122+00		-1.75	-0.36	400	288	60	50	-	Fair	design speed > desired speed for crest
3	9.3 SB	CTH P (NW ramp)	SB off	120+00	119+50	60	Grade		-0.36			-	-	-	-	-	Fair	critical grade < 0.5% desirable
3	9.3 SB	CTH P (NW ramp)	SB off	119+50	114+75	60	Grade		0.08			-	-	-	-	-	Poor	critical grade < 0.3% minimum
3	9.3 SB	CTH P (NW ramp)	SB off	114+75	112+50	60	Grade		0.92			-	-	-	-	-	Good	
3	9.3 SB	CTH P (NW ramp)	SB off	112+50	111+55	60	Grade		0.55			-	-	-	-	-	Good	
3	9.3 SB	CTH P (NW ramp)	SB off	111+55	110+05	60	Sag	110+80		-1	0.55	150	97	-	-	50	Poor	design speed > max speed for sag
3	9.3 SB	CTH P (NW ramp)	SB off	110+05	109+57	60	Grade		-1			-	-	-	-	-	Good	
3	9.3 SB	CTH P (NW ramp)	SB off	109+57	109+40	60	Grade		-2			-	-	-	-	-	Good	
3	9.52 SB	CTH P (NW loop)	SB on	109+60	109+77	30	Grade		-2			-	-	-	-	-	Good	
3	9.52 SB	CTH P (NW loop)	SB on	109+77	110+25	30	Grade		-1			-	-	-	-	-	Good	
3	9.52 SB	CTH P (NW loop)	SB on	110+25	111+75	30	Sag	111+00		-1	0.63	150	92	-	-	45	Good	
3	9.52 SB	CTH P (NW loop)	SB on	111+75	115+50	30	Grade		0.63			-	-	-	-	-	Good	
3	9.52 SB	CTH P (NW loop)	SB on	115+50	118+50	30	Crest	117+00		0.63	-0.35	300	306	60	50	-	Good	
3	9.52 SB	CTH P (NW loop)	SB on	118+50	119+00	30	Grade		-0.35			-	-	-	-	-	Fair	critical grade < 0.5% desirable
3	9.52 SB	CTH P (NW loop)	SB on	119+00	120+50	30	Sag	119+75		-0.35	-0.08	150	556	-	-	70+	Good	
3	9.52 SB	CTH P (NW loop)	SB on	120+50	123+50	30	Crest	122+00		-0.08	-1.61	300	196	55	40	-	Good	
3	9.52 SB	CTH P (NW loop)	SB on	123+50	124+50	30	Grade		-1.61			-	-	-	-	-	Good	
3	9.52 SB	CTH P (NW loop)	SB on	124+50	128+50	30	Sag	126+50		-1.61	0.83	400	164	-	-	65	Good	
3	9.52 SB	CTH P (NW loop)	SB on	128+50	123+87	30	Grade		0.83			-	-	-	-	-	Good	
3	9.52 SB	CTH P (NW loop)	SB on	132+87	138+87	30	Sag	135+87		0.83	2.4	600	382	-	-	70+	Good	
3	9.52 SB	CTH P (NW loop)	SB on	138+87	141+65	30	Grade		2.4			-	-	-	-	-	Good	
3	9.52 SB	CTH P (NW loop)	SB on	141+65	143+65	30	Crest	142+65		2.4	1.16	200	161	50	35	-	Good	
3	9.52 SB	CTH P (NW loop)	SB on	143+65	---	30	Grade		1.16			-	-	-	-	-	Good	

Exhibit F-11 Continued

RAMP GEOMETRIC DESIGN - VERTICAL ALIGNMENT																		
Segment	Cum. Mile	Ramp Location	Ramp Description	Ramp Station (From)	Ramp Station (To)	Design Speed (mph)	Alignment Feature	VPI Station	Critical Grade (%)	Approach Grade (%)	Exit Grade (%)	Curve Length (feet)	K-Value	Equivalent V (mph in Crest)		Equivalent V (mph in Sag)	VERTICAL RATING	Comments
														MAX	DES			
				FOR BEGINNING OF RAMP - REFER TO NW LOOP (THE TWO ARE COMBINED)														
3	2.33 NB	CTH P (NE ramp)	NB on		127+00	60	Grade		0.12			-	-	-	-	-	Poor	critical grade < 0.3% minimum
3	2.33 NB	CTH P (NE ramp)	NB on	127+00	130+00	60	Crest	128+50		0.12	-0.22	300	882	70+	70+	-	Good	
3	2.33 NB	CTH P (NE ramp)	NB on	130+00	132+00	60	Sag	131+00		-0.22	-0.04	200	1111	-	-	70+	Good	
3	2.33 NB	CTH P (NE ramp)	NB on	132+00	132+25	60	Grade		-0.04			-	-	-	-	-	Poor	critical grade < 0.3% minimum
3	2.33 NB	CTH P (NE ramp)	NB on	132+25	135+25	60	Sag	133+75		-0.04	1.73	300	169	-	-	65	Good	
3	2.33 NB	CTH P (NE ramp)	NB on	135+25	139+75	60	Crest	137+50		1.73	-2.4	450	109	45	30	-	Poor	design speed > max speed for crest
3	2.33 NB	CTH P (NE ramp)	NB on	139+75	140+25	60	Grade		-2.4			-	-	-	-	-	Good	
3	2.33 NB	CTH P (NE ramp)	NB on	140+25	143+25	60	Sag	141+75		-2.4	-0.9	300	200	-	-	70+	Good	
3	2.33 NB	CTH P (NE ramp)	NB on	143+25	---	60	Grade		-0.9			-	-	-	-	-	Good	
3	8.8 SB	CTH AP (SW ramp)	SB On	179+20	179+00	55	Grade		1			-	-	-	-	-	Good	
3	8.8 SB	CTH AP (SW ramp)	SB On	179+00	177+50	55	Sag	178+25		1	-3.36	150	34	-	-	25	Poor	design speed > max speed for sag
3	8.8 SB	CTH AP (SW ramp)	SB On	177+50	171+50	55	Crest	174+50		-3.36	2.65	600	100	45	30	-	Poor	design speed > max speed for crest
3	8.8 SB	CTH AP (SW ramp)	SB On	166+50	171+50	55	Grade		2.65			-	-	-	-	-	Good	
3	2.91 NB	CTH AP (SE ramp)	NB Off	168+50	169+00	55	Grade		2.35			-	-	-	-	-	Good	
3	2.91 NB	CTH AP (SE ramp)	NB Off	169+00	171+00	55	Sag	170+00		2.35	2.68	200	606	-	-	70+	Good	
3	2.91 NB	CTH AP (SE ramp)	NB Off	171+00	175+20	55	Crest	173+10		2.68	-2.22	420	86	40	25	-	Poor	design speed > max speed for crest
3	2.91 NB	CTH AP (SE ramp)	NB Off	175+20	176+25	55	Grade		-2.22			-	-	-	-	-	Good	
3	2.91 NB	CTH AP (SE ramp)	NB Off	176+25	177+25	55	Sag	176+75		-2.22	1	100	31	-	-	25	Poor	design speed > max speed for sag
3	8.46 SB	CTH AP (NW ramp)	SB Off	193+50	191+00	55	Sag	192+25		-0.27	-1.49	250	205	-	-	70+	Good	
3	8.46 SB	CTH AP (NW ramp)	SB Off	191+00	190+50	55	Grade		-1.49			-	-	-	-	-	Good	
3	8.46 SB	CTH AP (NW ramp)	SB Off	190+50	182+00	55	Crest	186+25		-1.49	5.51	850	121	45	30	-	Poor	design speed > max speed for crest
3	8.46 SB	CTH AP (NW ramp)	SB Off	182+00	181+90	55	Grade		5.51			-	-	-	-	-	Poor	critical grade > 5.0% maximum
3	8.46 SB	CTH AP (NW ramp)	SB Off	181+90	179+40	55	Sag	180+65		5.51	-1.02	250	38	-	-	30	Poor	design speed > max speed for sag
3	3.27 NB	CTH AP (NE ramp)	NB On	179+06	181+06	55	Sag	180+06		-1.01	1.91	200	68	-	-	40	Poor	design speed > max speed for sag
3	3.27 NB	CTH AP (NE ramp)	NB On	181+06	185+00	55	Grade		1.91			-	-	-	-	-	Good	
3	3.27 NB	CTH AP (NE ramp)	NB On	185+00	191+00	55	Crest	188+00		1.91	-0.13	600	294	60	50	-	Fair	design speed > max speed for crest
3	3.27 NB	CTH AP (NE ramp)	NB On	191+00	193+00	55	Grade		-0.13			-	-	-	-	-	Poor	critical grade < 0.3% minimum
4	7.89 SB	WIS 47 (NW ramp)	SB On	215+00	216+50	55	Grade		0.70			-	-	-	-	-	Good	
4	7.89 SB	WIS 47 (NW ramp)	SB On	216+50	218+50	55	Crest	216+50		0.70	0.75	200	4000	70+	70+	-	Good	
4	7.89 SB	WIS 47 (NW ramp)	SB On	218+50	220+00	55	Grade		0.75			-	-	-	-	-	Good	
4	7.89 SB	WIS 47 (NW ramp)	SB On	220+00	228+00	55	Crest	224+00		0.75	-1.28	800	394	65	55	-	Good	
4	7.89 SB	WIS 47 (NW ramp)	SB On	228+00	228+50	55	Grade		-1.28			-	-	-	-	-	Good	
4	7.89 SB	WIS 47 (NW ramp)	SB On	228+50	230+50	55	Sag	229+50		-1.28	1.47	200	73	-	-	40	Poor	design speed > max speed for sag
4	7.89 SB	WIS 47 (NW ramp)	SB On	230+50	23105.11	55	Grade		1.47			-	-	-	-	-	Good	
4	3.82 NB	WIS 47 (SW ramp)	NB Off	217+50	220+00	55	Grade		0.61			-	-	-	-	-	Good	
4	3.82 NB	WIS 47 (SW ramp)	NB Off	220+00	225+00	55	Crest	222+50		0.61	-1.54	500	233	55	45	-	Fair	design speed = max speed for crest
4	3.82 NB	WIS 47 (SW ramp)	NB Off	225+00	228+50	55	Grade		-1.54			-	-	-	-	-	Good	
4	3.82 NB	WIS 47 (SW ramp)	NB Off	228+50	230+50	55	Sag	229+50		-1.54	0.88	200	83	-	-	45	Poor	design speed > max speed for sag
4	3.82 NB	WIS 47 (SW ramp)	NB Off	230+50	23119.91	55	Grade		0.88			-	-	-	-	-	Good	

Exhibit F-11 Continued

RAMP GEOMETRIC DESIGN - VERTICAL ALIGNMENT																		
Segment	Cum. Mile	Ramp Location	Ramp Description	Ramp Station (From)	Ramp Station (To)	Design Speed (mph)	Alignment Feature	VPI Station	Critical Grade (%)	Approach Grade (%)	Exit Grade (%)	Curve Length (feet)	K-Value	Equivalent V (mph in Crest)		Equivalent V (mph in Sag)	VERTICAL RATING	Comments
														MAX	DES	MAX		
4	4.17 NB	WIS 47 (SE ramp)	NB On	23071.84	231+50	55	Grade		-0.45			-	-	-	-	-	Fair	critical grade < 0.5% desirable
4	4.17 NB	WIS 47 (SE ramp)	NB On	231+50	233+50	55	Sag	232+50		-0.45	3.38	200	52	-	-	35	Poor	design speed > max speed for sag
4	4.17 NB	WIS 47 (SE ramp)	NB On	233+50	235+50	55	Grade		3.38			-	-	-	-	-	Good	
4	4.17 NB	WIS 47 (SE ramp)	NB On	235+50	242+50	55	Crest	239+00		3.38	0.50	700	243	55	45	-	Fair	design speed = max speed for crest
4	7.48 SB	WIS 47 (NE ramp)	SB Off	23058.48	232+00	55	Grade		-1.71			-	-	-	-	-	Good	
4	7.48 SB	WIS 47 (NE ramp)	SB Off	232+00	233+50	55	Sag	232+00		-1.71	2.03	150	40	-	-	30	Poor	design speed > max speed for sag
4	7.48 SB	WIS 47 (NE ramp)	SB Off	233+50	238+00	55	Grade		2.03			-	-	-	-	-	Good	
4	7.48 SB	WIS 47 (NE ramp)	SB Off	238+00	243+00	55	Crest	240+50		2.03	0.80	500	407	70+	55	-	Good	
4	7.48 SB	WIS 47 (NE ramp)	SB Off	243+00	244+50	55	Grade		0.80			-	-	-	-	-	Good	
5	6.87 SB	US 10 (NW ramp)	SB On	271+50	273+50	55	Grade		0.97			-	-	-	-	-	Good	
5	6.87 SB	US 10 (NW ramp)	SB On	273+50	280+50	55	Crest	277+00		0.97	-2.09	700	229	55	45	-	Fair	design speed = max speed for crest
5	6.87 SB	US 10 (NW ramp)	SB On	280+50	281+00	55	Grade		-2.09			-	-	-	-	-	Good	
5	6.87 SB	US 10 (NW ramp)	SB On	281+00	283+00	55	Sag	282+00		-2.09	1.00	200	65	-	-	40	Poor	design speed > max speed for sag
5	6.87 SB	US 10 (NW ramp)	SB On	283+00	283+45.81	55	Grade		1.00			-	-	-	-	-	Good	
5	4.83 NB	US 10 (SW ramp)	NB Off	270+50	273+00	55	Sag	271+75		-0.56	1.10	250	151	-	-	60	Good	
5	4.83 NB	US 10 (SW ramp)	NB Off	273+00	281+00	55	Crest	277+00		1.10	-2.00	800	258	60	45	-	Fair	design speed > desired speed for crest
5	4.83 NB	US 10 (SW ramp)	NB Off	281+00	283+00	55	Sag	282+00		-2.00	0.96	200	68	-	-	40	Poor	design speed > max speed for sag
5	4.83 NB	US 10 (SW ramp)	NB Off	283+00	28354.04	55	Grade		0.96			-	-	-	-	-	Good	
5	5.2 NB	US 10 (SE ramp)	NB On	28339.93	284+00	55	Grade		-1.20			-	-	-	-	-	Good	
5	5.2 NB	US 10 (SE ramp)	NB On	284+00	285+00	55	Sag	284+00		-1.20	2.75	100	25	-	-	20	Poor	design speed > max speed for sag
5	5.2 NB	US 10 (SE ramp)	NB On	285+00	287+50	55	Grade		2.75			-	-	-	-	-	Good	
5	5.2 NB	US 10 (SE ramp)	NB On	287+50	293+50	55	Crest	290+50		2.75	-0.07	600	213	55	45	-	Fair	design speed = max speed for crest
5	5.2 NB	US 10 (SE ramp)	NB On	293+50	296+00	55	Grade		-0.07			-	-	-	-	-	Poor	critical grade < 0.3% minimum
5	6.48 SB	US 10 (NE ramp)	SB Off	283+00	284+00	55	Sag	283+50		-1.40	2.92	100	23	-	-	20	Poor	design speed > max speed for sag
5	6.48 SB	US 10 (NE ramp)	SB Off	284+00	287+00	55	Grade		2.92			-	-	-	-	-	Good	
5	6.48 SB	US 10 (NE ramp)	SB Off	287+00	293+00	55	Crest	290+00		2.92	-1.33	600	141	50	35	-	Poor	design speed > max speed for crest
5	6.48 SB	US 10 (NE ramp)	SB Off	293+00	296+50	55	Grade		-1.33			-	-	-	-	-	Good	
7	4.25 SB	CTH KK (SW ramp)	SB On	409+50	412+00	55	Grade		-0.74			-	-	-	-	-	Good	
7	4.25 SB	CTH KK (SW ramp)	SB On	412+00	418+00	55	Crest	415+00		-0.74	-2.12	600	435	70+	55	-	Good	
7	4.25 SB	CTH KK (SW ramp)	SB On	418+00	420+50	55	Grade		-2.12			-	-	-	-	-	Good	
7	4.25 SB	CTH KK (SW ramp)	SB On	420+50	423+50	55	Sag	422+00		-2.12	0.03	300	140	-	-	60	Good	
7	7.48 NB	CTH KK (SE ramp)	NB Off	412+03	413+04	55	Grade		-0.10			-	-	-	-	-	Poor	critical grade < 0.3% minimum
7	7.48 NB	CTH KK (SE ramp)	NB Off	413+04	414+00	55	Grade		-0.53			-	-	-	-	-	Good	
7	7.48 NB	CTH KK (SE ramp)	NB Off	414+00	419+00	55	Crest	416+50		-0.53	-2.34	500	276	60	50	-	Fair	design speed > desired speed for crest
7	7.48 NB	CTH KK (SE ramp)	NB Off	419+00	424+00	55	Grade		-2.34			-	-	-	-	-	Good	
7	7.48 NB	CTH KK (SE ramp)	NB Off	424+00	426+00	55	Sag	425+00		-2.34	1.50	200	52	-	-	35	Poor	design speed > max speed for sag
7	7.48 NB	CTH KK (SE ramp)	NB Off	426+00	426+51	55	Grade		1.50			-	-	-	-	-	Good	
7	3.81 SB	CTH KK (NW ramp)	SB Off	426+00	427+53	55	Sag	426+53		-1.50	1.53	153	50	-	-	35	Poor	design speed > max speed for sag
7	3.81 SB	CTH KK (NW ramp)	SB Off	427+53	430+50	55	Grade		1.53			-	-	-	-	-	Good	
7	3.81 SB	CTH KK (NW ramp)	SB Off	430+50	435+50	55	Crest	433+00		1.53	-1.66	500	157	50	35	-	Poor	design speed > max speed for crest

Exhibit F-11 Continued

RAMP GEOMETRIC DESIGN - VERTICAL ALIGNMENT																			
Segment	Cum. Mile	Ramp Location	Ramp Description	Ramp Station (From)	Ramp Station (To)	Design Speed (mph)	Alignment Feature	VPI Station	Critical Grade (%)	Approach Grade (%)	Exit Grade (%)	Curve Length (feet)	K-Value	Equivalent V (mph in Crest)		Equivalent V (mph in Sag)		VERTICAL RATING	Comments
														MAX	DES	MAX			
7	3.81 SB	CTH KK (NW ramp)	SB Off	435+50	438+89	55	Grade		-1.66			-	-	-	-	-	-	Good	
7	7.92 NB	CTH KK (NE ramp)	NB On	426+15	426+04	55	Grade		-1.43			-	-	-	-	-	-	Good	
7	7.92 NB	CTH KK (NE ramp)	NB On	426+04	428+04	55	Sag	427+04		-1.43	1.85	200	61	-	-	35		Poor	design speed > max speed for sag
7	7.92 NB	CTH KK (NE ramp)	NB On	428+04	430+25	55	Grade		1.85			-	-	-	-	-	-	Good	
7	7.92 NB	CTH KK (NE ramp)	NB On	430+25	437+25	55	Crest	433+75		1.85	-1.96	700	184	50	40	-		Poor	design speed > max speed for crest
7	7.92 NB	CTH KK (NE ramp)	NB On	437+25	440+09.56	55	Grade		-1.96			-	-	-	-	-	-	Good	
8	3.18 SB	CTH CE (SW ramp)	SB On	473+00	472+25	55	Grade		0.95			-	-	-	-	-	-	Good	
8	3.18 SB	CTH CE (SW ramp)	SB On	477+25	484+75	55	Crest	481+00		0.95	-4.35	750	142	50	35	-		Poor	design speed > max speed for crest
8	3.18 SB	CTH CE (SW ramp)	SB On	484+75	485+20	55	Grade		-4.35			-	-	-	-	-	-	Good	
8	3.18 SB	CTH CE (SW ramp)	SB On	485+20	486+20	55	Sag	485+70		-4.35	1.50	100	17	-	-	20		Poor	design speed > max speed for sag
8	3.18 SB	CTH CE (SW ramp)	SB On	486+20	486+35	55	Grade		1.50			-	-	-	-	-	-	Good	
8	8.51 NB	CTH CE (SE ramp)	NB Off	472+63.97	472+00	55	Grade		0.55			-	-	-	-	-	-	Good	
8	8.51 NB	CTH CE (SE ramp)	NB Off	472+00	473+00	55	Grade		0.55			-	-	-	-	-	-	Good	
8	8.51 NB	CTH CE (SE ramp)	NB Off	473+00	476+50	55	Grade		0.55			-	-	-	-	-	-	Good	
8	8.51 NB	CTH CE (SE ramp)	NB Off	476+50	484+50	55	Crest	480+50		0.55	-4.52	800	158	50	35	-		Poor	design speed > max speed for crest
8	8.51 NB	CTH CE (SE ramp)	NB Off	484+50	485+50	55	Sag	485+00		-4.52	1.50	100	17	-	-	20		Poor	design speed > max speed for sag
8	8.51 NB	CTH CE (SE ramp)	NB Off	485+50	486+01	55	Grade		1.50			-	-	-	-	-	-	Good	
8	2.81 SB	CTH CE (NW ramp)	SB Off	486+60	487+50	55	Grade		-1.00			-	-	-	-	-	-	Good	
8	2.81 SB	CTH CE (NW ramp)	SB Off	487+50	488+50	55	Sag	488+00		-1.00	2.82	100	26	-	-	25		Poor	design speed > max speed for sag
8	2.81 SB	CTH CE (NW ramp)	SB Off	488+50	489+50	55	Grade		2.82			-	-	-	-	-	-	Good	
8	2.81 SB	CTH CE (NW ramp)	SB Off	489+50	495+50	55	Crest	492+50		2.82	-2.33	600	117	45	30	-		Poor	design speed > max speed for crest
8	2.81 SB	CTH CE (NW ramp)	SB Off	495+50	498+50	55	Grade		-2.33			-	-	-	-	-	-	Good	
8	8.9 NB	CTH CE (NE ramp)	NB On	486+55	486+75	55	Grade		-1.50			-	-	-	-	-	-	Good	
8	8.9 NB	CTH CE (NE ramp)	NB On	486+75	488+75	55	Sag	487+75		-1.50	1.30	200	71	-	-	40		Poor	design speed > max speed for sag
8	8.9 NB	CTH CE (NE ramp)	NB On	488+75	490+50	55	Grade		1.30			-	-	-	-	-	-	Good	
8	8.9 NB	CTH CE (NE ramp)	NB On	490+50	497+00	55	Crest	490+50		1.30	-2.39	650	176	50	40	-		Poor	design speed > max speed for crest
8	8.9 NB	CTH CE (NE ramp)	NB On	497+00	498+00	55	Grade		-2.39			-	-	-	-	-	-	Good	
9	1.17 SB	CTH OO (SW ramp)	SB On	580+00	581+00	55	Grade		1.40			-	-	-	-	-	-	Good	
9	1.17 SB	CTH OO (SW ramp)	SB On	581+00	588+50	55	Crest	584+75		1.40	-3.07	750	168	50	40	-		Poor	design speed > max speed for crest
9	1.17 SB	CTH OO (SW ramp)	SB On	588+50	590+75	55	Grade		-3.07			-	-	-	-	-	-	Good	
9	1.17 SB	CTH OO (SW ramp)	SB On	590+75	591+75	55	Sag	590+75		-3.07	1.50	100	22	-	-	20		Poor	design speed > max speed for sag
9	1.17 SB	CTH OO (SW ramp)	SB On	591+75	591+94	55	Grade		1.50			-	-	-	-	-	-	Good	
9	10.47 NB	CTH OO (SE ramp)	NB Off	576+50	578+50	55	Grade		-0.12			-	-	-	-	-	-	Poor	critical grade < 0.3% minimum
9	10.47 NB	CTH OO (SE ramp)	NB Off	578+50	581+50	55	Sag	580+00		-0.12	0.45	300	524	-	-	70+		Good	critical grade < 0.5% desirable
9	10.47 NB	CTH OO (SE ramp)	NB Off	581+50	587+50	55	Crest	584+50		0.45	-3.03	600	173	50	40	-		Poor	design speed > max speed for crest
9	10.47 NB	CTH OO (SE ramp)	NB Off	587+50	589+00	55	Grade		-3.03			-	-	-	-	-	-	Good	
9	10.47 NB	CTH OO (SE ramp)	NB Off	589+00	591+00	55	Sag	590+00		-3.03	1.49	200	44	-	-	30		Poor	design speed > max speed for sag
9	10.47 NB	CTH OO (SE ramp)	NB Off	591+00	591+04	55	Grade		1.49			-	-	-	-	-	-	Good	
9	0.83 SB	CTH OO (NW ramp)	SB Off	591+88.69	592+50	55	Grade		-2.07			-	-	-	-	-	-	Good	
9	0.83 SB	CTH OO (NW ramp)	SB Off	592+50	593+50	55	Sag	593+00		-2.07	2.20	100	23	-	-	20		Poor	design speed > max speed for sag

Exhibit F-11 Continued

RAMP GEOMETRIC DESIGN - VERTICAL ALIGNMENT																		
Segment	Cum. Mile	Ramp Location	Ramp Description	Ramp Station (From)	Ramp Station (To)	Design Speed (mph)	Alignment Feature	VPI Station	Critical Grade (%)	Approach Grade (%)	Exit Grade (%)	Curve Length (feet)	K-Value	Equivalent V (mph in Crest)		Equivalent V (mph in Sag)	VERTICAL RATING	Comments
														MAX	DES			
9	0.83 SB	CTH OO (NW ramp)	SB Off	593+50	596+10	55	Grade		2.20			-	-	-	-	-	Good	
9	0.83 SB	CTH OO (NW ramp)	SB Off	596+10	600+60	55	Crest	598+35		2.20	-0.92	450	144	50	35	-	Poor	design speed > max speed for crest
9	0.83 SB	CTH OO (NW ramp)	SB Off	600+60	602+00	55	Grade		-0.92			-	-	-	-	-	Good	
9	0.83 SB	CTH OO (NW ramp)	SB Off	602+00	603+00	55	Grade		-0.75			-	-	-	-	-	Good	
9	10.85 NB	CTH OO (NE ramp)	NB On	591+80.35	592+00	55	Grade		-1.31			-	-	-	-	-	Good	
9	10.85 NB	CTH OO (NE ramp)	NB On	592+00	594+00	55	Sag	593+00		-1.31	3.04	200	46	-	-	30	Poor	design speed > max speed for sag
9	10.85 NB	CTH OO (NE ramp)	NB On	594+00	595+50	55	Grade		3.04			-	-	-	-	-	Good	
9	10.85 NB	CTH OO (NE ramp)	NB On	595+50	600+50	55	Crest	598+00		3.04	-1.21	500	118	45	30	-	Poor	design speed > max speed for crest
9	10.85 NB	CTH OO (NE ramp)	NB On	600+50	604+00	55	Grade		-1.21			-	-	-	-	-	Good	
10	0.41 SB	US 41 (SW ramp)	NB 41 to SB 441	622+00.00	627+00.00	60	Crest	624+50		1.46	-2.58	500	124	45	30	-	Poor	design speed > max speed for crest
10	0.41 SB	US 41 (SW ramp)	NB 41 to SB 441	627+00.00	630+00.00	60	Grade		2.58			-	-	-	-	-	Good	
10	0.41 SB	US 41 (SW ramp)	NB 41 to SB 441	630+00.00	636+00.00	60	Sag	633+00		-2.58	0.75	600	180	-	-	65	Good	
10	0.41 SB	US 41 (SW ramp)	NB 41 to SB 441	636+00.00	638+42.26	60	Grade		0.75			-	-	-	-	-	Good	
10	11.26 NB	US 41 (SE ramp)	NB 441 to NB 41	618+15.42	620+50	60	Grade		1.43			-	-	-	-	-	Good	
10	11.26 NB	US 41 (SE ramp)	NB 441 to NB 41	620+50	626+00	60	Crest	623+25		1.43	-2.91	550	127	45	30	-	Poor	design speed > max speed for crest
10	11.26 NB	US 41 (SE ramp)	NB 441 to NB 41	626+00	628+80	60	Grade		-2.91			-	-	-	-	-	Good	
10	11.26 NB	US 41 (SE ramp)	NB 441 to NB 41	628+80	634+30	60	Sag	631+55		-2.91	0.15	550	180	-	-	65	Good	
10	11.26 NB	US 41 (SE ramp)	NB 441 to NB 41	634+30	635+66.22	60	Grade		0.15			-	-	-	-	-	Poor	critical grade < 0.3% minimum
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	887+00.00	891+00.00	30	Grade		-0.69			-	-	-	-	-	Good	
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	891+00.00	616+40.00	30	Sag	894+05		1.09	-0.69	27460	15427	-	-	70+	Good	
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	616+40.00	632+92.00	30	Grade		1.09			-	-	-	-	-	Good	
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	904+60.00	902+25.00	30	Grade		-0.12			-	-	-	-	-	Poor	critical grade < 0.3% minimum
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	902+25.00	898+55.00	30	Sag	900+50		-0.12	-1.19	370	346	-	-	70+	Good	
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	898+55.00	632+92.00	30	Grade		-1.19			-	-	-	-	-	Good	

Notes:
- All ramps analyzed at one design speed

Exhibit F-12

RAMP GEOMETRIC DESIGN - GENERAL CRITERIA																		
Segment	Cum. Mile	Ramp Location	Ramp Description	Ramp Type	Ramp Station (From)	Ramp Station (To)	Design (mph)	Entrance/Exit on Left Side of Mainline?	Ramp Overall Length (feet)	Ramp Length for Stopping (ft)	Available Storage Length (ft)	Available Length for Accel/Decel (feet)	Required Length for Accel/Decel (feet)	Meets FDM Taper Style Ramp Standards?	Terminal Design Meets Criteria?	Cross Street ramp terminal OK?	GENERAL DESIGN RATING	Comments
2	1.96 NB	CTH P (SW ramp)	NB off	Directional	119+00	140+75	60	No	2160	615	1545	352.4	340	Yes	Yes	Yes	Good	
3	9.3 SB	CTH P (NW ramp)	SB off	Directional	148+50	109+40.57	60	No	3850	615	3235	350	340	Yes	Yes	Yes	Good	
3	9.52 SB	CTH P (NW loop)	SB on	Loop	127+00	109+60.25	30	No	3640	NA	NA	700	1350	No	Yes	Yes	Poor	deficient accel length; taper length = 930' < 1000' min
3	2.33 NB	CTH P (NE ramp)	NB on	Directional	150+50	121+56.17	60	No	2530	NA	NA	150	580	No	Yes	Yes	Poor	deficient accel length; taper style ramp: R1 = 764' < 1095' min
3	8.8 SB	CTH AP (SW ramp)	SB On	Diamond	166+50	179+00	55	No	1480	NA	NA	425	580	No	Yes	Yes	Poor	deficient accel length; taper style ramp: R1 = 885' < 1095' min
3	2.91 NB	CTH AP (SE ramp)	NB Off	Diamond	167+00	177+00	55	No	930	615	315	930	340	Yes	Yes	Yes	Good	
3	8.46 SB	CTH AP (NW ramp)	SB Off	Diamond	194+50	180+00	55	No	1520	615	905	390.6	340	Yes	Yes	Yes	Good	
3	3.27 NB	CTH AP (NE ramp)	NB On	Diamond	195+00	180+25	55	No	1950	NA	NA	550	580	No	Yes	Yes	Poor	deficient accel length; taper style ramp: R1 = 763.9 < 1095' min
4	7.89 SB	WIS 47 (NW ramp)	SB On	Diamond	215+50	231+00	55	No	1850	NA	NA	550	580	No	Yes	Yes	Poor	deficient accel length; taper length = 850' < 1000' min
4	3.82 NB	WIS 47 (SW ramp)	NB Off	Diamond	217+50	230+75	55	No	1320	615	705	353.6	340	Yes	Yes	Yes	Good	
4	4.17 NB	WIS 47 (SE ramp)	NB On	Diamond	232+00	247+50	55	No	1690	NA	NA	450	580	Yes	Yes	Yes	Poor	deficient accel length
4	7.48 SB	WIS 47 (NE ramp)	SB Off	Diamond	232+00	247+50	55	No	1310	615	695	353.6	340	Yes	Yes	Yes	Good	
5	6.87 SB	US 10 (NW ramp)	SB On	Diamond	271+50	282+00	55	No	1640	NA	NA	470	580	Yes	Yes	Yes	Poor	deficient accel length
5	4.83 NB	US 10 (SW ramp)	NB Off	Diamond	268+60	282+00	55	No	1285	615	670	353.6	340	Yes	Yes	Yes	Good	
5	5.2 NB	US 10 (SE ramp)	NB On	Diamond	283+40	300+50	55	No	1584	NA	NA	525	580	Yes	Yes	Yes	Poor	deficient accel length
5	6.48 SB	US 10 (NE ramp)	SB Off	Diamond	282+70	296+50	55	No	1320	615	705	353.6	340	Yes	Yes	Yes	Good	
7	4.25 SB	CTH KK (SW ramp)	SB On	Diamond	409+50	422+00	55	No	1900	NA	NA	590	580	No	Yes	Yes	Fair	taper length = 900' < min 1000'
7	7.48 NB	CTH KK (SE ramp)	NB Off	Diamond	408+00	423+00	55	No	1510	615	895	650	340	Yes	Yes	Yes	Good	
7	3.81 SB	CTH KK (NW ramp)	SB Off	Diamond	427+50	439+00	55	No	1990	615	1375	0	340	No	Yes	Yes	Poor	ramp enters mainline from curve to curve = no tangent decel length
7	7.92 NB	CTH KK (NE ramp)	NB On	Diamond	428+50	440+00	55	No	1900	NA	NA	510	580	No	Yes	Yes	Poor	deficient accel length; taper length = 950' < 1000' min
8	3.18 SB	CTH CE (SW ramp)	SB On	Diamond	472+64	482+00	55	No	1640	NA	NA	489	580	No	Yes	Yes	Poor	deficient accel length; taper length = 950' < 1000' min
8	8.51 NB	CTH CE (SE ramp)	NB Off	Diamond	472+64	482+00	55	No	1300	615	685	351.1	340	Yes	Yes	Yes	Good	
8	2.81 SB	CTH CE (NW ramp)	SB Off	Diamond	491+00	498+50	55	No	1160	615	545	351.1	340	Yes	Yes	Yes	Good	
8	8.9 NB	CTH CE (NE ramp)	NB On	Diamond	491+00	498+00	55	No	1640	NA	NA	530	580	No	Yes	Yes	Poor	deficient accel length; taper length = 950' < 1000' min
9	1.17 SB	CTH OO (SW ramp)	SB On	Diamond	578+50	591+50	55	No	1585	NA	NA	550	580	Yes	Yes	Yes	Poor	deficient accel length
9	10.47 NB	CTH OO (SE ramp)	NB Off	Diamond	576+50	591+00	55	No	1415	615	800	351.1	340	Yes	Yes	Yes	Good	
9	0.83 SB	CTH OO (NW ramp)	SB Off	Diamond	603+00	592+00	55	No	1050	615	435	351.1	340	Yes	Yes	Yes	Good	
9	10.85 NB	CTH OO (NE ramp)	NB On	Diamond	592+00	604+50	55	No	1530	NA	NA	550	580	Yes	Yes	Yes	Poor	deficient accel length
10	0.41 SB	US 41 (SW ramp)	NB 41 to SB 441	Directional	890+00	618+50	60	No	2270	NA	NA	460	580	No	Yes	Yes	Poor	deficient accel length; taper length = 885' < 1000' min
10	11.26 NB	US 41 (SE ramp)	NB 441 to NB 41	Directional	617+50	926+00	60	No	2370	NA	NA	351.1	340	Yes	Yes	Yes	Good	
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	Loop	632+92	884+00	30	No	2740	NA	NA	591.8	580	No	Yes	Yes	Fair	taper length = 908' < 1000' min
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	Loop	905+00	632+92	30	No	2160	NA	NA	NA	NA	NA	Yes	Yes	Good	

Exhibit F-13

RAMP GEOMETRIC DESIGN - CROSS SECTIONS																			
Segment	Cum. Mile	Ramp Location	Ramp Description	Ramp Type	Ramp Station (To)	Ramp Station (From)	Design Speed Over/Under 40 mph	Number of Lanes	Width per Lane (feet)	Clear Shoulder Width if Rural (feet)		Rural / Urban		Barrier Wall Present?	Curb & Gutter Type	Normal Crown Slope (%)	CROSS-SECTION RATING	Comments	
										Left	Right	Left	Right						
2	1.96 NB	CTH P (SW ramp)	NB off	Directional	119+00	123+02.36	Over	Transfer from one 15' lane to two 12' lanes											
2	1.96 NB	CTH P (SW ramp)	NB off	Directional	123+02.36	130+60	Over	2	12	4	8	Rural	Rural	No	NA	2	Poor	deficient shoulder width for # of lanes > 1	
2	1.96 NB	Combined with NW ramp	NB & SB off	Directional	130+60	133+00	Over	Transition where NW and SW ramps combine											
2	1.96 NB	Combined with NW ramp	NB & SB off	Directional	133+00	137+50	Over	3	12	0	8	Urban	Rural	No	Mountable	2	Poor	under 40mph w / mountable c&g present, deficient shoulder width for # of lanes > 1	
2	1.96 NB	Combined with NW ramp	NB & SB off	Directional	137+50	139+10	Over	Transfer from 3 lanes into 4 lanes (2 lanes branch for left turn, and 2 lanes branch for right turns)											
2	1.96 NB	Combined with NW ramp	NB & SB off	Directional	139+10	141+60	Over	4	12	0	8	Urban	Urban	No	Mountable	2	Poor	under 40mph w / mountable c&g present, deficient shoulder width for # of lanes > 1	
3	9.3 SB	CTH P (NW ramp)	SB off	Directional	148+50	131+85	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
3	9.3 SB	CTH P (NW ramp)	SB off	Directional	131+85	120+60	Over	1	15	0	8	Urban	Rural	No	Mountable	2	Poor	under 40mph w / mountable c&g present, deficient shoulder width	
3	9.3 SB	Combined with SW ramp	NB & SB off	Directional	120+60	118+20	Over	Transition where NW and SW ramps combine											
3	9.3 SB	Combined with SW ramp	NB & SB off	Directional	118+20	113+75	Over	3	12	0	8	Urban	Rural	No	Mountable	2	Poor	under 40mph w / mountable c&g present, deficient shoulder width	
3	9.3 SB	Combined with SW ramp	NB & SB off	Directional	113+75	111+90	Over	Transfer from 3 lanes into 4 lanes (2 lanes branch for left turn, and 2 lanes branch for right turns)											
3	9.3 SB	Combined with SW ramp	NB & SB off	Directional	111+90	109+40.57	Over	4	12	0	8	Urban	Urban	No	Mountable	2	Poor	under 40mph w / mountable c&g present, deficient shoulder width	
3	9.52 SB	CTH P (NW loop)	SB on	loop	127+00	140+10	Under	1	15	4	8	Rural	Rural	No	NA	2	Good		
3	9.52 SB	CTH P (NW loop)	SB on	loop	140+10	131+73	Under	1	15	0	0	Rural	Urban	No	Mountable	2	Poor	under 40mph w / mountable c&g present, deficient shoulder width	
3	9.52 SB	CTH P (NW loop)	SB on	loop	131+73	128+00	Under	1	15	0	8	Urban	Rural	No	Mountable	2	Poor	under 40mph w / mountable c&g present, deficient shoulder width	
3	9.52 SB	CTH P (NW loop)	SB on	loop	128+00	125+00	Under	Transition from 1 lane to 2 lanes											
3	9.52 SB	CTH P (NW loop)	SB on	loop	125+00	114+88	Under	2	12	0	8	Urban	Rural	No	Mountable	2	Poor	under 40mph w / mountable c&g present, deficient shoulder width for # of lanes > 1	
3	9.52 SB	Combined with NE ramp	NB & SB on	Directional	114+88	113+75	Under	Transition where NE ramp and NW loop combine											
3	9.52 SB	Combined with NE ramp	NB & SB on	Directional	113+75	111+50	Under	2	12	0	8	Urban	Rural	No	Mountable	2	Poor	under 40mph w / mountable c&g present, deficient shoulder width for # of lanes > 1	
3	9.52 SB	Combined with NE ramp	NB & SB on	Directional	111+50	110+30	Under	Left turning vehicles from NB Racine combine with right turning traffic from SB Racine											
3	9.52 SB	Combined with NE ramp	NB & SB on	Directional	110+30	109+60.65	Under	3	12	0	0	Urban	Urban	No	Mountable	2	Poor	under 40mph w / mountable c&g present, deficient shoulder width for # of lanes > 1	
3	2.33 NB	CTH P (NE ramp)	NB on	Directional	150+50	126+85	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
3	2.33 NB	Combined with NW loop	NB & SB on	Directional	126+85	125+75	Over	Transition where NE ramp and NW loop combine											
3	2.33 NB	Combined with NW loop	NB & SB on	Directional	125+75	123+40	Over	2	12	0	8	Urban	Rural	No	Mountable	2	Poor	under 40mph w / mountable c&g present, deficient shoulder width for # of lanes > 1	
3	2.33 NB	Combined with NW loop	NB & SB on	Directional	123+40	122+25	Over	Left turning vehicles from NB Racine combine with right turning traffic from SB Racine											
3	2.33 NB	Combined with NW loop	NB & SB on	Directional	122+25	121+56.17	Over	3	12	NA	NA	Urban	Urban	No	Mountable	2	Poor	over 40mph w / mountable c&g present	
3	8.8 SB	CTH AP (SW ramp)	SB On	Diamond	166+50	179+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
3	2.91 NB	CTH AP (SE ramp)	NB Off	Diamond	167+00	177+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
3	8.46 SB	CTH AP (NW ramp)	SB Off	Diamond	194+50	180+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
3	3.27 NB	CTH AP (NE ramp)	NB On	Diamond	195+00	180+25	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
4	7.89 SB	WIS 47 (NW ramp)	SB On	Diamond	215+50	231+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
4	3.82 NB	WIS 47 (SW ramp)	NB Off	Diamond	217+50	230+75	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
4	4.17 NB	WIS 47 (SE ramp)	NB On	Diamond	232+00	247+50	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
4	7.48 SB	WIS 47 (NE ramp)	SB Off	Diamond	232+00	247+50	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
5	6.87 SB	US 10 (NW ramp)	SB On	Diamond	269+00	282+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
5	4.83 NB	US 10 (SW ramp)	NB Off	Diamond	270+50	282+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
5	5.2 NB	US 10 (SE ramp)	NB On	Diamond	283+40	300+50	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
5	6.48 SB	US 10 (NE ramp)	SB Off	Diamond	282+70	296+50	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
7	4.25 SB	CTH KK (SW ramp)	SB On	Diamond	409+50	422+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
7	7.48 NB	CTH KK (SE ramp)	NB Off	Diamond	408+00	423+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
7	3.81 SB	CTH KK (NW ramp)	SB Off	Diamond	427+50	439+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
7	7.92 NB	CTH KK (NE ramp)	NB On	Diamond	428+50	440+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
8	3.18 SB	CTH CE (SW ramp)	SB On	Diamond	472+64	482+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
8	8.51 NB	CTH CE (SE ramp)	NB Off	Diamond	472+64	482+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
8	2.81 SB	CTH CE (NW ramp)	SB Off	Diamond	491+00	498+50	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
8	8.9 NB	CTH CE (NE ramp)	NB On	Diamond	491+00	498+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
9	1.17 SB	CTH OO (SW ramp)	SB On	Diamond	578+50	591+50	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
9	10.47 NB	CTH OO (SE ramp)	NB Off	Diamond	576+50	591+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
9	0.83 SB	CTH OO (NW ramp)	SB Off	Diamond	603+00	592+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
9	10.85 NB	CTH OO (NE ramp)	NB On	Diamond	592+00	604+50	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
10	0.41 SB	US 41 (SW ramp)	NB 41 to SB 441	Directional	890+00	618+50	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
10	11.26 NB	US 41 (SE ramp)	NB 441 to NB 41	Directional	617+50	926+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	loop	632+92	645+25	Over	2	13	6	8	Rural	Rural	No	NA	2	Poor	deficient shoulder width for # of lanes > 1	
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	loop	645+25	889+41.93	Over	Transition from 2 lanes into 1											
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	loop	889+41.93	884+00	Over	1	15	4	8	Rural	Rural	No	NA	2	Good		
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	loop	905+00	898+08.88	Under	1	15	4	8	Rural	Rural	no	NA	2	Good		
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	loop	898+08.88	636+92.13	Under	1	15	4	8	Rural	Urban	no	Mountable	2	Fair	under 40mph w / mountable c&g present	
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	loop	636+92.13	635+00	Under	1	15	4	8	Rural	Rural	no	NA	2	Good		
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	loop	635+00	632+92	Under	2	13	4	8	Rural	Rural	no	NA	2	Poor	deficient shoulder width for # of lanes > 1	

Exhibit F-14

OVERALL RAMP GEOMETRIC DESIGN															
Segment	Cum. Mile	Ramp Location	Ramp Description	Ramp Type	Ramp Station (From)	Ramp Station (To)	Design Speed (MPH)	HORIZONTAL RATING	VERTICAL RATING	GENERAL DESIGN RATING	OA RATING (horiz, vert & general)	CROSS-SECTION RATING	S.E. RATING	OA RATING (SE & CROSS-SECTIONS)	Comments
2	1.96 NB	CTH P (SW ramp)	NB off	Directional	119+00	140+75	60	Good	Poor	Good	Poor	Poor	Poor	Poor	
3	9.3 SB	CTH P (NW ramp)	SB off	Directional	148+50	109+40.57	60	Poor	Poor	Good	Poor	Poor	Poor	Poor	
3	9.52 SB	CTH P (NW loop)	SB on	Loop	127+00	109+60.25	30	Fair	Fair	Poor	Poor	Poor	Good	Poor	
3	2.33 NB	CTH P (NE ramp)	NB on	Directional	150+50	121+56.17	60	Poor	Poor	Poor	Poor	Poor	Poor	Poor	
3	8.8 SB	CTH AP (SW ramp)	SB On	Diamond	166+50	179+00	55	Poor	Poor	Poor	Poor	Good	Poor	Poor	
3	2.91 NB	CTH AP (SE ramp)	NB Off	Diamond	167+00	177+00	55	Poor	Poor	Good	Poor	Good	Poor	Poor	
3	8.46 SB	CTH AP (NW ramp)	SB Off	Diamond	194+50	180+00	55	Poor	Poor	Good	Poor	Good	Poor	Poor	
3	3.27 NB	CTH AP (NE ramp)	NB On	Diamond	195+00	180+25	55	Good	Poor	Poor	Poor	Good	Good	Good	
4	7.89 SB	WIS 47 (NW ramp)	SB On	Diamond	215+50	231+00	55	Poor	Poor	Poor	Poor	Good	Poor	Poor	
4	3.82 NB	WIS 47 (SW ramp)	NB Off	Diamond	217+50	230+75	55	Good	Poor	Good	Poor	Good	Fair	Fair	
4	4.17 NB	WIS 47 (SE ramp)	NB On	Diamond	232+00	247+50	55	Good	Poor	Poor	Poor	Good	Good	Good	
4	7.48 SB	WIS 47 (NE ramp)	SB Off	Diamond	232+00	247+50	55	Good	Poor	Good	Poor	Good	Fair	Fair	
5	6.87 SB	US 10 (NW ramp)	SB On	Diamond	271+50	282+00	55	Good	Poor	Poor	Poor	Good	Good	Good	
5	4.83 NB	US 10 (SW ramp)	NB Off	Diamond	268+60	282+00	55	Good	Poor	Good	Poor	Good	Good	Good	
5	5.2 NB	US 10 (SE ramp)	NB On	Diamond	283+40	300+50	55	Good	Poor	Poor	Poor	Good	Good	Good	
5	6.48 SB	US 10 (NE ramp)	SB Off	Diamond	282+70	296+50	55	Good	Poor	Good	Poor	Good	Fair	Fair	
7	4.25 SB	CTH KK (SW ramp)	SB On	Diamond	409+50	422+00	55	Good	Good	Fair	Fair	Good	Good	Good	
7	7.48 NB	CTH KK (SE ramp)	NB Off	Diamond	408+00	423+00	55	Good	Poor	Good	Poor	Good	Poor	Poor	
7	3.81 SB	CTH KK (NW ramp)	SB Off	Diamond	427+50	439+00	55	Good	Poor	Poor	Poor	Good	Good	Good	
7	7.92 NB	CTH KK (NE ramp)	NB On	Diamond	428+50	440+00	55	Good	Poor	Poor	Poor	Good	Fair	Fair	
8	3.18 SB	CTH CE (SW ramp)	SB On	Diamond	472+64	482+00	55	Good	Poor	Poor	Poor	Good	Fair	Fair	
8	8.51 NB	CTH CE (SE ramp)	NB Off	Diamond	472+64	482+00	55	Good	Poor	Good	Poor	Good	Fair	Fair	
8	2.81 SB	CTH CE (NW ramp)	SB Off	Diamond	491+00	498+50	55	Good	Poor	Good	Poor	Good	Fair	Fair	
8	8.9 NB	CTH CE (NE ramp)	NB On	Diamond	491+00	498+00	55	Poor	Poor	Poor	Poor	Good	Poor	Poor	
9	1.17 SB	CTH OO (SW ramp)	SB On	Diamond	578+50	591+50	55	Poor	Poor	Poor	Poor	Good	Poor	Poor	
9	10.47 NB	CTH OO (SE ramp)	NB Off	Diamond	576+50	591+00	55	Good	Poor	Good	Poor	Good	Good	Good	
9	0.83 SB	CTH OO (NW ramp)	SB Off	Diamond	603+00	592+00	55	Good	Poor	Good	Poor	Good	Poor	Poor	
9	10.85 NB	CTH OO (NE ramp)	NB On	Diamond	592+00	604+50	55	Good	Poor	Poor	Poor	Good	Good	Good	
10	0.41 SB	US 41 (SW ramp)	NB 41 to SB 441	Directional	890+00	618+50	60	Poor	Poor	Poor	Poor	Good	Poor	Poor	
10	11.26 NB	US 41 (SE ramp)	NB 441 to NB 41	Directional	617+50	926+00	60	Poor	Poor	Good	Poor	Good	Poor	Poor	
10	11.49 NB	US 41 (NW loop 1)	NB 441 to SB 41	Loop	632+92	884+00	30	Poor	Good	Fair	Poor	Poor	Good	Poor	
10	0 SB	US 41 (NW loop 2)	SB 41 to SB 441	Loop	905+00	632+92	30	Fair	Poor	Good	Poor	Poor	Good	Poor	

Exhibit F-15

ACCESS CONTROL / INTERCHANGE SPACING AND LANE BALANCE ON MAINLINE													
Segment	Cum. Mile (From)	Cum. Mile (To)	WIS 441 Direction	Access Ramp Entry		Access Ramp Exit		Access Control Distance	Mainline lane drop/add appropriate?	Route Continuity	Lane Balance	OA Rating	Comment
				From	STA	To	STA						
3	2.33 NB	2.91 NB	NB	CTH P	145+00	CTH AP	168+00	2200	YES	Good	Good	Fair	AC < desired value of 2640'
3 & 4	3.27 NB	3.82 NB	NB	CTH AP	196+00	WIS 47	217+50	2000	YES	Good	Good	Fair	AC < desired value of 2640'
4 & 5	4.17 NB	4.83 NB	NB	WIS 47	244+50	US 10	270+50	2410	YES	Good	Good	Fair	AC < desired value of 2640'
5 & 6	5.2 NB	7.48 NB	NB	US 10	300+50	CTH KK	408+00	10705	YES	Good	Good	Good	
7 & 8	7.92 NB	8.51 NB	NB	CTH KK	449+00	CTH CE	472+50	2230	YES	Good	Good	Fair	AC < desired value of 2640'
8 & 9	8.9 NB	10.47 NB	NB	CTH CE	500+50	CTH OO	576+50	7495	YES	Good	Good	Good	
9 & 10	10.85 NB	11.26 NB	NB	CTH OO	603+50	US 41	618+00	1275	YES	Good	Good	Poor	AC < minimum value of 1500'
9 & 10	0.41 SB	0.83 SB	SB	US 41	618+50	CTH OO	603+00	1425	YES	Good	Good	Poor	AC < minimum value of 1500'
8 & 9	1.17 SB	2.81 SB	SB	CTH OO	578+15	CTH CE	498+50	7605	YES	Good	Good	Good	
7 & 8	3.18 SB	3.81 SB	SB	CTH CE	472+50	CTH KK	438+50	3010	YES	Good	Good	Good	
5, 6, & 7	4.25 SB	6.48 SB	SB	CTH KK	409+50	US 10	296+50	11140	YES	Good	Good	Good	
4 & 5	6.87 SB	7.48 SB	SB	US 10	270+00	WIS 47	244+50	2435	YES	Good	Good	Fair	AC < desired value of 2640'
3 & 4	7.89 SB	8.46 SB	SB	WIS 47	215+50	CTH AP	194+50	2105	YES	Good	Good	Fair	AC < desired value of 2640'
3	8.8 SB	9.3 SB	SB	CTH AP	166+50	CTH P	148+50	1770	YES	Good	Good	Fair	AC < desired value of 2640'

Exhibit F-16

ACCESS CONTROL ON CROSSROADS							
Segment	Cross Road	Wis 441 Ramp Description	Interchang e Quadrant	Nearest Side-Road	Access Control Distance (feet)	OA Rating	Comments
3	CTH AP (Midw ay Rd)	SB off	NW	Racine Rd.	705	Poor	AC < minimum value of 1000'
3	CTH AP (Midw ay Rd)	SB on	SW	Racine Rd.	705	Poor	AC < minimum value of 1000'
3	CTH AP (Midw ay Rd)	NB off	SE	Earl St.	480	Poor	AC < minimum value of 1000'
3	CTH AP (Midw ay Rd)	NB on	NE	Earl St.	480	Poor	AC < minimum value of 1000'
4	WIS 47 (Appleton Rd)	SB off	NE	Tuckaw ay Lane	375	Poor	AC < minimum value of 1000'
4	WIS 47 (Appleton Rd)	SB on	NW	Valley Rd.	800	Poor	AC < minimum value of 1000'
4	WIS 47 (Appleton Rd)	NB off	SW	Drum Corp Dr.	695	Poor	AC < minimum value of 1000'
4	WIS 47 (Appleton Rd)	NB on	SE	Drum Corp Dr.	695	Poor	AC < minimum value of 1000'
5	US 10 (Oneida St.)	SB off	NE	Roeland Ave. / W. Valley Rd.	980	Poor	AC < minimum value of 1000'
5	US 10 (Oneida St.)	SB on	NW	Roeland Ave. / W. Valley Rd.	980	Poor	AC < minimum value of 1000'
5	US 10 (Oneida St.)	NB off	SW	E. Meadow Grove Blvd.	620	Poor	AC < minimum value of 1000'
5	US 10 (Oneida St.)	NB on	SE	E. Meadow Grove Blvd.	620	Poor	AC < minimum value of 1000'
7	CTH KK (Calument St.)	SB off	NW	S. Kensington Dr.	435	Poor	AC < minimum value of 1000'
7	CTH KK (Calument St.)	SB on	SW	S. Kensington Dr.	440	Poor	AC < minimum value of 1000'
7	CTH KK (Calument St.)	NB off	SE	Tow n Rd.	670	Poor	AC < minimum value of 1000'
7	CTH KK (Calument St.)	NB on	NE	Stonybrook Rd.	665	Poor	AC < minimum value of 1000'
8	CTH CE (College Ave.)	SB off	NW	S. Kensington Dr.	1115	Fair	AC < desirable value of 1320'
8	CTH CE (College Ave.)	SB on	SW	S. Kensington Dr.	1120	Fair	AC < desirable value of 1320'
8	CTH CE (College Ave.)	NB off	SE	Eisenhow er Dr.	2000	Good	
8	CTH CE (College Ave.)	NB on	NE	Eisenhow er Dr.	2010	Good	
9	CTH OO (Northland Ave.)	SB off	NW	Conkey St.	1580	Good	
9	CTH OO (Northland Ave.)	SB on	SW	Conkey St.	1580	Good	
9	CTH OO (Northland Ave.)	NB off	SE	N. French Rd.	485	Poor	AC < minimum value of 1000'
9	CTH OO (Northland Ave.)	NB on	NE	N. French Rd.	510	Poor	AC < minimum value of 1000'

Exhibit F-17

FREEWAY GUIDE SIGNING												
Segment	Cum. Mile	Location	Ramp Description	Ramp Type	Advance Signs	Gore Sign	Exit Only Signs	Signing Organization	Sign Condition	Uniformity of Message Display	OA Rating	Comments
2	1.96 NB	CTH P	NB Off	Directional	2	Yes	NA	Good	Good	Fair	Fair	First advance exit sign placed 0.75 miles prior to exit, no median sign betw een this and exit, no exit number
3	9.3 SB	CTH P	SB Off	Directional	4	Yes	NA	Good	Good	Fair	Fair	First advance exit sign placed 0.75 miles prior to exit and only a median sign betw een this and exit, no exit number
3	2.91 NB	CTH AP	NB Off	Diamond	3	Yes	Yes	Good	Good	Fair	Fair	First advance exit sign placed 0.5 miles prior to exit and only a median sign betw een this and exit at 0.25 miles out, No exit number on signs
3	8.46 SB	CTH AP	SB Off	Diamond	5	Yes	Yes	Good	Good	Fair	Fair	First advance exit sign placed 0.75 miles out and only a median sign betw een this and exit, no exit number
4	3.82 NB	WIS 47	NB Off	Diamond	4	Yes	NA	Good	Good	Fair	Fair	No exit number on signs
4	7.48 SB	WIS 47	SB Off	Diamond	5	Yes	NA	Good	Good	Fair	Fair	First advance exit sign placed 0.75 miles prior to exit and only a median sign betw een this and exit, no exit number
5	4.83 NB	US 10	NB Off	Diamond	5	Yes	NA	Good	Good	Fair	Fair	No exit number on signs
5	6.48 SB	US 10	SB Off	Diamond	5	Yes	NA	Good	Good	Fair	Fair	First advance exit sign placed 1.25 miles prior to exit w here others are 0.5 miles and only a median sign betw een this and sign at exit, no exit numbers
7	3.81 SB	CTH KK	SB Off	Diamond	5	Yes	NA	Good	Good	Fair	Fair	First advance exit sign placed 0.75 miles prior to exit and only a median sign betw een this and exit, no exit number
7	7.48 NB	CTH KK	NB Off	Diamond	5	Yes	NA	Good	Good	Fair	Fair	First advance exit sign placed 1.25 miles prior to exit w here others are 0.5 miles and only a median sign betw een this and sign at exit, no exit numbers
8	8.51 NB	CTH CE	NB Off	Diamond	5	Yes	NA	Good	Good	Fair	Fair	First advance exit sign placed 0.75 miles prior to exit and only a median sign betw een this and exit, no exit number
8	2.81 SB	CTH CE	SB Off	Diamond	4	Yes	NA	Good	Good	Fair	Fair	First advance exit sign placed 1.25 miles out w here others are 0.5 miles and only a median sign betw een this and sign at exit, no exit numbers
9	10.47 NB	CTH OO	NB Off	Diamond	5	Yes	NA	Good	Good	Fair	Fair	No exit number on signs
9	0.83 SB	CTH OO	SB Off	Diamond	3	Yes	NA	Good	Good	Fair	Fair	No exit number on signs
10	11.26 NB	US 41	NB 441 to NB 41	Directional	4	Yes	NA	Fair	Good	Fair	Fair	Advisory speed located on support for overhead sign as separate sign. Last Advance exit sign placed 0.5 miles prior to exit
10	0.41 SB	US 41	NB 41 to SB 441	Directional	2	Yes	NA	Good	Good	Good	Good	First Advance sign placed 0.5 miles prior to exit
10	11.49 NB	US 41	NB 441 to SB 41	Directional	4	Yes	No	Fair	Good	Fair	Fair	Advisory speed located on plaque attached to overhead sign, color correct? Additional speed signs along outside of curve. Last Advance exit sign placed 0.5 miles prior to exit
10	0 SB	US 41	SB 41 to SB 441	Loop	3	Yes	NA	Fair	Good	Good	Fair	Two exit signs approx. 370' apart, sign attached to bridge deck seems unnecessary as it is not close enough to the ramp gore and does not give a distance to the ramp. First advance exit sign 1 mile prior to exit

Exhibit F-18

MAINLINE SAFETY PERFORMANCE										
Segment	Cum. Mile From	Cum. Mile to	Highway & Direction	From (Feature Name)	To (Feature Name)	Statewide Annual Crash Average per HMV/M	5 Yr. Average Crash Rate per HMV/M	Location Crash Severity	OA Rating	Comments
3	2.33 NB	2.91 NB	WIS 441 NB	CTH P	CTH AP	56	0	0.00	Good	
3 & 4	3.27 NB	3.82 NB	WIS 441 NB	CTH AP	WIS 47	56	0	0.00	Good	
4 & 5	4.17 NB	4.83 NB	WIS 441 NB	WIS 47	US 10	56	0	0.00	Good	
5 & 6	5.2 NB	7.48 NB	WIS 441 NB	US 10	CTH KK	56	21	0.30	Fair	severity is between 0.3 and 0.5
7 & 8	7.92 NB	8.51 NB	WIS 441 NB	CTH KK	CTH CE	56	0	0.00	Good	
8 & 9	8.9 NB	10.47 NB	WIS 441 NB	CTH CE	CTH OO	56	35	0.36	Fair	severity is between 0.3 and 0.5
9 & 10	10.85 NB	11.26 NB	WIS 441 NB	CTH OO	US 41	56	0	0.00	Good	
9 & 10	0.41 SB	0.83 SB	WIS 441 SB	US 41	CTH OO	56	0	0.00	Good	
8 & 9	1.17 SB	2.81 SB	WIS 441 SB	CTH OO	CTH CE	56	34	0.42	Fair	severity is between 0.3 and 0.5
7 & 8	3.18 SB	3.81 SB	WIS 441 SB	CTH CE	CTH KK	56	0	0.00	Good	
5, 6, & 7	4.25 SB	6.48 SB	WIS 441 SB	CTH KK	US 10	56	27	0.42	Fair	severity is between 0.3 and 0.5
4 & 5	6.87 SB	7.48 SB	WIS 441 SB	US 10	WIS 47	56	0	0.00	Good	
3 & 4	7.89 SB	8.46 SB	WIS 441 SB	WIS 47	CTH AP	56	0	0.00	Good	
3	8.8 SB	9.3 SB	WIS 441 SB	CTH AP	CTH P	56	0	0.00	Good	

Exhibit F-19

MAINLINE RAMP SAFETY PERFORMANCE								
Segment	Cumulative Mile	Ramp Location	Ramp Description	Statewide Annual Crash Average per HMVM	5 Yr. Average Crash Rate per HMVM	Location Crash Severity	OA Rating	Comments
3	2.62 NB	WIS 441 & CTH P (Racine Road)	EB/NB off-ramp	56	3	0.00	Good	
3	2.62 NB		EB/NB on-ramp	56	17	0.75	Poor	
3	9.30 SB		WB/SB off-ramp	56	137	0.55	Poor	Severity > 0.5, crash rate > 73
3	9.52 SB		WB/SB on-ramp	56	87	0.35	Poor	Crash rate > 73
3	3.03 NB	WIS 441 & CTH AP (Midway Road)	NB off-ramp	56	85	0.67	Poor	Severity > 0.5, crash rate > 73
3	3.03 NB		NB on-ramp	56	0	0.00	Good	
3	8.70 SB		SB off-ramp	56	0	0.00	Good	
3	8.70 SB		SB on-ramp	56	94	0.47	Poor	Crash rate > 73
4	3.98 NB	WIS 441 & Appleton Road	NB off-ramp	56	10	0.50	Poor	Severity > 0.5
4	3.98 NB		NB on-ramp	56	0	0.00	Good	
4	7.72 SB		SB off-ramp	56	19	0.50	Poor	Severity > 0.5
4	7.72 SB		SB on-ramp	56	0	0.00	Good	
5	4.99 NB	WIS 441 & Oneida Street	NB off-ramp	56	5	0.00	Good	
5	4.99 NB		NB on-ramp	56	27	0.33	Fair	Severity is 0.30 to 0.5
5	6.69 SB		SB off-ramp	56	13	0.00	Good	
5	6.69 SB		SB on-ramp	56	28	0.67	Poor	Severity > 0.5
7	7.69 NB	WIS 441 & Calumet Street	NB off-ramp	56	56	0.22	Fair	Crash rate is between 56 and 73
7	7.69 NB		NB on-ramp	56	33	0.83	Poor	Severity > 0.5
7	4.01 SB		SB off-ramp	56	22	0.00	Good	
7	4.01 SB		SB on-ramp	56	44	0.29	Good	
8	8.70 NB	WIS 441 & College Avenue	NB off-ramp	56	41	0.25	Good	
8	8.70 NB		NB on-ramp	56	40	0.44	Fair	Severity is 0.30 to 0.5
8	3.00 SB		SB off-ramp	56	21	0.25	Good	
8	3.00 SB		SB on-ramp	56	54	0.44	Fair	Severity is 0.30 to 0.5
9	10.69 NB	WIS 441 & Northland Avenue	NB off-ramp	56	51	0.40	Fair	Severity is 0.30 to 0.5
9	10.69 NB		NB on-ramp	56	23	0.80	Poor	Severity > 0.5
9	1.01 SB		SB off-ramp	56	25	1.00	Poor	Severity > 0.5
9	1.01 SB		SB on-ramp	56	128	0.32	Poor	Severity > 0.5, crash rate > 73

Exhibit F-20

RAMP TERMINAL SAFETY PERFORMANCE							
Segment	Cum. Mile	Ramp Location	Ramp Description	Location Annual Crash Average per MEV (5 years of crash data used)	Severity Rate	OA Rating	Comments
3	2.62 NB	WIS 441 & CTH P (Racine Road)	CTH P	0.18	0.13	Good	
3	3.03 NB	WIS 441 & CTH AP (Midway Road)	NB	0.25	0.20	Good	
3	8.70 SB	WIS 441 & CTH AP (Midway Road)	SB	0.07	0.00	Good	
4	3.98 NB	WIS 441 & Appleton Road	NB	0.12	0.20	Good	
4	7.72 SB	WIS 441 & Appleton Road	SB	0.19	0.25	Good	
5	4.99 NB	WIS 441 & Oneida Street	NB	0.62	0.53	Poor	Severity > 0.5
5	6.69 SB	WIS 441 & Oneida Street	SB	0.69	0.42	Fair	Severity is between 0.3 and 0.5
7	7.69 NB	WIS 441 & Calumet Street	NB	0.56	0.53	Poor	Severity > 0.5
7	4.01 SB	WIS 441 & Calumet Street	SB	0.60	0.42	Fair	Severity is between 0.3 and 0.5
8	8.70 NB	WIS 441 & College Avenue	NB	0.60	0.30	Fair	Severity is between 0.3 and 0.5
8	3.00 SB	WIS 441 & College Avenue	SB	0.61	0.49	Fair	Severity is between 0.3 and 0.5
9	10.69 NB	WIS 441 & Northland Avenue	NB	0.32	0.27	Good	
9	1.01 SB	WIS 441 & Northland Avenue	SB	0.51	0.31	Fair	Severity is between 0.3 and 0.5

Exhibit F-21

MAINLINE LEVEL OF SERVICE										
Segment	Cum. Mile From	Cum. Mile To	WIS 441 Direction	Access Entry	Access Exit	Peak Hour	Density (pc/mi/ln)	LOS	OA Rating	Comments
3	2.33 NB	2.91	NB	CTH P	CTH AP	AM	18.3	C	Good	
						PM	28.2	D	Fair	
3 & 4	3.27 NB	3.82 NB	NB	CTH AP	WIS 47	AM	15.3	B	Good	
						PM	26.1	D	Fair	
4 & 5	4.17 NB	4.83 NB	NB	WIS 47	US 10	AM	11.3	B	Good	
						PM	23.5	C	Good	
5 & 6	5.2 NB	7.48 NB	NB	US 10	CTH KK	AM	8.7	A	Good	
						PM	18.7	C	Good	
7 & 8	7.92 NB	8.51 NB	NB	CTH KK	CTH CE	AM	14.0	B	Good	
						PM	16.3	B	Good	
8 & 9	8.9 NB	10.47 NB	NB	CTH CE	CTH OO	AM	19.0	C	Good	
						PM	13.9	B	Good	
9 & 10	10.85 NB	11.26 NB	NB	CTH OO	US 41	AM	14.6	B	Good	
						PM	10.5	A	Good	
9 & 10	0.41 SB	0.83 SB	SB	US 41	CTH OO	AM	10.0	A	Good	
						PM	14.0	B	Good	
8 & 9	1.17 SB	2.81 SB	SB	CTH OO	CTH CE	AM	13.2	B	Good	
						PM	19.7	C	Good	
7 & 8	3.18 SB	3.81 SB	SB	CTH CE	CTH KK	AM	12.7	B	Good	
						PM	14.5	B	Good	
5, 6, & 7	4.25 SB	6.48 SB	SB	CTH KK	US 10	AM	15.8	B	Good	
						PM	9.9	A	Good	
4 & 5	6.87 SB	7.48 SB	SB	US 10	WIS 47	AM	20.8	C	Good	
						PM	12.1	B	Good	
3 & 4	7.89 SB	8.46 SB	SB	WIS 47	CTH AP	AM	22.8	C	Good	
						PM	15.5	B	Good	
3	8.8 SB	9.3 SB	SB	CTH AP	CTH P	AM	25.0	C	Good	
						PM	18.5	C	Good	

Exhibit F-22

RAMP TERMINAL INTERSECTION LEVEL OF SERVICE								
Segment	Cum. Mile	Ramp Location	Peak Hour	Intersection Control	Delay per Vehicle (sec)	LOS	OA Rating	Comments
9	10.69 NB	CTH OO and NB ramps	AM	Traffic Signal	23.0	C	Good	
9			PM	Traffic Signal	15.8	B	Good	
9	1.01 SB	CTH OO and SB ramps	AM	Traffic Signal	8.6	A	Good	
9			PM	Traffic Signal	13.2	B	Good	
8	8.70 NB	CTH CE and NB ramps	AM	Traffic Signal	19.1	B	Good	
8			PM	Traffic Signal	105.2	F	Poor	
8	3.00 SB	CTH CE and SB ramps	AM	Traffic Signal	26.7	C	Good	
8			PM	Traffic Signal	29.8	C	Good	
7	7.69 NB	CTH KK and NB ramps	AM	Traffic Signal	46.9	D	Fair	
7			PM	Traffic Signal	14.3	B	Good	
7	4.10 SB	CTH KK and SB ramps	AM	Traffic Signal	27.8	C	Good	
7			PM	Traffic Signal	17.9	B	Good	
5	4.99 NB	US 10 (Oneida St. N-S) NB ramps	AM	Traffic Signal	25.4	C	Good	
5			PM	Traffic Signal	20.0	C	Good	
5	6.69 SB	US 10 (Oneida St. N-S) SB ramps	AM	Traffic Signal	12.8	B	Good	
5			PM	Traffic Signal	20.8	C	Good	
4	3.98 NB	WIS 47 and NB ramps	AM	Traffic Signal	17.4	B	Good	
4			PM	Traffic Signal	15.3	B	Good	
4	7.72 SB	WIS 47 and SB ramps	AM	Traffic Signal	21.3	C	Good	
4			PM	Traffic Signal	21.8	C	Good	
3	2.62 NB	CTH AP and NB ramps	AM	Stop Sign	5.8	A	Good	
3			PM	Stop Sign	4.1	A	Good	
3	8.70 SB	CTH AP and SB ramps	AM	Stop Sign	5.7	A	Good	
3			PM	Stop Sign	5.3	A	Good	
3	2.62 NB	CTH P (Racine Rd.) and ramps	AM	Traffic Signal	11.1	B	Good	
3			PM	Traffic Signal	13.7	B	Good	