

Excerpt from Draft EIS being prepared for:
USH 41 (Memorial Drive to CTH M), Brown County
Project I.D. 1133-10-01

Section 1

Purpose and Need Summary

Introduction

Section 1 describes the purpose and need for proposed improvements in the Memorial Drive to County M section of the US 41 corridor in Brown County. Purpose and need factors encompass existing problems and those anticipated to occur by the project's design year (2035).

1.1 Proposed Action

The Wisconsin Department of Transportation (WisDOT), in consultation with the Federal Highway Administration (FHWA), is proposing to reconstruct US 41 from Memorial Drive to County M, a length of approximately 3.3 miles in Brown County, Wisconsin (see exhibit 1-1 – project location map).

Proposed improvements include reconstructing the interchanges at US 141/Velp Avenue, I-43 and County M to meet current design standards, adding an additional lane in each direction on the US 41 mainline, adding auxiliary lanes along US 41 in both directions, constructing new bridges along US 41 over US 141/Velp Avenue, CN Railroad, Wietor Drive, I-43, and Duck Creek, and replacing the County EB/Lakeview Drive structure and the County M structure over US 41.

In addition, roundabouts would be constructed at the US 141/Velp Avenue interchange ramp terminals, the US 141/Velp Avenue/Memorial Drive intersection east of US 41, the County M interchange ramp terminals, and the frontage road intersections with County M. WisDOT is committed to using roundabouts where appropriate based on the following benefits of roundabouts compared to signalized intersections:

- Roundabouts improve safety by providing slower intersection entry speeds and minimizing the potential for turning movement conflicts.
- Roundabouts provide more intersection capacity than signalized intersections, resulting in less delay for traffic entering and exiting the intersections.
- Roundabouts have lower impact collisions due to the intersection entry angle.
- Roundabouts generally have lower maintenance costs than signalized intersections.

Other improvements include replacing the box culvert for Beaver Dam Creek, constructing stormwater detention ponds in the southwest quadrant of US 141/Velp Avenue interchange and near the County EB/Lakeview Drive overpass, and constructing crash investigation sites along the northbound and southbound off ramps at the US 141/Velp Avenue and County M interchanges. Crash investigation sites are pull out areas that help minimize traffic backups and delay by allowing vehicles involved in minor crashes to move off the freeway. Accommodating for crash investigation sites was a US 41 corridor wide application.

1.2 Purpose of Proposed Action

The purpose of the proposed action is to provide a safe and efficient transportation system that serves present and future traffic demand while minimizing disturbance to the natural and built environment to the extent practicable.

1.3 Need for Proposed Action

The need for the proposed action is based on a combination of factors that include system linkage and route importance (including possible future conversion of US 41 to an Interstate Highway), traffic demand/operations, existing highway deficiencies, and safety concerns. The remainder of Section 1 discusses these factors.

1.3.1 System Linkage and Route Importance

US 41 and I-43 provide a vital north-south transportation link with trip lengths and travel densities of an interstate or inter-regional nature. US 41 connects the Chicago-Milwaukee metropolitan area with the Fox River Valley industrial area and recreational areas of northeastern Wisconsin and upper Michigan. US 41 is a multi-lane principal arterial highway under WisDOT's *Connections 2030* Plan developed to provide a network of high quality highways linking the state's economic centers, and designed with maximum service and safety characteristics. US 41 is also a component of the National Highway System (NHS). Highways in the NHS serve major population centers, multimodal transportation facilities, and meet national defense requirements.

US 41 and I-43 are designated as long truck routes by the 2009 Wisconsin Long Truck Operators Map. This designation allows trucks up to 65 feet in length to use these highways and exemplifies the importance of the US 41 corridor to commercial interests within and outside the state.

The 2005 federal transportation bill, SAFETEA-LU (*Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users*) includes the future conversion of US 41 to an Interstate facility between Milwaukee and I-43 in Green Bay. A study for the Interstate conversion is being conducted under a separate WisDOT project. Improvements made to US 41 will not preclude future conversion of US 41 to an Interstate Highway. Improvements made to I-43 will need to meet interstate standards. See 'Existing Highway Deficiencies' for more information.

Within the project area, US 41 and I-43 serve the City of Green Bay, Village of Howard, Village of Suamico, and surrounding communities. The regional and local plans for these communities include the US 41 expansion project. The plans include the *Green Bay Metropolitan Planning Organization Long-Range Transportation Plan* completed in November 2005 and amended in 2007, and the *Brown County Comprehensive Plan* completed by the Brown County Planning Commission in October 2004. Current and planned growth and development in these communities contributes a high volume of commuter traffic and heavy truck traffic on both freeways.

Summary: System linkage and route importance are key factors in developing improvements that enhance regional and local mobility and that are compatible with the possible future conversion of US 41 to an Interstate Highway.

1.3.2 Traffic Demand/Operations

Existing and Forecast Traffic

Traffic volumes are expressed as Annual Average Daily Traffic (AADT) volumes that reflect average travel conditions rather than daily or seasonal fluctuations. According to the US 41 Traffic Study – Brown County Forecasted Traffic Volume Network memo prepared for WisDOT by CH2MHill in 2007, existing peak hour and AADT volumes were obtained from traffic counts of the mainline segments and ramps, and from intersection turning movements. The year 2035 AADT forecasts were provided from the regional travel demand model.

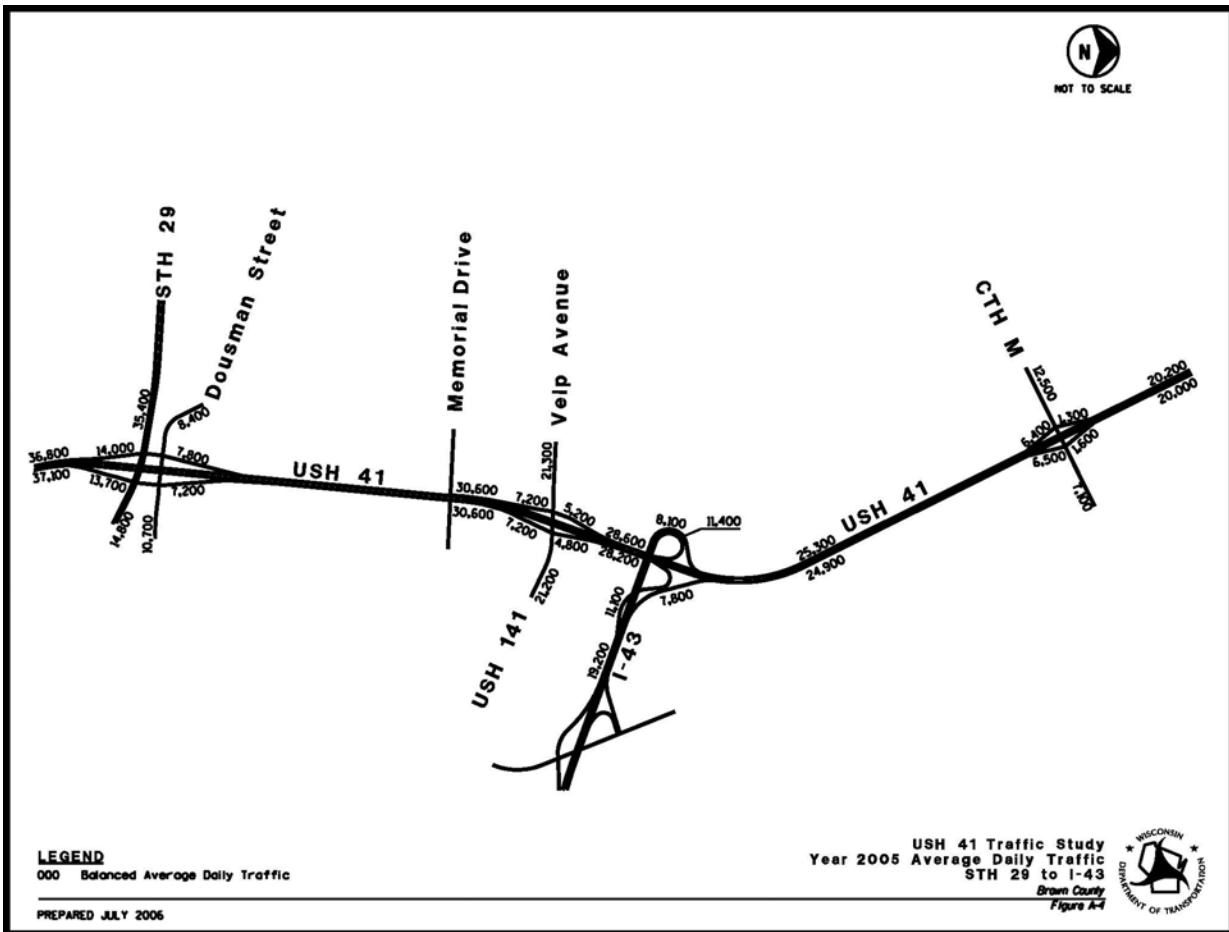
Existing and forecasted traffic is summarized in Table 1-1. The traffic data covers existing traffic (2005) through design year 2035.

**Table 1-1
Existing and Forecast Traffic (2005 – 2035)**

Roadway Segment	Existing Traffic 2005 AADT	Future Traffic 2015 AADT	Future Traffic 2035 AADT	Percent Increase (2005-2035)
US 41 Mainline, Memorial Drive to US 141/Velp Avenue	61,200	73,400	97,700	60%
US 41 Mainline, US 141/Velp Ave to I-43	56,800	69,300	94,400	66%
US 41 Mainline, I-43 to County M	50,200	60,300	80,500	60%
I-43, Atkinson Drive to US 41	38,400	44,200	55,700	45%

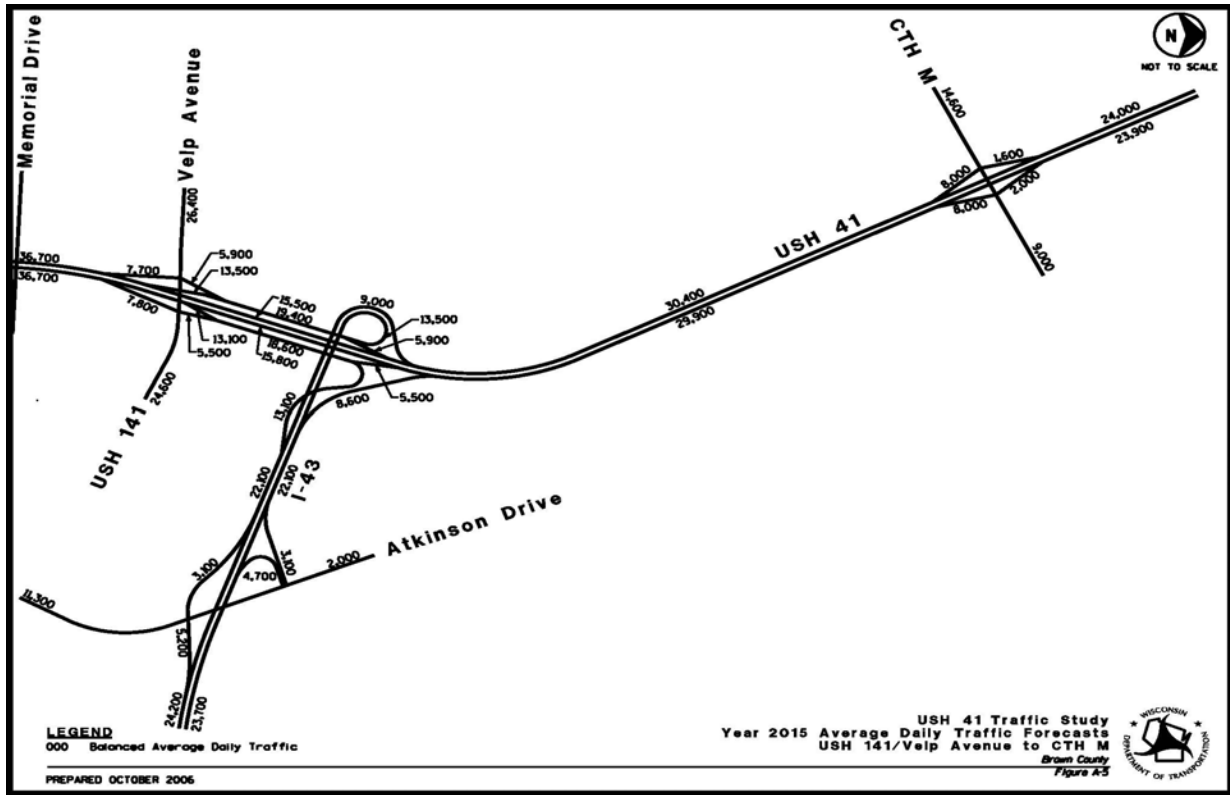
The alignment diagrams (Figures 1-1 through 1-3) illustrate traffic volumes (AADT) on the US 41 mainline, ramps and sideroads.

**Figure 1-1
Existing AADT (Year 2005)**



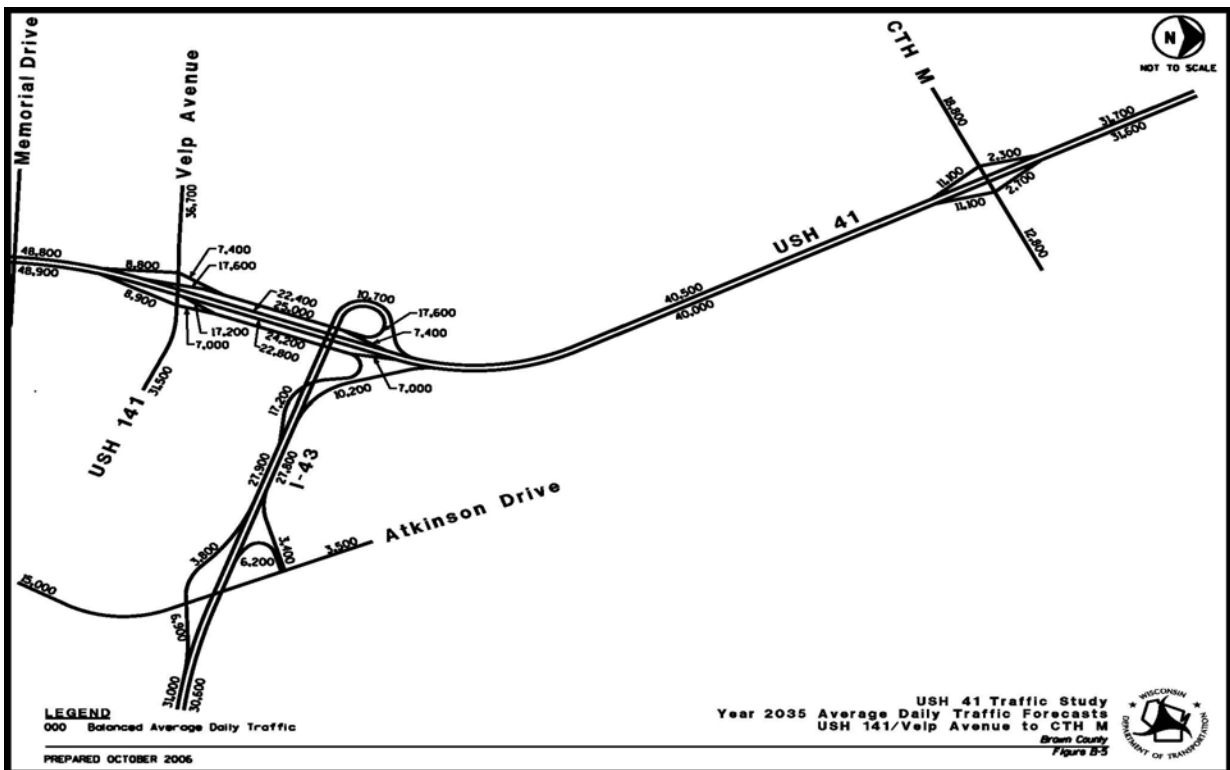
Source: US 41 Traffic Study – Brown County Forecasted Traffic Volume Network Memo. CH2MHill®, January 2007.

Figure 1-2
Future AADT (2015)



Source: US 41 Traffic Study – Brown County Forecasted Traffic Volume Network Memo. CH2MHill®, January 2007.

Figure 1-3
Future AADT (2035)



Source: US 41 Traffic Study – Brown County Forecasted Traffic Volume Network Memo. CH2MHill®, January 2007.

According to WisDOT's Facilities Development Manual (FDM), Procedure 11-15-1, Figure 1, 60,000 AADT is the threshold volume that can be safely handled at an acceptable service level on a 4-lane backbone highway. Current traffic volumes on US 41, between Memorial Drive and US 141/Velp Avenue are already above this threshold, and the segments of US 41 between US 141/Velp Avenue and County M will meet or exceed this threshold by 2015. Therefore, improvements on US 41 that address traffic capacity and mobility are warranted such as additional through lanes and auxiliary lanes, and improvements that separate regional and local traffic movements .

The number and size of trucks in the traffic stream affects traffic operations, safety and contributes to the level of congestion. On US 41, trucks comprise approximately 10.9% of the AADT according to WisDOT's forecasts for design year 2035. The level of truck traffic should also be taken into consideration for design purposes, since trucks take more time to change lanes, occupy more roadway space, require more turning room, and consequently have a greater effect on traffic flow and congestion than passenger vehicles.

Level of Service (LOS)

Level of Service measures a highway's ability to handle traffic. LOS is affected by factors such as AADT volumes, peak hour volumes, truck traffic, number of driving lanes, lane width, vertical grades, ability to pass, and presence or absence of traffic signals. The *Highway Capacity Manual 2000* (Transportation Research Board Special Report 209) establishes guidelines for the appropriate LOS on various types of highways. LOS values range from A (free flow conditions) to F (conditions over capacity).

WisDOT also uses a numeric LOS scale which was developed to balance the social, environmental, and monetary costs of using LOS C as the performance threshold against the costs of accepting more congestion on the state's highways before capacity improvements are considered. Both alpha and numeric LOS values are provided in Table 1-2.

**Table 1-2
Level of Service (LOS) Values and Descriptions**

LOS Alpha Scale	LOS Numeric Scale	Description
A	1.01 to 2.00	No Congestion
B	2.01 to 3.00	No Congestion
C	3.01 to 4.00	Minimal Congestion
D	4.01 to 5.00	Moderate Congestion
E	5.01 to 6.00	Severe Congestion
F	6.01 or higher	Extreme Congestion

The acceptable LOS for *Connections 2030* backbone highways is LOS C, according to WisDOT's Facilities Development Manual (FDM), Procedure 11-5-3, and as shown in Table 1-3.

**Table 1-3
Acceptable Levels of Service**

Highway System Type	Rural and Small Urban Areas	Urbanized Areas with Population > 50,000	Acceptable Level of Service (LOS) Established for Project
Corridors 2020 Backbone Routes (US 41 is also a NHS route)	LOS C (< = 4.0)	LOS C (< = 4.0)	LOS C (< = 4.0) (US 41 and I-43)
Corridors 2020 Connector Routes and NHS Routes (not including NHS Backbone Routes)	LOS C (< = 4.0)	Mid LOS D (< = 4.5)	
Other Principal Arterials	LOS D (< = 5.0)	Mid LOS E (< = 5.5)	
Minor Arterials	LOS D (< = 5.0)	Mid LOS E (< = 5.5)	
Collectors & Local Function Roads	LOS D (< = 5.0)	Mid LOS E (< = 5.5)	

According to the *US 41 EIS Paramics Traffic Operations Report* prepared for WisDOT by Strand Associates in 2010, US 41 and I-43 freeway operations were analyzed under the existing conditions, and future no build conditions. In the existing conditions, all but two of the freeway segments in the study area operate at a LOS C or better. The southbound basic and diverge segments on US 41 between US 141/Velp Avenue and WIS 29 operate at LOS D in the AM peak hour.

In the future, many of the freeway segments within, and around this study area will be nearing or exceeding capacity. As shown in Table 1-4, the AM peak hour has a poor LOS for southbound traffic, while the PM peak hour has substantially worse traffic operations for northbound vehicles, and demonstrates the need for an improvement in the study area. The projected average speeds on each of the four unacceptable LOS freeway segments listed in Table 1-4 are less than 20 miles per hour.

**Table 1-4
Design Year 2035 LOS for Freeway Sections**

LOS (Numeric scale)	Freeway Section	Peak Hour
LOS E (5.58)	US 41 from US 141/Velp Avenue to Mason Street – southbound	AM
LOS D (4.53)	US 41 from US 141/Velp Avenue to County M – southbound	AM
LOS F (>6)	US 41 from Mason Street to County M – northbound	PM
LOS F (>6)	I-43 from Webster Avenue to US 41 – northbound	PM

The Paramics Traffic Operations Report showed the network will have substantial congestion in design year 2035 at the existing signalized intersections throughout the corridor during both AM and PM peak hours. All but the US 141/Velp Avenue/Atkinson Avenue intersection would operate at LOS E or LOS F. The unsignalized intersections listed in Table 1-5 have failing approach movements (LOS F) in the PM peak hour:

**Table 1-5
Design Year 2035 Unsignalized Intersections Operating at LOS F**

LOS	Freeway Section/Intersection	Peak Hour
LOS F	US 141/Velp Avenue and Island Court – northbound and eastbound	PM
LOS F	US 141/Velp Avenue and Memorial Drive – westbound and northbound	PM
LOS F	County M and West Deerfield Avenue – northbound and southbound	PM
LOS F	County M and US 41 Northbound Ramps – northbound	PM
LOS F	County M and East Deerfield Avenue – northbound and southbound	PM
LOS F	Atkinson Avenue and I-43 Northbound Ramps – eastbound	PM

Summary: The effect of increased congestion on mobility in the US 41 corridor and within the interchange areas is a key factor in developing proposed improvements that separate local and regional traffic movements to the extent possible. Traffic increases on US 41 will make merge/diverge operations more difficult and dangerous. Without capacity expansion on US 41 and geometric improvements to its interchanges, delays on US 41 will increase and safety problems will worsen.

1.3.3 Existing Highway Deficiencies

The existing US 41 freeway mainline and its interchanges within the project area were constructed over 35 years ago and designed to handle lower volume traffic conditions. The construction AADT when US 41 was previously built from US 141/Velp Avenue to County M was 15,450, with a design year (1990) AADT of 23,300. There have been some improvements since then to increase the capacity of the interchanges, but they do not meet current design standards. In addition, with the development that has occurred along the US 41 corridor, US 41 has changed in function from a rural highway to an urban highway around Green Bay. The traffic demand is evidence of US 41 subsequent designation as a backbone highway under *Connections 2030*, its designation as a National Highway System (NHS) route, and as a possible future Interstate highway under SAFETEA-LU.

The US 41 mainline and interchanges are exhibiting signs of deterioration due to aging of the roadway infrastructure, bridges, drainage structures, guardrail and barrier walls. US 41 from Memorial Drive to County M has been overlaid with asphalt once since the original concrete pavement was constructed in 1970-71. The asphalt overlay on US 41 occurred in 1999 north of Duck Creek, and in 2003 south of Duck Creek. I-43 was originally constructed with concrete in 1978, and overlaid with asphalt in 2002. The Pavement Distress Index (PDI) value is 14.50, as surveyed in 2003. A PDI value of 100 is excellent, and a value of less than 50 is considered poor. A low PDI can contribute to a diminishing return on investment for resurfacing US 41 in the future.

Inadequate traffic capacity due to lack of channelization for turning movements and/or lack of intersection traffic control at ramp terminal intersections is also of concern at these interchanges. See the previous section addressing LOS deficiencies at the intersections within the project area.

The existing US 41 northbound and southbound roadway lanes are 12 feet wide, the median is 60 feet wide (measured between yellow marked edgelines, of opposing lanes), the shoulders adjacent to the median side are 6 feet wide, and the outside shoulders are 10 feet wide. Existing I-43 is also a four-lane divided freeway with the same geometry as US 41, except that the median is 64 feet wide. The existing US 41 roadway typical section is sufficient for existing traffic conditions. However, the typical section for the design year 2035 traffic volumes requires additional capacity on US 41, additional shoulder width, and therefore additional structure width.

Except for the Military Avenue structure over I-43, none of the grade separation structures in the project corridor meet current design standards for vertical clearance. The deficient vertical clearances are shown in bold in Table 1-6. The design standards are 14.75 feet full clearance for local roads and 16.75 feet full clearance for state and county highways, according to WisDOT's Facilities Development Manual (FDM), Procedure 11-35-1.

**Table 1-6
Grade Separation Structures**

Structure Number	Structure Location	Existing Minimum Vertical Clearance (feet)	Roadway Width (feet)
B-05-0064	US 41 SB over US 141 SB	14.9	39.0
B-05-0065	US 41 NB over US 141 SB	14.9	39.0
B-05-0068	US 41 SB over I 43 SB	16.2	49.9
B-05-0069	US 41 SB over I 43 SB	16.5	49.9
B-05-0227	Military Avenue over I 43	16.8	45.5
B-05-0129	County EB (Lakeview Dr) over US 41	16.3	44.0
B-05-0130	County M (Lineville Rd) over US 41	16.4	71.0

Note: Dimensions shown in bold are substandard

There are access control spacing deficiencies in the project area. Per WisDOT's FDM, Procedure 11-5-5, the minimum standard for separation distance between interchange ramp terminals and adjacent side roads is 1,000 and the desirable distance is 1,320 feet. Table 1-7 lists the locations where the separation distance between interchange ramp terminals and adjacent side roads does not meet current design standards.

**Table 1-7
Locations with Inadequate Separation Between
Interchange Ramps and Side Roads**

Interchange Ramp Intersection	Adjacent Side Road Intersection	Separation Distance (feet)
US 141/Velp Avenue and US 41 NB ramp terminal	Memorial Drive and US 141/Velp Avenue	350
US 141/Velp Avenue and US 41 SB ramp	Island Court and US 141/Velp Avenue	500
County M and US 41 NB ramp terminal	East Deerfield Avenue and County M	385
County M and US 41 SB ramp terminal	West Deerfield Avenue and County M	385

There are also several locations where the frontage roads along both sides of US 41 between Duck Creek and County M (East and West Deerfield Avenue) do not meet current design standards for separation distance between the edge of the highway and the frontage road. Per WisDOT's FDM, Procedure 11-25-45, the required distance between the edge of the through lane on a rural arterial highway and the edge of the through lane on the frontage road is 85 feet minimum and 115 feet desirable. In some areas, the existing separation distance between US 41 and these frontage roads is 50-60 feet.

The tight loop ramps at the I-43 interchange have design speeds that are less than desirable for System Interchanges (freeway to freeway interchange). Most of the existing ramp design speeds are less than 50% of the freeway mainline design speeds. Per FDM Procedure 11-30-1, the ramp design speed for freeway to freeway interchanges should be within 85% of the freeway mainline design speed, and no lower than 10 mph below the mainline design speed. For US 41 and I-43, the design speed is 70 mph, therefore the ramp design speed should be a minimum of 60 mph for a Systems Interchange.

Table 1-8 lists the design speeds for each of the existing ramps at the US 41/I-43 interchange.

**Table 1-8
Existing Horizontal Design Speeds
For the Tight Loop Ramps at US 41/I-43 Interchange**

Interchange Ramp Direction	Existing Design Speed (mph)
Northbound US 41 to Southbound I-43	30
Northbound I-43 to Northbound US 41	45
Southbound US 41 to Southbound I-43	35
Northbound I-43 to Southbound US 41	30

According to the 2004 American Association of State Highway and Transportation Officials (AASHTO) Geometric Design of Highways and Streets (GDHS), a guide value for ramp design speed as related to highway design speed is that a directional ramp (Northbound I-43 to Northbound US 41 ramp) should be designed for a 50-60 mph speed, a semi-directional ramp (Southbound US 41 to Southbound I-43 ramp) should be designed for a 50-60 mph speed, and loop ramps should be designed for a minimum of 30 mph (Northbound US 41 to Southbound I-43 ramp and Northbound I-43 to Southbound US 41 ramp)

The speed differential between the freeway mainline and the loop ramps increase the potential for vehicles to run off the road if speed isn't sufficiently reduced to negotiate the controlling loop ramp radius. All four of the US 41/I-43 interchange ramps have a substandard superelevation (banking of the curved roadway so it can be safely maneuvered at reasonable speeds). Per FDM Procedure 11-30-1, the maximum superelevation rate for ramps is 6 percent. The maximum superelevation rate that currently exists on all four of the US 41/I-43 interchange ramps is 8 percent. In addition, all the ramps have an outside shoulder width of 8 feet, which is less than the current minimum design standard of 10 feet for a system ramp.

The lengths of the exit ramps on diamond-type interchanges are typically in the range of 900 to 1,200 feet from the crossroad terminal to the point where the mainline shoulder meets the ramp shoulder, according to FDM Procedure 11-30-1. The exit ramps for US 141/Velp Avenue both have substandard length. The southbound exit ramp is 800 feet long, and the northbound exit ramp is 850 feet long.

The proximity of the interchanges at US 141/Velp Avenue and I-43 cause operational deficiencies and safety concerns due to inadequate traffic weaving distances. Desirable interchange spacing in urban areas is 1 mile. The US 141/Velp Avenue interchange is less than 1/3 mile from the I-43 interchange.

Traffic weaving occurs along US 41, between the US 141/Velp Avenue interchange northbound on ramp and the I-43 interchange southbound off ramp, and along US 41 between the I-43 southbound on ramp and the US 141/Velp Avenue interchange southbound off ramp. The deficiency in interchange spacing leads to weaving conflicts, which has an effect on LOS, traffic capacity, lane speed differential, and safety. According to the 2004 AASHTO GDHS a guideline of 2,000 feet is the minimum recommended length between successive ramps. The existing weave distance is approximately 1,400 feet along northbound US 41 between the on-ramp from US 141/Velp Avenue to the off-ramp to southbound I-43, and approximately 1,430 along southbound US 41 between the on-ramp from northbound I-43 to the off-ramp to US 141/Velp Avenue, neither of which meets the 2,000 feet guideline for weaving distances.

<p><i>Summary: Reconstruction of the US 41 mainline and its interchanges is required to improve traffic operations and capacity and to address existing deficiencies.</i></p>

1.3.4 Safety

Highway safety is measured by the frequency and severity of crashes. An important objective of proposed improvements in the US 41 corridor is to minimize crash potential through roadway mainline and intersection design features and access management.

There was one fatality along US 41 mainline, between I-43 and County M. The fatal crash involved a sideswipe-same direction of two southbound vehicles south of the County EB overpass. The average annual fatal crash rate is 0.8 hundred million vehicles miles traveled (HMVMT) for US 41 between I-43 and County M, which is above the statewide average crash rate (2005-2007) of 0.5 HMVMT.

Table 1-9 presents crash data for the US 41 mainline from 2005 through 2007. Table 1-9 includes segment lengths, traffic volumes (AADT) and total crashes, which are used to develop the crash rates for comparison to statewide average crash rates for rural interstate highways. The statewide average crash rate for the reporting period (2005-2007) was 62 crashes per hundred million vehicles miles traveled (HMVMT), and the statewide average injury and fatal crash rate is 18.9 crashes per HMVMT. As indicated in Table 1-9, the US 41 segment between US 141/Velp Avenue and I-43 has the highest crash rate, 121 crashes per HMVMT. The short distance, which includes the weaving movements between interchanges, used in the equation for determining the crash rate per HMVMT results in a high crash rate between US 141/Velp Avenue and I-43. All crash data and statewide average crash rates, exclude accidents that involve deer.

Table 1-9
US 41 and I-43 Mainline Crash Data (2005-2007)

Roadway Segments	Segment Length (miles)	AADT (2006)	Total Crashes	Average Annual Total Crash Rate (HMVMT)	Average Injury and Fatal Crash Rate (HMVMT)
US 41 mainline (Memorial Drive to US 141/Velp Ave)	0.8	57,200*	32	64	14.0
US 41 mainline (US 141/Velp Avenue to I-43)	0.40	52,900	28	121	30.2
US 41 mainline (I-43 to County M)	2.30	47,300	58	49	15.1
I 43 (US 41 to Atkinson Drive)	2.0	34,600	16	21	9.2

Note: Dimensions shown in bold are substandard

* AADT 2006 from WisDOT website, US 41 Detail, Brown County

Source: Crash Analysis Data for ID 1133-10-00 Projects. Strand Associates®, February 2010.

Each ramp for the US 41 and I-43 Systems Interchange was analyzed separately in a Crash Analysis Report prepared by Strand Associates. Statewide average ramp crash rates are not available; therefore the results were instead compared to the statewide rural interstate average crash rates. The statewide average annual total crash rate is 62 crashes per HMVMT, and the statewide average injury and fatal crash rate is 18.9 crashes per HMVMT. As shown in Table 1-10 below, both the total crash rate and average injury and fatal crash rate exceeded the statewide average for all 4 ramps at this interchange. All crash data and statewide average crash rates, exclude accidents that involve deer.

Table 1-10
US 41 / I-43 Ramp Crash Data (2005-2007)

Roadway Segments	Segment Length (miles)	AADT (2006)	Total Crashes	Average Annual Total Crash Rate (HMVMT)	Average Injury and Fatal Crash Rate (HMVMT)
US 41 Southbound to I-43 Southbound Ramp	0.88	10,390	10	100	30.0
US 41 Northbound to I-43 Southbound Ramp	0.62	12,410	14	166	35.6
I-43 Northbound to US 41 Northbound Ramp	0.47	8,940	11	239	108.7
I-43 Northbound to US 41 Southbound Ramp	0.65	13,110	13	139	32.2

Note: Dimensions shown in bold are substandard

Source: Crash Analysis Data for ID 1133-10-00 Projects, Prepared by Strand Associates®, February 2010.

Summary: Safety concerns are an important consideration in developing proposed improvements that improve traffic weaving conditions between the US 141/Velp Avenue and I-43 interchanges, minimize speed differential on the freeway, and that separate regional and local traffic movements to the extent possible.

Study Area Location Map

US 41
DePere – Suamico
(Memorial Drive to County M)
Brown County
Project I.D. 1133-10-01

