

APPENDIX F
PREFERRED ALTERNATIVE IDENTIFICATION MEMORANDUM

THIS PAGE INTENTIONALLY LEFT BLANK

WIS 23

Preferred Alternative Identification Memorandum

Project ID 1440-13/15-00
Fond du Lac to Plymouth
Fond du Lac and Sheboygan Counties

Finalized on May 15, 2018

The Preferred Alternative Identification Memorandum (Memorandum) in Appendix F was finalized on May 15, 2018. Three technical aspects of the information presented in the Memorandum have changed since the 2018 LS SDEIS was published. They are discussed in the paragraphs below and any updates related to these changes are included in other parts of the 2018 LS SFEIS and Record of Decision (LS SFEIS/ROD). Because the Memorandum was finalized and used to document the basis for the identification of the Preferred Alternative in the May 2018 LS SDEIS, the Memorandum in Appendix F has not been updated. However, with the changes noted below, WisDOT and FHWA re-reviewed the considerations given in the identification of the Preferred Alternative. The updated information only slightly modified the results of the analysis and the 4-lane On-alignment Alternative was still found to be the most appropriate choice as the Preferred Alternative.

1. Crash data updated. The Memorandum references crash data for the five-year period from 2012 to 2016. Wisconsin statewide average crash rates for the five-year period from 2013 to 2017 became available after the 2018 LS SDEIS was published. Because of this, crash data for WIS 23 has been updated to the five-year period of 2013 to 2017 in the body of the 2018 LS SFEIS and is provided in Section 1.3.G. Crash trends for both five-year periods are similar. Section 2.8.B of the 2018 LS SFEIS updates the crash data shown in Appendix F, Table 4.0-4. Because the five-year crash analysis results are similar and the safety countermeasures presented in Table 4.0-4 are unchanged, the results shown in the evaluation matrix for criteria 7.a and 7.b have not changed.

The crash data in this Memorandum refers to A-level and B-level injury severities as incapacitating injuries and non-incapacitating injuries, respectively, based on the 2012 to 2016 Wisconsin statewide average crash rate guidance. In the 2013 to 2017 Wisconsin statewide average crash rate guidance, the A-level and B-level injury severity definitions were revised to suspected serious injury and suspected minor injury, respectively. The injury severity definition revisions are updated in the body of the 2018 LS SFEIS within Section 1.3.G.

2. Design criteria evaluation. Appendix F, Table 5.0-1 in the 2018 LS SDEIS indicated that each of the build alternatives would be constructed to fully meet design standards for the design class (either for a 2-lane or a 4-lane roadway) of the respective alternative. Updated information since the 2018 LS SDEIS indicates Design Exceptions to Standards would be required for each of the build alternatives because the existing and proposed profile grades do not meet minimum standards in several locations. The proposed interchange at County G would address the substandard horizontal sight distance along northbound County G for trucks turning left onto WIS 23 for the 4-lane On-alignment Alternative. The Design Exceptions to Standards were approved for the 4-lane On-alignment Alternative because they are not anticipated to substantially impact the safety or operations of the roadway under this 4-lane alternative, and meeting the design standard would result in substantial impacts to the natural environment and increased project costs. The substandard

intersection angle for Pit Road will be documented in the Design Study Report during final design. Refer to Sections 1.3.E and 2.3-2.5 of the 2018 LS SFEIS for more information.

Because of the necessary Design Exceptions to Standards and other substandard items, none of the build alternatives fully meet the design criteria. Each alternative in Appendix F, Table 5.0-1 is now considered to moderately satisfy criterion 5.a, Highway Geometry.

As a result, the totals of how well each alternative satisfied the 15 Purpose and Need evaluation criteria changed. These changes are reflected in the body of the 2018 LS SFEIS/ROD, but not in this Memorandum, for the reasons described above. The revised summary follows:

- The No-Build Alternative moderately satisfied two of the 15 criteria. (no change)
- The Passing Lane Alternative fully or substantially satisfied four to five of the criteria and moderately satisfied one criterion.
- The Hybrid Alternative satisfied three criteria fully or substantially, and moderately satisfied 10 criteria.
- The 4-lane On-alignment Alternative fully or substantially satisfied 14 of the 15 criteria and moderately satisfied one criterion.

3. Construction cost updated. This Memorandum references construction costs in Fiscal Year (FY) 2017 dollars. Costs have been updated to FY 2019 dollars and include delivery and construction contingencies. These changes are reflected in the body of the 2018 LS SFEIS/ROD.

Table of Contents

1.0	Purpose, Project Limits, and Background	F-3
2.0	Project Purpose and Need	F-4
3.0	Alternatives	F-14
4.0	Traffic and Safety	F-19
5.0	Purpose and Need Evaluation.....	F-24
6.0	Impacts	F-29
7.0	Public and Local Government Comment.....	F-30
8.0	Preferred Alternative Identification	F-32

1.0 PURPOSE, PROJECT LIMITS, AND BACKGROUND

A. Purpose

The purpose of this memorandum is to document the evaluation leading to the selection of the Preferred Alternative for WIS 23 from Fond du Lac to Plymouth. In the Council of Environmental Quality's (CEQ) 40 Questions, Question 4 discusses the selection of the Preferred Alternative. Question 4 indicates that the Preferred Alternative is the alternative the sponsoring agency believes would fulfill its statutory mission and responsibilities, considering economic, environmental, and other factors.

For WIS 23, the factors used in the selection of the Preferred Alternative include:

- How well the alternative addresses the Project Purpose and Need.
- The magnitude and significance of impacts.
- Public and stakeholder support.

A discussion of these factors is incorporated in Sections 2.0 and 5.0 of this memo.

B. Project Limits

The WIS 23 study evaluates a 19.1-mile section of primarily rural highway that spans from US Highway 151 (US 151) in Fond du Lac County to County P in Sheboygan County, Wisconsin. The study seeks to investigate alternatives to improve traffic operations and safety for this primarily 2-lane corridor. Figure 1.0-1 shows the study limits.



Figure 1.0-1 LS SEIS Study Limits

Except for the western 1-mile, 4-lane section, the majority of WIS 23 is a rural 2-lane highway within the study limits with a posted speed of 55 miles per hour (mph). The 2018 Limited Scope Supplemental Environmental Impact Statement (LS SEIS) corridor begins at the US 151/WIS 23 interchange, on the east side of the city of Fond du Lac. The highway then extends approximately 19.1 miles east to County P on the northwest side of the city of Plymouth. East of County P to WIS 67 in the city of Plymouth, WIS 23 was expanded to four lanes in 2004 and 2005. WIS 23 from WIS 67 to I-43 in the city of Sheboygan was previously expanded to four lanes. This leaves the Fond du Lac to Plymouth section as the remaining 2-lane segment between US 151 in the city of Fond du Lac and I-43 in the city of Sheboygan.

C. Project Background

The study started in 2003 and extends through 2018. Within that time, WisDOT and Federal Highway Administration (FHWA) prepared and released Environmental Impact Statements and Supplemental Environmental Impact Statements. WisDOT and FHWA are preparing this new 2018 LS SEIS to evaluate

and provide additional analysis on new or changed impacts since the March 2014 LS Supplemental Final Environmental Impact Statement (SFEIS). Since the publishing of the 2014 LS SFEIS, several events and efforts have occurred that influence the selection of the WIS 23 Preferred Alternative. They include:

- Lower recent traffic counts combined with updating the variables used in the traffic forecast have led to 2040 forecast volumes that are lower than those presented in the 2014 LS SFEIS. This, along with updates to other traffic analysis inputs such as truck percentages, has allowed some lower build alternatives that are not 4-lane expansion for the entire corridor to satisfy more of the Project Purpose and Need criteria.
- Based on the 2010 ROD, and the 2014 ROD that was vacated in 2015, WisDOT:
 - Purchased 528¹ acres for the 2014 LS SFEIS Preferred Alternative, the 4-lane On-alignment Alternative and Corridor Preservation.
 - Relocated 30 of the 33 residential relocations needed for the 4-lane On-alignment Alternative and Corridor Preservation. Of these 30 purchased residences, 27 have been razed.
 - Relocated 3 of the 6 business relocations needed for the 4-lane On-alignment Alternative and Corridor Preservation. All three of these businesses have been razed.
 - Relocated 17 of the 22 farm relocations needed for the 4-lane On-alignment Alternative and Corridor Preservation. Of these, 16 of the farm sites have had the buildings razed.

2.0 PROJECT PURPOSE AND NEED

A. Project Purpose and Objectives

The purpose of the proposed action is to provide additional highway capacity [i.e., to provide appropriate and effective Level of Service (LOS)²] to serve existing and projected traffic volumes and improve operational efficiency and safety for local and through traffic while avoiding or minimizing environmental effects. Objectives for a proposed action on WIS 23 include the following:

- Preserve the corridor for future transportation needs by coordinating local governmental land use plans with transportation improvement plans. These plans include nonmotorized transportation accommodations. Proper planning will help alleviate development pressures on WIS 23 while addressing environmental issues for the future highway project.
- Provide a safe and dependable highway connection to and from regional communities while reducing conflicts between local and through traffic.
- Improve the highway facility to meet current design standards for this Connector Route in Corridors 2030, part of the *Connections 2030 Statewide Long-Range Transportation Plan*.³
- Provide system continuity between the city of Sheboygan and the city of Fond du Lac. WIS 23 is a major east-west connecting highway between these population centers of east central Wisconsin.
- Improve safety at intersections, private driveways, and farm crossings.
- Increase the mobility by adding capacity (i.e., to provide appropriate and effective LOS) and minimizing public and private access.
- Improve the operational efficiency of the WIS 23 corridor, appropriate for the highway's function as a Corridors 2030 Connector route, promoting regional and statewide economic development.

¹ Actual surveyed amount is 530 acres between excess right of way and wetland mitigation. Value shown represents the approximate amount calculated using GIS parcel line files, not surveyed right of way lines. This also includes 159 acres for wetland mitigation sites, which would not be considered excess right of way.

² LOS is a measure of traffic congestion which ranges from A (excellent conditions) to F (extremely congested conditions).

³ Connections 2030 Statewide Long-Range Transportation Plan for Wisconsin. Corridors 2030 is part of Connections 2030. Additional information is available at: <http://wisconsindot.gov/Pages/projects/multimodal/c2030-maps.aspx>

- Maintain a rural highway-type facility while addressing the increased traffic needs of the expanding urban areas.
- Provide accommodations for nonmotorized transportation.
- Preserve right of way needed for future grade separations and interchanges so future safety improvements are easily implemented.

B. Project Purpose and Need and Evaluation Criteria

Since 2012, WisDOT has used screening criteria that reflect the objectives of the WIS 23 Project Purpose and Need. These criteria have been used to screen alternatives to determine which alternatives satisfy the Project Purpose and Need and should be incorporated in the Environmental Impact Statement (EIS). Those that did not were eliminated from detailed study. In the selection of the Preferred Alternative these criteria are used to determine which alternatives best satisfy the Project Purpose and Need. Note that these are used not to screen or eliminate, but to identify the effectiveness and merit of the alternatives in this document.

The following paragraphs summarize both the Project Needs and the criteria used to determine the effectiveness of an alternative meeting these needs.

System Linkage and Route

Importance—WIS 23 is a Connector route in Corridors 2030, which is part of the *Connections 2030 Statewide Long-Range Transportation Plan*. It is identified as a National Highway System (NHS) Route. It is a rural principal arterial between the city of Fond du Lac and the city of Sheboygan and a major east-west connecting highway between these and other population centers of east central Wisconsin. It provides a major link between I-43 and I-41. WIS 23 is a state-designated long truck route. The 115-mile Connector route link from the Madison metropolitan area to the city of Sheboygan and nearby recreational



Figure 2.0-1 System Linkage

areas travels on 4-lane divided expressways and freeways except for the 2-lane section of WIS 23 addressed in this document. Of the 33 miles between US 151 in the city of Fond du Lac to I-43 in the city of Sheboygan, 15 miles is already a 4-lane divided expressway facility and the remaining 18-mile section between County K and County P is a 2-lane roadway. As a Connector route and NHS route, it should be upgraded in accordance with criteria that adequately serve the existing and planned future traffic of the highway in a manner that is conducive to safety, durability, and economy of maintenance.

On roadways of statewide importance, it is desirable, though not required by WisDOT, AASHTO, or FHWA standards, to have a consistent facility type between major highways and metropolitan centers. Questions that indicate how well an alternative addresses the System Linkage and Route Importance include the following criteria:

1. How well does the alternative address truck traffic needs?

The alternative should adequately address truck traffic needs. This includes addressing the WIS 23 operational challenges resulting from trucks platooning. There are currently limited opportunities for passing and few climbing lanes and much of the corridor is marked as no passing. Based on summer 2017 traffic counts, daily truck traffic ranged from 22 to 26 percent and peak hour truck traffic ranged

from 13 to 17 percent for the two-lane portion of WIS 23. Platooning (i.e. groups of vehicles traveling closely together) from corridor truck traffic or slower-driving passenger vehicles occurs along the corridor today. How effectively the criteria was met is defined as follows:

- a. No = Platooning needs not addressed.
- b. Minimally = Most platooning remains.
- c. Moderately = Some platooning remains.
- d. Yes = Platooning needs addressed.

2. Does the alternative provide system continuity?

As mentioned, it is desirable to have a consistent facility type on WIS 23 between the US 151 4-lane expressway and the I-43 4-lane Interstate. Alternatives should provide a reasonable level of consistency in facility type. For the alternatives evaluation, this question was answered “Yes” if the alternative provided a consistent 4-lane facility from US 151 to I-43.

Transportation Demand and Regional Economic Development– WIS 23 provides a connection to economic sectors within the eastern Wisconsin region such as manufacturing, tourism, recreation, agriculture, and trade. Over \$20 billion worth of commodities originate or terminate in Fond du Lac and Sheboygan Counties.⁴ WIS 23 provides important access to local businesses, with over 500 businesses located within 2 miles of the study corridor.

WIS 23 is an important freight corridor. It is estimated that in 2018, almost 2 million tons of freight valued at \$2.2 billion will have traveled on WIS 23 in Fond du Lac and Sheboygan Counties.⁵ The daily truck percentage along the two-lane portion of WIS 23 ranges from 22 to 26 percent. The share of truck traffic relative to all traffic on the corridor at these percentages is considered high. Increasing travel time and traffic hazards contribute to higher transportation costs for both commuters and truck traffic. Increased travel and shipping costs result in higher product costs. This makes existing local businesses less competitive and less likely to expand and makes it more difficult for communities in the region to attract new business and industry.

Highway improvements that lower transportation costs and increase accessibility create a positive perception of the region, increase its competitiveness, and enhance economic development opportunities. Certain industries may be attracted to corridor communities because of improved access to population centers, suppliers, or buyers. Conversely, failing to improve the existing deficient access conditions may prevent new business and employment opportunities from locating within the corridor. Local business groups indicated at the indirect and cumulative effects workshops that they have difficulty attracting industry and business investment to areas served by the 2-lane WIS 23 corridor.

The WIS 23 corridor was designated as a Connector in Corridors 2030, because of its multiple roles. WIS 23 connects producers with markets and people to jobs and is an important link to recreational facilities in east central Wisconsin. Economics are a key factor in the designation of both Backbone and Connector Routes in Corridors 2030.⁶ Reducing travel times and providing predictable travel times decrease transportation costs for businesses and increase the attractiveness of the corridor and adjacent communities for business development. Providing easy and intuitive access also helps businesses that rely on tourists and recreational patrons. Questions that indicate how well an alternative addresses the Transportation Demand and Regional Economic Development need include the following criteria:

1. How much does the alternative reduce travel time?

To what extent does the alternative reduce travel time and maintain travel speeds near the posted speed limit. For this evaluation, estimated travel times were calculated based on the use of probe data as described in Appendix A of the 2018 LS SEIS.⁷ How effectively the criteria was met is defined as follows:

⁴ 2015 IHS Transearch Database

⁵ From freight component of the statewide travel demand model (model run in January, 2018)

⁶ Part of the Connections 2030 Statewide Long-Range Transportation Plan

⁷ Estimated travel time calculations are shown in Attachment H of the Traffic Modeling Methodology memorandum included in Appendix A of the 2018 LS SEIS.

- a. Minimally = 0 to 2 minute improvement over existing conditions (2017) travel times.
- b. Substantially = 2 minute or greater improvement over existing conditions (2017) travel times.

With an improvement of over 2 minutes in travel time, benefits are anticipated to be more noticeable for emergency services, businesses, and residents that travel the corridor. As mentioned previously, the current two-lane portion of WIS 23 is posted at 55 mph. Conversion to a 4-lane expressway would allow for posted speeds to be increased to 65 mph, similar to portions of WIS 23 east of the study limits and other nearby 4-lane expressways such as US 151 between Columbus and Fond du Lac.

2. How well does the alternative provide predictable travel?

In addition to LOS, travel time reliability could be used as a mobility measure of effectiveness to demonstrate operational needs of a corridor.⁸ Travel time reliability suggests how predictable travel is for a roadway and takes into account variables such as crashes, weather, and congestion. For the WIS 23 study, the ability to pass and the level of safety improvements included in each alternative were considered for evaluating predictability of travel. How effectively the criteria was met is defined as follows:

- a. No = No change to predictability of travel.
- b. Minimally = Provides more predictable travel by providing passing opportunities and/or improving safety for some portions of the corridor.
- c. Moderately = Provides more predictable travel by providing passing opportunities and/or improving safety for most of the corridor.
- d. Yes = Provides predictable travel by providing passing opportunities and improving safety for the entire corridor.

Legislative and Planning History—As a Corridors 2030 Connector route, WIS 23 warrants increasing attention to mobility and safety. Because of this, in the 1999 biennial budget, the legislature enumerated WIS 23 as a major project. Authorization for a major project along the portion of WIS 23 from WIS 67 to US 41 in Sheboygan and Fond du Lac Counties is found in Wisconsin State Statute 84.013(3)(ra). The 1999 enumeration of WIS 23 does not supersede the National Environmental Policy Act (NEPA)/Wisconsin Environmental Policy Act (WEPA) process. Through the NEPA/WEPA process, lesser alternatives may be selected. If they are selected and they do not meet major project criteria, the project would no longer qualify as a major project and would no longer be eligible for funding under the Wisconsin Majors program. Questions that indicate how well an alternative addresses the Legislative and Transportation Planning need include the following criteria:

1. Is the alternative consistent with and/or reflected in local land use and transportation plans?

To be consistent, alternatives that are evaluated should be reflected in, or not contradict, local land use and transportation plans. The Fond du Lac area Metropolitan Planning Organization (MPO)⁹ and Sheboygan Area¹⁰ plans indicate the desire to improve mobility along WIS 23 and to provide 4-lane expansion for the entire study corridor.

How effectively the criteria was met is defined as follows:

- a. No = Does not reflect the plans.
- b. Minimally = Improves mobility, does not include new 4-lane expansion for any portion of corridor.
- c. Moderately = Improves mobility, includes new 4-lane expansion for portion of corridor.
- d. Yes = Reflects the plans.

⁸ FDM 11-5-3.3.2.1, Accessed May 11, 2018.

⁹ Fond du Lac plan: http://www.ecwrpc.org/wp-content/uploads/2017/01/FDL_LRP_2015.pdf. Accessed May 11, 2018.

¹⁰ Sheboygan plan: <http://www.sheboygancounty.com/home/showdocument?id=5120>. Accessed May 11, 2018.

2. Is the alternative consistent with the intent of Wisconsin State Statute 84.013(3)(ra)?

To be fully consistent the project must meet state statute. 84.013(3)(ra). Wisconsin State Statute 84.013(3)(ra) includes authorization for major highway improvements along the portion of WIS 23 from WIS 67 to US 41 in Sheboygan and Fond du Lac Counties. How effectively the criteria was met is defined as follows:

- a. No = Is not consistent with 84.013(3)(ra).
- b. Moderately = Consistent with 84.013(3)(ra) for a portion of the corridor.
- c. Yes = Consistent with 84.013(3)(ra).

Existing and Future Traffic Volumes and Resulting Operation—Roadway LOS is a measure of how well a highway serves the travel demands placed on it. LOS ranges from A to F in order of decreasing operational quality. Table 2.0-1 shows the daily traffic volume and the LOS, numeric LOS, and percent time spent following another vehicle along WIS 23 during the peak hours of the day for the 2-lane portion of WIS 23. For 2-lane roads, the percent time spent following another vehicle, and in some conditions, average speed,¹¹ are the metrics that determine the LOS.

Within the four 15-minute periods of the peak hour, some periods have higher traffic volumes than others. The Highway Capacity Manual methodology accounts for traffic volume variations within the peak hour by using a peak-hour factor. WisDOT policy, as outlined in the Facilities Development Manual (FDM) 11-5-3.5.2, is to account for peak hour traffic volume variations based on existing field data when performing traffic operations analysis for existing conditions. However, because it is difficult to predict how traffic volumes will vary within an hour in the future design year, WisDOT’s FDM policy assumes uniform traffic volumes throughout the hour for the design year. This policy accounts for the flattening of volume variation within the design hour that occurs as traffic increases and roadways become more congested in the design year. The combination of the small increases in weighted average forecast average annual daily traffic volumes (2 to 7 percent) and using uniform 15-minute volumes within the 2040 peak hour contributes to a projected 2040 LOS that will be about the same or slightly better than the LOS calculated for 2017 (0.07 to 0.15 difference in numeric LOS).

The share of truck volume on WIS 23 is high. Daily truck volumes range from 22 to 26 percent, which provides an overall picture of the mix of traffic along the corridor. Truck volumes in the peak hour range from 13 to 17 percent, which is used in the operations analysis.¹² On 2-lane roadways, high truck volumes are particularly detrimental to roadway operational characteristics because passing requires use of the opposing traffic lane. The high number of trucks create platoons of traffic where vehicles are not able to travel the free-flow speed and have difficulty passing. The truck traffic limits the overall capacity of the existing road with the inability to pass, creating conflicts with slower local traffic, recreational vehicles, vehicles towing trailers, and farm machinery.

Table 2.0-1 2017 and Projected 2040 No-Build Level of Service in 2-Lane Sections of WIS 23

	County UU to County G	County G to County P
Length	9.7 miles	8.0 miles
Westbound		
Weighted Average Daily Volume* (both directions-vehicles per day) 2017	7,140	7,640
% Time Spent Following	67.7%	66.3%
Numeric LOS	4.18	4.09
LOS	D	D

¹¹ Previous National Environmental Policy Act documents presented the average speed as calculated by Highway Capacity Software (HCS). Analysis of probe data (GPS data from phones or vehicles) for the WIS 23 corridor indicates that travel speeds on WIS 23 vary from those predicted by HCS. See the Traffic Modeling Methodology memorandum in Appendix A of the 2018 LS SEIS for more information.

¹² See Appendix A of 2018 LS SEIS for more information on how truck percentages are used in the operations analysis.

Table 2.0-1 2017 and Projected 2040 No-Build Level of Service in 2-Lane Sections of WIS 23

	County UU to County G	County G to County P
Weighted Forecast Average Daily Volume* (both directions-vehicles per day) 2040	7,610	7,810
% Time Spent Following	66.6%	64.9%
Numeric LOS	4.11	3.99 [#]
LOS	D	C
Eastbound		
Weighted Average Daily Volume* (both directions-vehicles per day) 2017	7,140	7,640
% Time Spent Following	67.5%	64.2%
Numeric LOS	4.17	3.95
LOS	D	C
Weighted Forecast Average Daily Volume* (both directions-vehicles per day) 2040	7,610	7,810
% Time Spent Following	66.3%	62.0%
Numeric LOS	4.09	3.80
LOS	D	C

This table divides the corridor into two sections because the 2017 volumes are slightly higher east of County G. Refer to Appendix A of the 2018 LS SEIS for more detail on segmentation and information on traffic analysis inputs.

*Weighted Average Daily Volume, needed for the traffic operations analysis, is the sum of all daily volumes multiplied by the length of highway they represent, divided by the total length of the analysis segment. Refer to Appendix A of the 2018 LS SEIS for sample calculations of the weighted average daily volume.

The numeric LOS range for LOS C is 3.01 to 4.00, and for LOS D the range is 4.01 to 5.00. For County G to County P westbound, the 2040 No-Build LOS of 3.99 is just 0.02 away from LOS D.

According to WisDOT FDM policy,¹³ for Corridors 2030 Connector routes the desirable level of service is LOS C (≤ 4.0). These thresholds are based on a balance of social, environmental, and dollar costs and may not match with every traveler's perception of when congestion warrants roadway improvements.

The FDM states that the desirable LOS for side road intersections associated with Corridors 2030 Connector Routes and NHS routes is LOS D or better for the intersection as a whole and for all turning movements.¹⁴ Because WIS 23 is a Corridors 2030 route and a NHS route, WisDOT seeks to provide LOS D or better operation levels at all intersections. Operation levels tend to deteriorate at more highly used intersections because there is a higher demand for access, which leads to queuing. Higher volume intersections along WIS 23 include county trunk highways that are classified either as minor arterials or rural collectors. Reasonable operational levels become more critical and more difficult to achieve at the highly used intersections of County G, County UU, and County W. Questions that indicate how well an alternative addresses this need include the following criteria:

1. How well does the alternative improve WIS 23 mainline operational efficiency and mobility by meeting desired LOS for a Corridors 2030 Connector Route?

An alternative should maintain the desired LOS C, or below numeric LOS 4.0, along the WIS 23 mainline in the 2040 design year. How effectively the criteria was met is defined as follows:

- a. No = Does not provide LOS C throughout the corridor.
- b. Moderately = Provides LOS C throughout portions of the corridor.
- c. Yes = Provides LOS C or better throughout the corridor.

¹³ FDM 11-5, Table 3.1 Desirable Levels of Service. Accessed May 9, 2018.

¹⁴ FDM 11-5-3.2.2 Congestion and Intersection LOS. Accessed May 9, 2018.

2. How well does the alternative provide a reasonable LOS for vehicles trying to access WIS 23?

Alternatives that provide LOS D or better for side-road movements onto or across WIS 23 at the more highly used intersections of County G, County UU, and County W satisfy this criterion. How effectively the criteria was met is defined as follows:

- a. No = Does not meet intersection LOS D goal
- b. Moderately = Most intersections meet LOS D goal
- c. Yes = Meets intersection LOS D goal

Existing Highway Geometric Characteristics—Much of the route is marked for no passing and when passing zones are available, opposing traffic volumes reduce passing opportunities and result in a lower LOS.

WisDOT's FDM describes Design Criteria by Design Classes,¹⁵ which are divided into four categories: A1 (low volume 2-lane), A2 (moderate volume 2-lane), A3 (4-lane divided), and A4 (6-lane divided). For each Design Class, there are generic traffic volume guideline ranges that are used to provide the appropriate LOS expectations. The following question indicates how well an alternative addresses the highway geometry need.

1. How well does the alternative incorporate the appropriate design criteria for the roadway classification?

The alternative should provide the number of lanes or passing opportunities to maintain adequate LOS. It should also have appropriate shoulder widths, clear zones, and horizontal/vertical alignments to provide a safe facility and meet standards and driver expectations for NHS and Connector routes. The geometric design should adequately accommodate the mix of traffic, including trucks, farm equipment and recreational vehicles. How effectively the criteria was met is defined as follows:

- a. No = Does not meet design criteria for all or most of corridor.
- b. Moderately = Meets design criteria for portions of the corridor.
- c. Yes = Meets design criteria throughout the corridor.

Access—A high number of access points is directly related to both highway safety and mobility. WIS 23 has greater numbers of driveway and side-road access than what is recommended for a Connector route. Local traffic and farm machinery enter and exit the highway from approximately 235 county and local roads, private driveways, and field access points.¹⁶ Because of the safety risks associated with access, WisDOT adopted a statewide policy for managing access on side roads. WIS 23 is a Tier 2A corridor in the State Access Management Plan (SAMP).¹⁷ Goals for Tier 2A corridors include maximizing interregional traffic movements. Most Tier 2A corridors are, or are planned for, 4 lanes. Also, expressway standards that limit access are highly desirable for Tier 2A corridors.¹⁸

WIS 23 improvements should seek to remove hazardous access movements from the corridor through eliminating access points, installing grade-separated crossings, access combination, and other access management measures. The following questions indicate how well an alternative satisfies this access criterion.

1. How well does the alternative reduce the number of hazardous movements (left turns or crossing from side roads) at public access points through the installation of access restrictions or interchanges?

Alternatives that include geometric modifications that improve, eliminate, or relocate hazardous movements at more public access points (or intersections) better satisfy this criterion. How effectively the criteria was met is defined as follows:

¹⁵ Attachment 1.1 in the FDM 11-15. Accessed May 9, 2018.

¹⁶ This value has not been updated since the 2014 LS SFEIS to account for recent acquisitions. The recent acquisitions result in a net change of 3 fewer access points along the corridor, or a revised total of 232 access points along WIS 23.

¹⁷ <http://wisconsin.gov/Documents/projects/data-plan/plan-res/samp.pdf>. Accessed April 13, 2018. The SAMP is described in Facilities Development Manual 11-7-5.

¹⁸ FDM 7-5-1. Accessed May 9, 2018. Also, expressway standards are those associated with a high-speed, divided, 4-lane highway.

- a. No = No improvement, removal, or relocation of public access points.
 - b. Minimally = Low number of public access points improved, removed, or relocated.
 - c. Moderately = Some public access points improved, removed, or relocated.
 - d. Substantially = Majority of public access points improved, removed, or relocated.
2. How well does the alternative reduce the number of private access points through right of way acquisition?

Alternatives that eliminate or relocate more access points better satisfy this criterion. How effectively the criteria was met is defined follows:

- a. No = No access points removed.
 - b. Minimally = Low number of private access points removed.
 - c. Moderately = Some private access points removed.
 - d. Substantially = Majority of private access points removed.
3. Does the alternative designate and preserve land for future access modifications, such as overpasses and interchanges, through official mapping?

Alternatives that preserve land for future access modifications through the provisions associated with Wisconsin Statute 84.295 satisfy this criterion. For the alternatives evaluation, this question was answered “Yes” if the alternative could include Corridor Preservation, which is described further in Section 3.0 of this memorandum.

Safety–While the overall WIS 23 crash rate is below the statewide average for a 2-lane rural state trunk highway, some sections, particularly near high use intersections, experience higher than average crash rates. The area from 7 Hills Road to County W/Loehr Road experiences fatal and injury crash rates approximately two to four times higher than the state average. From 2012 to 2016, 53 of the 207 corridor crashes (26 percent) involved vehicles crossing the highway centerline. Figures 2.0-2 and -3 illustrate the 5-year total crash rates and the 5-year fatal and serious injury (KAB)¹⁹ crash rates on sections of WIS 23 compared to the 2012-2016 5-year statewide average crash rate for similar roadways.

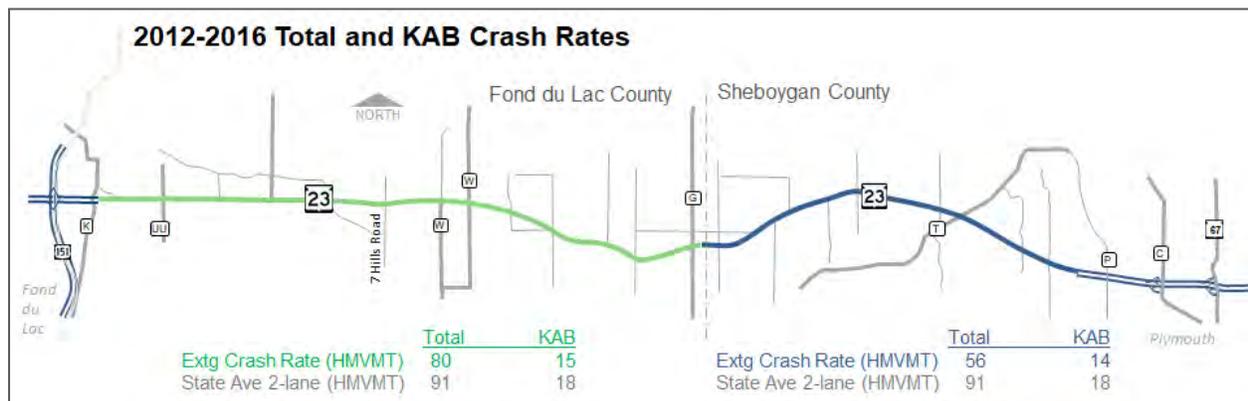


Figure 2.0-2 WIS 23 Crash Rates

¹⁹ KAB Injury Crash Rate includes K-Level (fatal), A-Level (incapacitating injury), and B-Level (non-incapacitating injury) crashes as defined by WisDOT guidance

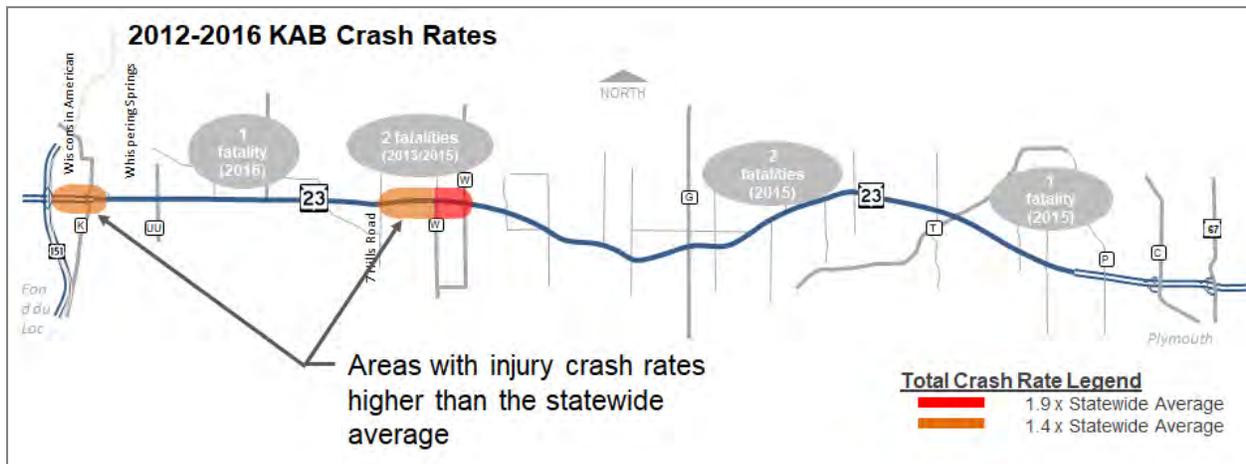


Figure 2.0-3 WIS 23 KAB Crash Rates

Of the nondeer crashes, 88, or 42 percent, were associated with intersections. Intersections introduce turning movements where vehicles must cross through WIS 23 traffic. Intersections also introduce left-turning vehicles that stop in the through travel lane while waiting for a gap in traffic. Intersections with the highest number of crashes from 2012 to 2016 generally correspond with intersections with the highest traffic volumes. Figure 2.0-4 schematically shows the location and number of intersection crashes, along with intersection crash rates where they have been calculated.

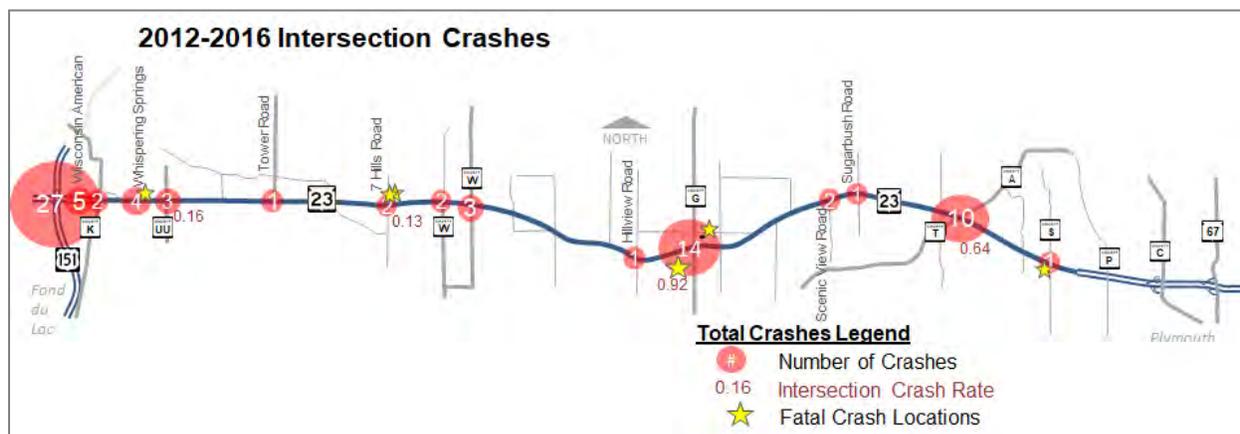


Figure 2.0-4 WIS 23 Intersection Crash Locations 2012-2016

Preliminary 2017 crash data was reviewed; however, corridor crash rates were not updated to reflect the 5-year period of 2013-2017 because the 2013-2017 WisDOT statewide crash rates have not been finalized. With the preliminary 2017 crash data incorporated into a 5-year average, the resulting crash rate trends along WIS 23 show an increase in injury crashes. From 2012-2016 there were a total of 36 serious-injury crashes that included 68 occupant injuries (with varying occupant injury severities). In the year 2017 alone, there were 13 serious-injury crashes with 37 occupant injuries.

With any road improvement, it is important to address safety deficiencies to reduce crash potential. Safety improvements are often termed as countermeasures because they counter specific safety deficiencies. WisDOT considers and incorporates countermeasures in highway improvements to address safety deficiencies when possible. In recent years, there have been studies and guides published that allow a more quantitative approach to safety evaluation. These resources can be used to evaluate the potential effectiveness of safety improvements. The following criteria indicate how well an alternative addresses the safety need.

1. How well does the alternative address WIS 23 mainline safety?

Alternatives that provide countermeasures that directly address the types of crashes occurring on the WIS 23 corridor satisfy this criterion. Safety countermeasures may include shoulder widening, addition

of intersection turn lanes, median installation, or mainline capacity expansion. How effectively the criteria was met is defined as follows:

- a. No = No safety countermeasures are introduced.
- b. Minimally = Limited safety countermeasures are introduced.
- c. Moderately = Some safety countermeasures are introduced.
- d. Substantially = Many safety countermeasures are introduced.

2. How well does the alternative address intersection safety?

Alternatives that provide countermeasures that directly address the types of crashes occurring at WIS 23 intersections satisfy this criterion. Countermeasures that reduce crossing conflicts include access control treatments, RCUTs, or interchanges.²⁰ Alternatives that reduce more crossing conflicts better meet this criteria. How effectively the criteria was met is defined as follows:

- a. No = All crossing conflicts remain.
- b. Minimally = Nearly all crossing conflicts remain.
- c. Moderately = Some crossing conflicts remain.
- d. Substantially = Few crossing conflicts remain.

Accommodations for Nonmotorized Travel—Currently, there are no good east-west routes or accommodations on WIS 23 for nonmotorized travel between Fond du Lac’s Prairie Trail and Sheboygan County’s Old Plank Road Trail. Additionally, WIS 23 provides one of the few crossings of the Sheboygan River and other topographic features, yet there is a 16-mile gap on WIS 23 where separated pedestrian and bicycle facilities are not provided. See Figure 2.0-5.



Figure 2.0-5 Regional Gap in Bike Facilities

²⁰ FDM 11-25-1. Accessed May 11, 2018.

The following question indicates how well an alternative addresses this need.

1. Does the alternative provide accommodations for nonmotorized travel?

Alternatives that provide a separate path or on-highway accommodations satisfy this criterion. For the alternatives evaluation, this question was answered “Yes” if the alternative extends the Old Plank Road Trail.

3.0 ALTERNATIVES

A. No-Build Alternative

The No-Build Alternative involves the continued use of the existing WIS 23 without reconstruction or enhancements of the existing roadway. It includes routine maintenance activities necessary to keep the highway infrastructure in satisfactory condition. An example of a routine maintenance activity is the planned 2018 overlay of WIS 23 in Sheboygan County to address poor pavement conditions.

Figure 3.0-1 schematically illustrates the No-Build Alternative.

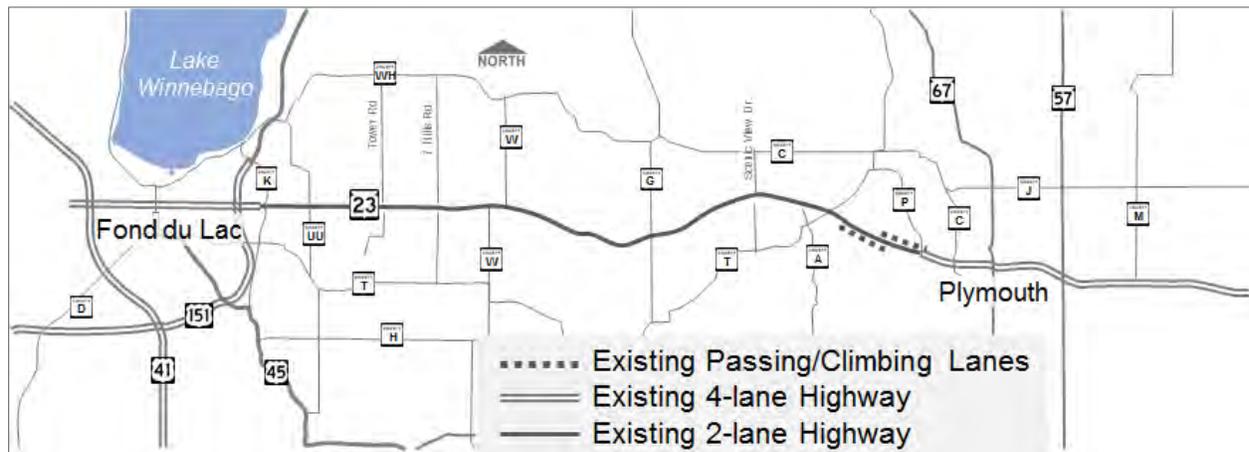


Figure 3.0-1 No-Build Alternative

Because this alternative does not satisfy the Purpose and Need, it was eliminated from consideration. The No-Build Alternative is still carried forward in the document as a baseline for comparison in accordance with 40 CFR 1502.14(d).

B. Build Alternatives

The three build alternatives considered in the 2018 LS SEIS are described in the sections below and are the Passing Lane, Hybrid, and 4-lane On-alignment Alternatives.

Each of the build alternatives has a possible Corridor Preservation aspect associated with it. Corridor preservation seeks to preserve right of way for transportation improvements that are likely to be needed in the future. The preservation most often takes the form of official mapping, either by the local jurisdiction or by WisDOT.²¹ For the Passing Lane and Hybrid Alternatives, it consists of preserving the right of way needed to convert WIS 23 to a 4-lane facility, as well as preserving right of way needed for future access modifications. For the 4-lane On-alignment Alternative, it consists of preserving right of way needed for future access modifications. The intent of Corridor Preservation is to designate WIS 23 as an expressway under Wisconsin Statute 84.295. This designation is a planning action to identify the requisite improvements and associated right of way needs to improve this facility to a higher-level expressway.

²¹ Wisconsin Statute 84.295 (10) gives WisDOT the authority to establish locations and right of way widths for future freeways or expressways. Resources within the corridor preservation areas associated with the build alternatives are not impacted by the act of preservation, except that property owners wishing to erect or alter a structure within that mapped right of way must give WisDOT 60 days' notice before beginning that construction. The statute also states that if notice is not given to WisDOT, compensation will not be made by WisDOT for structure improvements occurring within the corridor preservation area. In the future, if WisDOT determines that transportation improvements are needed within these preserved areas, a subsequent environmental document would be prepared which evaluates impacts and costs.

This designation is also a *preservation* action where Official Mapping, under Wisconsin Statute 84.295(10), is used to preserve those right of way needs for future conversion.

1. Passing Lane Alternative

WIS 23 is not designated as a passing lane corridor in WisDOT’s FDM,²² yet current traffic forecasts indicate design-hour volumes fall within the thresholds where passing lanes could be considered based on WisDOT FDM policy.²³ The Passing Lane Alternative installs two passing lanes in the eastbound direction and two passing lanes in the westbound direction to complement the existing eastbound and westbound climbing lanes that exist between County A and County P in Sheboygan County. Posted speeds along WIS 23 would not be modified in this alternative. Figure 3.0-2 schematically illustrates the Passing Lane Alternative.

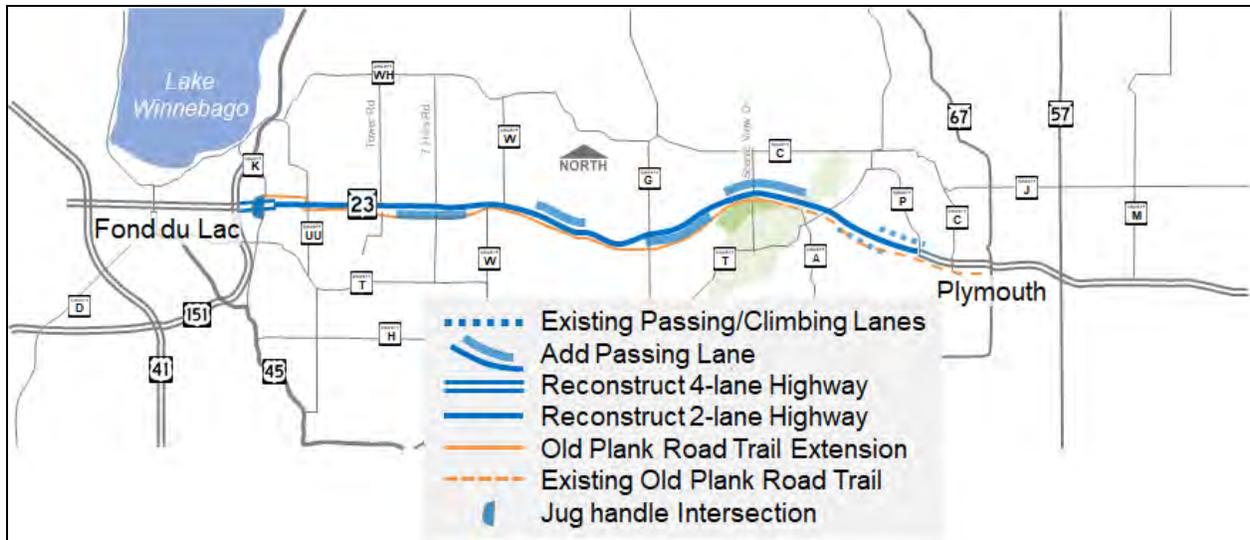


Figure 3.0-2 Passing Lane Alternative

The Passing Lane Alternative typical section is shown in Figure 3.0-3.

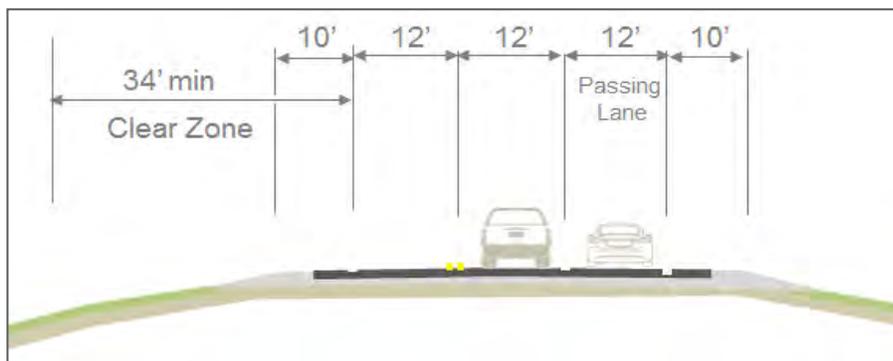


Figure 3.0-3 Passing Lane Typical Section

There are two suboptions with the Passing Lane Alternative: one that installs left-turn lanes at higher volume intersections and one that does not. The Passing Lane Alternative without left-turn lanes would upgrade side-road intersections with the intersection type recommended in WisDOT’s FDM. However, under this alternative, left-turn lanes that would facilitate turning movements at

²² Passing lane corridors are specified in the WisDOT FDM 11-15-10, Attachment 10.1 which shows a map of the Wisconsin roadways that are considered passing lane corridors.

²³ FDM 11-15, Attachment 10.2 Warrant for Considering Passing Lanes. WIS 23 assumptions: level terrain; K100=710 to 757 vph; Trucks=13% [from field data (PM peak); minimum assumptions, daily range is 22 to 26%].

higher volume intersections on WIS 23 would not be provided as part of the intersection upgrades because they would decrease the amount of roadway available for passing.²⁴

The Passing Lane Alternative suboption with left-turn lanes adds left-turn lanes on WIS 23 at ten higher volume intersections. The left-turn lane provides a refuge for left-turning vehicles, removing them from exposure to the through travel stream. The left-turn lane also adds a median area so that side road traffic can make a left turn onto WIS 23 as a two-stage maneuver. Adding the left-turn refuge decreases the amount of roadway that is available for passing. As mentioned, the median associated with the left-turn lane also provides a median refuge for side-road vehicles (passenger cars) crossing or making a left turn onto WIS 23.

The Passing Lane Alternative would install a roundabout intersection at the Wisconsin American Parkway intersection with WIS 23. It would also install a new jughandle intersection at County K to address crashes and higher traffic volumes at this intersection. The jughandle intersection would have a grade separation with bridges that carry WIS 23 traffic over County K.

The Passing Lane Alternative would extend the Old Plank Road Trail, a multi-use path, from where it currently ends, near the Northern Unit of the Kettle Moraine State Forest (KMSU-NU), west to the Prairie Trail in the city of Fond du Lac.²⁵ The section of the trail from the Prairie Trail to 2.5 miles east of County UU would be located on the north side of the WIS 23. Between Tower Road and Poplar Road, the trail would cross to the south side of WIS 23 through a grade-separated underpass. From that point east, until it connects with the existing Old Plank Road Trail, near Plymouth the Old Plank Road Trail extension would travel on the south side of WIS 23.

The Passing Lane Alternative would also include a grade-separated crossing (underpass) for the Ice Age Trail (IAT). The IAT and the State Equestrian Trail are joined as they cross WIS 23 at the Kettle Moraine Forest. A snowmobile trail also crosses WIS 23 at this location. The IAT is one of only eight National Scenic Trails, and Wisconsin's only scenic trail. Because the IAT and State Equestrian Trail cross perpendicular to WIS 23 and the Kettle Moraine State Forest is located on both sides of WIS 23, there is no opportunity to avoid the trails. To address this crossing need, WisDOT would install a grade-separated underpass providing a clear width of 20 feet and a vertical clearance of 12 feet for the combined trails. This crossing was negotiated with National Park Service as part of the Section 6(f) conversion request in the 2014 LS SFEIS. This commitment remains in effect.

Corridor Preservation could be included as part of the Passing Lane Alternative. Corridor preservation would consist of preserving the right of way for future improvements to convert WIS 23 to a 4-lane facility and also preserve right of way for future access modifications including 4 diamond interchanges (County UU, County W, County G, and County A), 4 grade separations (overpasses) and 3 cul-de-sacs. The intent of Corridor Preservation is to designate WIS 23 as an expressway under Wisconsin Statute 84.295. This designation is a planning action to identify the requisite improvements and associated right of way needs to improve this facility to a higher level expressway. This designation is also a preservation action where Official Mapping, under Wisconsin Statute 84.295(10), is used to preserve those right of way needs for future conversion. Additional environmental documentation would need to be completed prior to the construction of any improvements associated with corridor preservation measures.

2. Hybrid Alternative

The Hybrid Alternative provides a 4-lane divided highway from US 151 to County G, and a 2-lane roadway with passing lanes from County G to County P. Figure 3.0-4 schematically illustrates this alternative. The 4-lane divided highway would span approximately 12 miles from US 151 in Fond du Lac to County G, and have the same typical section as the 4-lane On-alignment Alternative shown in Figure 3.0-6. East of County G, WIS 23 would be a 2-lane roadway with passing lanes and

²⁴ Providing left-turn lanes requires the installation of a median for a portion of the highway, reducing the ability to pass in these locations.

²⁵ For the Passing Lane Alternative, the Old Plank Road Trail is located to minimize right of way requirements. If in the future the Passing Lane Alternative were expanded to 4-lanes, about 12 miles of the Old Plank Road Trail would need to be reconstructed.

left turn lanes for the remaining 7 miles with the same typical section as in Figure 3.0-3. Posted speeds along WIS 23 would not be modified in this alternative.

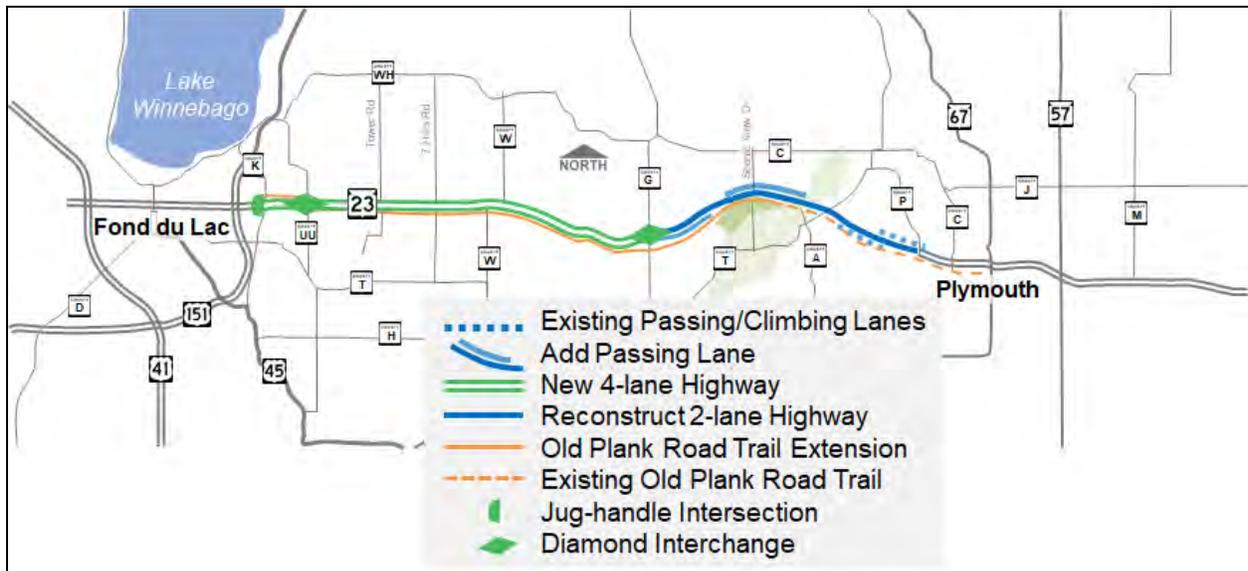


Figure 3.0-4 Hybrid Alternative—4 Lanes from US 151 to County G, 2 Lanes from County G to County P

With this alternative, the eastbound passing lane east of County G is combined with the County G interchange on-ramp.

The Hybrid Alternative has a roundabout intersection at Wisconsin American Parkway and a jughandle intersection at County K. The Old Plank Road Trail Extension would span from US 151 to the existing Old Plank Road Trail west of the city of Plymouth. The Hybrid Alternative would also include a grade-separated crossing (underpass) for the IAT.

The Hybrid Alternative also installs a diamond interchange at County UU with County UU passing over WIS 23. This interchange includes access roads that connect to adjacent property and a park and ride lot that connects with the Old Plank Road Trail extension. With the Hybrid Alternative, the Old Plank Road Trail would cross from the north to the south side of WIS 23 on County UU at the interchange.

The Hybrid Alternative also includes a diamond interchange at County G. The interchange includes a park and ride lot in the southeast quadrant, as well as an access road to connect to adjacent properties.

The Hybrid Alternative makes access modifications in the 4-lane portion of the alternative. These access modifications include the installation of Restricted Crossing U-Turns (RCUTs), also known as J-turns, at several high-volume intersections. The RCUT intersection design only allows right-in/right-out/left-in movements and removes the most hazardous movements from the intersection. Drivers that want to turn left or travel across WIS 23 on the side road must take a right and then make a U-turn at an appropriate distance from the intersection.

Corridor Preservation could be included as part of the Hybrid Alternative. Corridor preservation would consist of preserving the right of way for future improvements to convert WIS 23 to a 4-lane facility from County G to County P and also preserve right of way for future access modifications including 2 diamond interchanges (County W and County A), 4 grade separations (overpasses) and 3 cul-de-sacs. The intent of Corridor Preservation is to designate WIS 23 as an expressway under Wisconsin Statute 84.295. This designation is a planning action to identify the requisite improvements and associated right of way needs to improve this facility to a higher level expressway. This designation is also a preservation action where Official Mapping, under Wisconsin Statute 84.295(10), is used to preserve those right of way

needs for future conversion. Additional environmental documentation would need to be completed prior to the construction of any improvements associated with corridor preservation measures.

3. 4-lane On-alignment Alternative

The 4-lane On-alignment Alternative evaluated in this document was the Preferred Alternative in the 2014 LS SFEIS. This alternative would provide a 4-lane divided highway on the existing alignment for the full length of the project. It includes the roundabout at Wisconsin American Parkway, the County K jughandle intersection, and diamond interchanges at County UU and County G. As discussed with the Hybrid Alternative, RCUTs are proposed at nine intersections. The 4-lane On-alignment Alternative also includes the Old Plank Road Trail extension that extends from US 151 to the existing Old Plank Road Trail just west of Plymouth. The trail would cross from north to south of WIS 23 on County UU at the interchange, the same crossing as with the Hybrid Alternative. Figure 3.0-5 schematically illustrates the 4-lane On-alignment Alternative.

From US 151 to County UU, the 4-lane On-alignment typical section would include four 12-foot lanes, 6-foot inside shoulders, 10-foot outside shoulders, and an 18-foot median with mountable curb. The outside edges may flow into either a rural section with a ditch or use mountable curb and gutter. The design speed for this section of roadway will be 55 mph and will be posted for 45 mph.

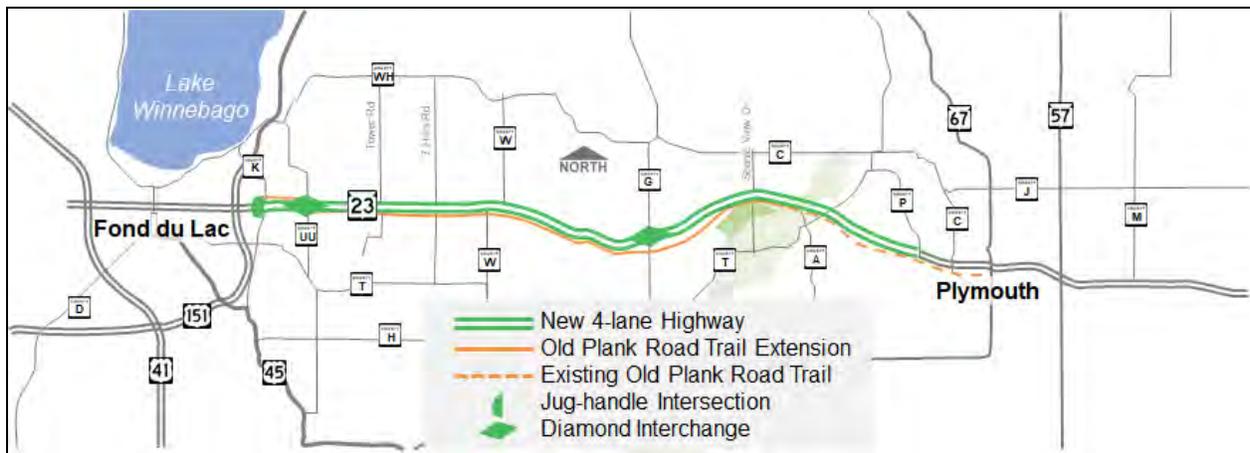


Figure 3.0-5 4-lane On-alignment Alternative

From County UU east to County P in Sheboygan County, WIS 23 has a typical expressway cross section. This includes four 12-foot lanes, 6-foot inside shoulders, 10-foot outside shoulders, and a 60-foot median. Generally, the existing roadbed will carry the eastbound lanes, and the westbound lanes will be constructed north of the existing roadway. The exception to this is between County W and Division Street, where the new lanes will be south of the existing roadbed. Figure 3.0-6 illustrates the two typical sections for the 4-lane On-alignment Alternative.

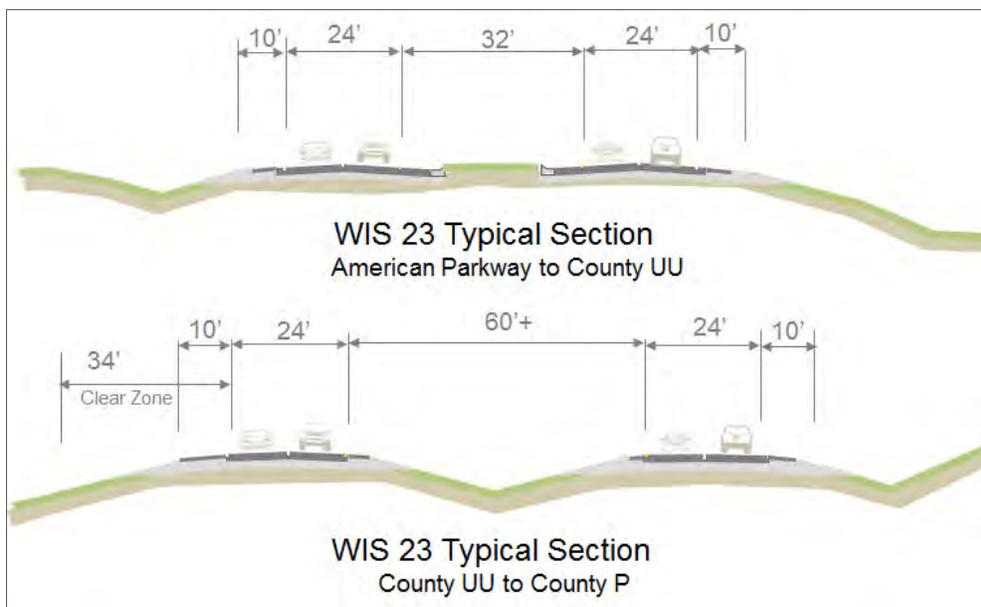


Figure 3.0-6 4-lane On-alignment Typical Sections

Conversion to a 4-lane expressway would allow for the existing posted speeds of 55 mph along WIS 23 to be increased to 65 mph, similar to portions of WIS 23 east of the study limits and other nearby 4-lane expressways such as US 151 between Columbus and Fond du Lac.

Corridor Preservation could be included as part of the 4-lane On-alignment Alternative. Corridor preservation would consist of preserving the right of way for future access modifications including 2 diamond interchanges (County W and County A), 4 grade separations (overpasses) and 3 cul-de-sacs. The intent of Corridor Preservation is to designate WIS 23 as an expressway under Wisconsin Statute 84.295. This designation is a planning action to identify the requisite improvements and associated right of way needs to improve this facility to a higher level expressway. This designation is also a preservation action where Official Mapping, under Wisconsin Statute 84.295(10), is used to preserve those right of way needs for future conversion. Additional environmental documentation would need to be completed prior to the construction of any improvements associated with corridor preservation measures.

4.0 TRAFFIC AND SAFETY

A. Traffic Forecasts

The traffic forecasting analysis developed for and presented in the main body of the WIS 23 2018 LS SEIS used an updated version of the Northeast Region Travel Demand Model (NERTDM) and recent traffic counts to develop consistent forecasts for the No-Build Alternative and each of the build alternatives. Per WisDOT Traffic Forecasting Section policy (as detailed in the May, 2018 Transportation Planning Manual), a separate forecasting analysis was conducted based on Traffic Analysis Forecasting Information System (TAFIS) and regression modeling to establish the reasonableness of the No-Build forecast.

The results of this separate analysis can be found in Attachment B of Appendix B of the 2018 LS SEIS, and are presented to compare the no-build results prepared for the formal NEPA study (as presented in Attachment A of this Appendix B of the 2018 LS SEIS) to those derived from WisDOT's internal screening process. Forecast values from the two analyses are consistent.²⁶

Once the No-Build forecast was developed WisDOT set up the NERTDM to analyze the build alternatives. Network changes were coded in the model to develop traffic forecasts for the Build Alternatives including the Passing Lane Alternative, Hybrid Alternative, and 4-lane On-alignment Alternative. The network changes showed modest capacity increases and access changes that affected traffic volumes in the Passing Lane Alternative. The Hybrid Alternative and 4-lane On-alignment

²⁶ Refer to traffic forecast memo in Appendix B of the 2018 LS SEIS for additional information.

Alternative showed larger traffic effects due to greater capacity increases and additional access improvements. The Hybrid and 4-lane On-alignment alternatives attracted more traffic from the local system than the No-Build and Passing Lane alternatives. Appendix B of the 2018 LS SEIS provides a more detailed explanation of the traffic forecasting procedures and results.

Figure 4.0-1 shows the WIS 23 corridor 2040 forecasts for each of the alternatives being considered.

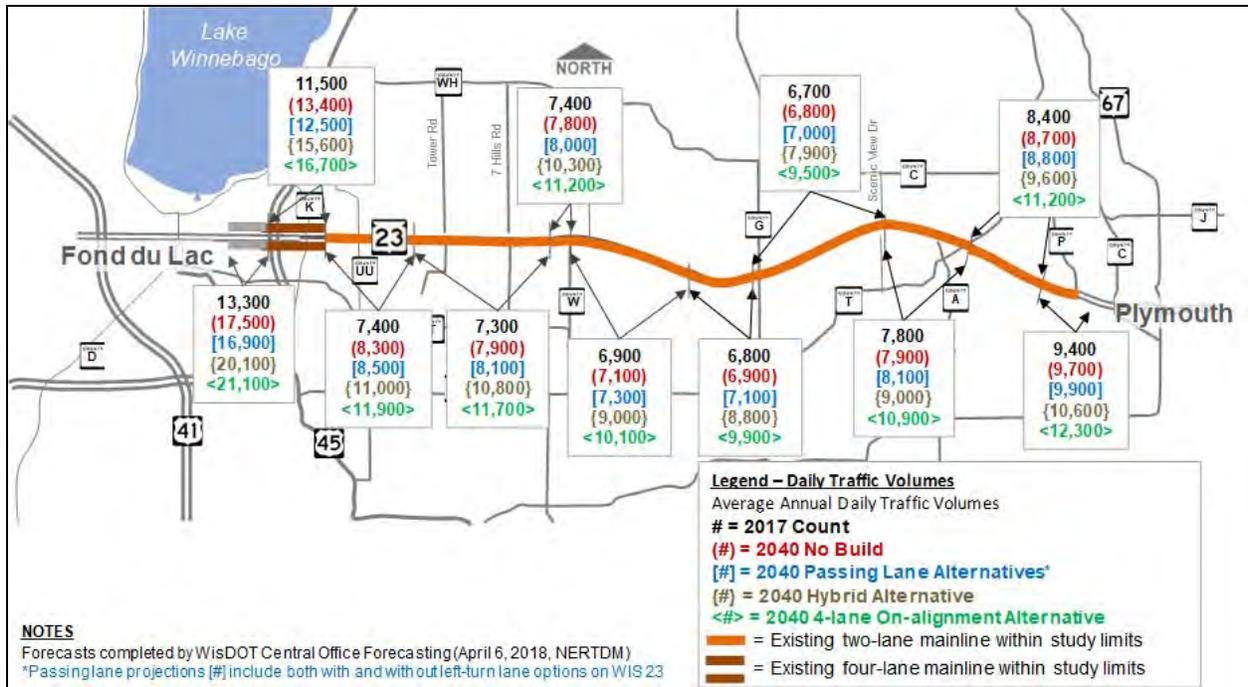


Figure 4.0-1 2040 Traffic Forecast Volumes for Alternatives

B. Operational Analysis

WisDOT performed an operational analysis for each alternative using Highway Capacity Software (HCS). The analysis included WIS 23 mainline operations as well as side road operations analysis. Two memoranda describing the inputs and methodology used for the operational analysis are available in Appendix A of the 2018 LS SEIS.

Tables 4.0-1 and -2 show the operational analyses for the WIS 23 mainline. The tables divide the corridor into two sections because the 2017 volumes are slightly higher east of County G. Dividing the corridor into sections provides a more accurate analysis of each section. 2017 values are not shown for the Passing Lane, Hybrid, and 4-lane On-alignment Alternatives since 2017 represents an existing condition. The tables also show the LOS using fully uniform peaking characteristics for 2040. This assumes that WIS 23 would experience the same amount of traffic for each 15-minute period of the peak hour, consistent with current WisDOT policy for future operational analysis. The combination of the small increase in the forecast average annual daily traffic volumes (2 to 7 percent) and the leveling of volumes within the peak hour contributes to a projected 2040 No-Build LOS that will be about the same or slightly better than the LOS calculated for 2017.

Table 4.0-1 Alternative Operations—County UU to County G

	No-Build		Passing Lane Alternative Without Left Turn Lanes		Passing Lane Alternative With Left Turn Lanes		Hybrid Alternative		4-lane On-alignment Alternative	
	EB	WB	EB	WB	EB	WB	EB ^[1]	WB ^[1]	EB ^[1]	WB ^[1]
LOS 2017 (Numeric)	4.17	4.18	2017 values are not shown for the Passing Lane, Hybrid, and 4-lane On-alignment Alternatives since 2017 represents an existing condition.							
LOS 2017	D	D								
% Following 2040	66.3%	66.6%	53.1%	52.8%	54.8%	54.3%	--	--	--	--
LOS 2040 (Numeric)	4.09	4.11	3.21	3.19	3.32	3.29	--	--	--	--
LOS 2040	D	D	C	C	C	C	A	A	A	A

[1] Note that % following is not shown in alternatives with 4-lane cross section because it is not a variable in determining LOS.

Table 4.0-2 Alternative Operations—County G to County P

	No-Build		Passing Lane Alternative Without Left Turn Lanes		Passing Lane Alternative With Left Turn Lanes		Hybrid Alternative		4-lane On-alignment Alternative	
	EB	WB	EB	WB	EB	WB	EB	WB	EB ^[1]	WB ^[1]
LOS 2017 (Numeric)	3.95	4.09	2017 values are not shown for the Passing Lane, Hybrid, and 4-lane On-alignment Alternatives since 2017 represents an existing condition.							
LOS 2017	C	D								
% Following 2040	62.0%	64.9%	62.0%	52.6%	64.2%	54.7%	67.7%	55.7%	--	--
LOS 2040 (Numeric)	3.80	3.99 ^[2]	3.80	3.17	3.95 ^[3]	3.31	4.05 ^[4]	3.38	--	--
LOS 2040	C	C	C	C	C	C	D	C	A	A

[1] Note that % following is not shown in alternatives with 4-lane cross section because it is not a variable in determining LOS.
 [2] The numeric LOS range for LOS C is 3.01 to 4.00, and for LOS D the range is 4.01 to 5.00. For County G to County P westbound, the 2040 No-Build LOS of 3.99 is just 0.02 away from LOS D.
 [3] For County G to County P westbound, the 2040 Passing Lane Alternative LOS of 3.95 is just 0.06 away from LOS D.
 [4] For County G to County P westbound, the 2040 Hybrid Alternative LOS of 4.05 is just 0.05 away from LOS C. The Hybrid Alternative operates slightly worse than the Passing Lane Alternative because more traffic is drawn to WIS 23.

Table 4.0-3 lists the LOS for higher volume side road intersections in the 2040 design year. Note that the traffic operations for the Passing Lane with left-turn lanes Alternative is better than the traffic operations for the Passing Lane without left-turn lanes Alternative. This is because the Passing Lane with left-turn lanes establishes a median for the left-turn bay. This median allows left turning and through vehicles from the side road to make the maneuver in two stages, improving the operations. Figure 4.0-2 illustrates this maneuver.

The RCUT operations for the County W/Loehr Rd intersections results for the Hybrid and 4-lane On-alignment Alternatives in Table 4.0-3 display the delay experienced for the right-in/right-out/left-in movements at the primary intersection and the delay and travel time experienced for the U-turn movements. For an RCUT, drivers that want to turn left onto or travel across WIS 23 from the side road must take a right turn and then make a U-turn at an appropriate distance from the intersection. This results in extra travel time, in addition to the stop-control delay, for movements that would use the U-turn.

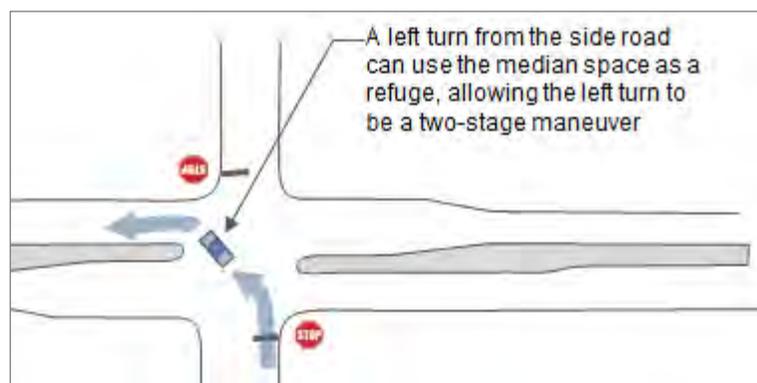


Figure 4.0-2 Left Turns with the Passing Lane with Left-Turn Lanes Alternative

Table 4.0-3 Side Road Operations

NBL/TH = Northbound Left/Through, NBR = Northbound Right, SBL/TH = Southbound Left/Through, SBR= Southbound Right

Intersection and Movement (unless otherwise noted)	No-Build Delay (s)	No-Build LOS	Passing Ln w/o Left Ins Delay (s)	Passing Ln w/o Left Ins LOS	Passing Ln w/Left Ins Delay (s)	Passing Ln w/Left Ins LOS	Intersection and Movement (unless otherwise noted)	Hybrid Alternative Delay (s)	Hybrid Alternative LOS	4-lane On-alignment Delay (s)	4-lane On-alignment LOS	
County UU 2040 AM Peak								Interchange with roundabout				
NBL/TH	24.5	C	25.4	D	17.3	C	NB	3.4	A	3.4	A	
NBR	10.4	B	10.4	B	10.4	B	EB off	3.5	A	3.5	A	
SBL/TH	22.1	C	22.7	C	16.0	C	SB	3.2	A	3.3	A	
SBR	12.4	B	12.6	B	12.6	B	WB off	3.2	A	3.2	A	
County UU 2040 PM Peak								Interchange with roundabout				
NBL/TH	39.1	E	41.8	E	21.2	C	NB	4.2	A	4.3	A	
NBR	12.7	B	12.8	B	12.8	B	EB off	3.4	A	3.4	A	
SBL/TH	27.9	D	29.0	D	18.5	C	SB	3.8	A	3.9	A	
SBR	11.6	B	11.7	B	11.7	B	WB off	3.5	A	3.5	A	
County W/ Loehr Rd 2040 AM Peak								RCUT				
NBL/TH	16.7	C	17.0	C	13.8	B	NBR	9.8	A	10.0	A	
NBR	10.1	B	10.1	B	10.1	B	EBL	8.8	A	9.0	A	
SBL/TH	17.2	C	17.7	C	14.1	B	SBR	10.4	B	10.7	B	
SBR	10.7	B	10.7	B	10.7	B	U-turns	U-turns	A (delay) D (travel time)	U-turns	A (delay) D (travel time)	
County W/ Loehr Rd 2040 PM Peak								RCUT				
NBL/TH	20.5	C	21.1	C	16.0	C	NBR	10.1	B	10.3	B	
NBR	10.9	B	11.0	B	11.0	B	EBL	8.9	A	9.2	A	
SBL/TH	21.3	C	22.1	C	15.9	C	SBR	10.6	B	11.0	B	
SBR	10.8	B	10.9	B	10.9	B	U-Turns	U-turns	A-B (delay) D (travel time)	U-turns	B (delay) D (travel time)	
County G 2040 AM Peak								Interchange with roundabout				
NBL/TH	17.6	C	18.1	C	14.5	B	NB	3.6	A	3.7	A	
NBR	10.4	B	10.5	B	10.5	B	EB off	3.7	A	3.7	A	
SBL/TH	16.9	C	17.3	C	14.1	B	SB	3.4	A	3.5	A	
SBR	10.3	B	10.4	B	10.4	B	WB off	3.5	A	3.5	A	
County G 2040 PM Peak								Interchange with roundabout				
NBL/TH	22.0	C	22.9	C	16.4	C	NB	3.8	A	3.9	A	
NBR	10.6	B	10.7	B	10.7	B	EB off	3.7	A	3.8	A	
SBL/TH	20.6	C	21.3	C	15.8	C	SB	3.4	A	3.5	A	
SBR	10.5	B	10.6	B	10.6	B	WB off	3.5	A	3.5	A	

Note: See Appendix A, Traffic Modeling Methodology Memorandum, for detailed operations tables and information on input and assumptions used in the intersection traffic operations analysis.

C. Safety

Safety improvements are often termed countermeasures because they counter specific safety deficiencies. WisDOT has always considered and incorporated countermeasures in highway improvements to address safety deficiencies. In recent years there have been studies and guides published that allow a more quantitative approach to safety evaluation. Two references that provide guidance on countermeasures to existing crash problems are the *2010 Highway Safety Manual*, published by American Association of State Highway and Transportation Officials²⁷; and the *2008 Desktop Reference for Crash Reduction Factors*²⁸ published by FHWA and based on report FHWA-SA-08-011. Information from these texts is referenced here to provide an understanding of the potential effectiveness of the countermeasures being incorporated in the alternatives that will be addressed in this 2018 LS SEIS.

The Highway Safety Manual outlines a process that allows highway designers to predict the safety effects of different geometric modifications. The process uses Crash Modification Factors (CMF). A CMF is a multiplicative factor used when calculating the expected number of crashes after implementing a given countermeasure at a specific site.

The 2008 Desktop Reference for Crash Reduction Factors uses Crash Reduction Factors (CRF). A CRF is the percentage crash reduction that might be expected after implementing a given countermeasure at a specific site.

Table 4.0-4 WIS 23 Crash Types and Countermeasures

Crash Type	Number 2012-2016	Countermeasure	AASHTO CRF ^{a, c}	FHWA CRF ^c	Incorporated in Alternative?			
					No Build	Passing Ln	Hybrid	4-lane On-alignment
Head-On	5	Install median	12% injury 18% non-injury	15%	No	No	Partially	Yes
Sideswipe, Opposite Direction	13	Install median	12% injury 18% non-injury	15%	No	No	Partially	Yes
Sideswipe, Same Direction	26	Install passing lanes	25%	25% ²⁹	No	Yes	Partially	No
		Expand to 4 lanes	None given	35%	No	No	Partially	Yes
Angle Crashes at Intersection	29	Install interchange	42%	None given	No	No	2 interchanges	2 interchanges
		Install RCUT	20%	18%	No	No	Yes	Yes
		Install median refuge	None given	27% ³⁰	No	Partially	Partially	Yes
Rear-End Crashes ^b	52	Install left-turn lane	48%	48%	No	Partially	Yes	Yes
Run-off-the-Road	71	Expanding shoulder beyond 6 feet	13%	4% (8') 18% (10')	No	Yes	Yes	Yes

^a Converted from CMF.
^b Total rear-end crashes shown, of which 13 involved stopped left-turning vehicles and 6 involved vehicles slowing to make a turn.
^c Note CRF provided typically apply to all crash types at an intersection. While the countermeasures target specific safety concerns, there is not a direct correlation between the CRFs provided and the specified crash type.

²⁷ *2010 Highway Safety Manual*, (American Association of State Highway and Transportation Officials, First Edition, 2010, <http://www.highwaysafetymanual.org/Pages/default.aspx>)

²⁸ *Desktop Reference for Crash Reduction Factors*, Report Number FHWA-SA-08-011; Bahar, Geni; Masliah, Maurice; Wolff, Rhys; Park, Pete; U.S. Department of Transportation, Federal Highway Administration (FHWA), Office of Safety; <http://safety.fhwa.dot.gov/tools/crf/resources/fhwasa08011/>

²⁹ Assumed passing lanes in both directions.

³⁰ Note: the Desktop Reference for Crash Reduction Factors specifies a CRF of 27 percent for all crash types and severities, rather than specific angle crashes.

The main difference between CRF and CMF is that CRF provides an estimate of the percentage reduction in crashes, while CMF is a multiplicative factor. Both terms are widely used in the field of traffic safety.³¹ For the purposes of this technical memo, CMFs are converted to CRFs, for comparison sake, meaning they indicate the percent reduction of that type of crash the countermeasure may produce. Table 4.0-4 shows the type of crashes experienced on WIS 23, the type of countermeasure that is being used to address that safety concern, and the associated CRF associated with that countermeasure. Note that the countermeasures are provided for comparison as an indication of the measure's effectiveness. To project crash reductions, the predictive methods discussed in the 2010 Highway Safety Manual must be used.

It should be noted that each of the Build Alternatives includes a corridor preservation aspect that would designate and preserve land for future access modifications, such as overpasses and interchanges, through official mapping and an expressway designation component that helps prepare for future conversion.

5.0 PURPOSE AND NEED EVALUATION

Table 5.0-1 lists how well each alternative addresses the project purpose and need criteria discussed in Section 2.0 of this report. Generally, higher build alternatives more optimally address the criteria because they incorporate additional capacity and have the ability to incorporate more safety counter measures.

Because of this, the 4-lane On-alignment Alternative most optimally addresses the criteria, followed by the Hybrid Alternative.

³¹ Mathematically stated, $CMF = 1 - (CRF/100)$. For example, if a particular countermeasure is expected to reduce the number of crashes by 23 percent (i.e., the CRF is 23), the CMF will be $1 - (23/100) = 0.77$.

Table 5.0-1 WIS 23 Purpose and Need Evaluation Matrix					
Purpose and Need Evaluation Criteria	No Build Alternative	Passing Lane Alternative Without Left-Turn Lanes	Passing Lane Alternative With Left-Turn Lanes (and Median Refuge)	Hybrid Alternative 4-Lane to County G Passing Lane County G to County P	4-lane On-alignment Alternative
Average 2040 AADT County UU to County G	7,610	7,810	7,810	10,010	11,000
Average 2040 AADT County G to County P	7,810	7,990	7,990	8,840	10,500
Construction Cost (2017 dollars)	\$4.5 million	\$45.2 million (estimate based on Passing Lanes w/Left Turns design as it represents the higher impact sub-option)		\$72.7 million	\$85.8 million
1. System Linkage and Route Importance					
a. How well does the alternative address truck traffic needs? <i>No = Platooning needs not addressed. Minimally = Most platooning remains. Moderately = Some platooning remains. Yes = Platooning needs addressed.</i>	No There are limited opportunities for passing and few climbing lanes. Much of the corridor is marked as no passing. Based on summer 2017 traffic counts, daily truck traffic ranged from 22-26% and peak-hour truck traffic ranged from 13-17% for 2-lane WIS 23. Platooning from corridor truck traffic or slower-driving passenger vehicles continues, similar to the existing conditions.	Minimally Passing Lane segment provides 2 passing lanes in each direction that help disperse platoons and offset the negative effects of slow-moving vehicles, but do not prevent platoons from forming.	Minimally Passing Lane segment provides 2 passing lanes in each direction that help disperse platoons and offset the negative effects of slow-moving vehicles, but do not prevent platoons from forming.	Moderately The 4-lane portion from US 151 to County G keeps platoons from forming. East of County G, the 2-lane passing lane segment does not address platooning caused by trucks. The passing lane segment does provide 2 passing lanes that help disperse platoons and offset the negative effects of slow-moving vehicles, but these do not completely prevent platoons from forming.	Yes The 4-lane improvement keeps platoons from forming.
b. Does the alternative provide system continuity? <i>No = A mixture of 2-lane and 4-lane facility types. Yes = Consistent 4-lane facility.</i>	No The US 151 and WIS 23 Connector from Fond du Lac to Sheboygan (33 miles) is a mixture of 2-lane and 4-lane facility types.	No WIS 23 Connector from Fond du Lac to Sheboygan remains a mixture of 2-lane (19 miles), passing lane and 4-lane facility types.	No WIS 23 Connector from Fond du Lac to Sheboygan remains a mixture of 2-lane (19 miles), passing lane and 4-lane facility types.	No WIS 23 Connector from Fond du Lac to Sheboygan remains a mixture of 2-lane (8 miles will remain), passing lane and 4-lane facility types.	Yes WIS 23 Connector from Fond du Lac to Sheboygan (33 miles) has a consistent 4-lane facility type from Fond du Lac to Sheboygan.
2. Transportation Demand / Regional Economic Development					
a. How much does the alternative reduce travel time? <i>Minimally = 0-2 minute improvement over existing conditions (2017) travel times. Substantially = 2+ minute improvement over existing conditions (2017) travel times.</i>	Minimally Travel times are similar to the existing conditions during the 2040 peak hours. Average speeds during the 2040 peak hours are 58 mph.	Minimally Travel times are slightly better than the No-Build Alternative during the 2040 peak hours, with a travel time savings of 10-15 seconds. Average speeds during the 2040 peak hours are 59 mph.	Minimally Travel times are slightly better than the No-Build Alternative during the 2040 peak hours, with a travel time savings of 0-10 seconds. Average speeds during the 2040 peak hours are 59 mph.	Minimally Travel times are slightly better than the No-Build Alternative during the 2040 peak hours, with a travel time savings of 10-20 seconds. Average speeds during the 2040 peak hours are 60 mph in the 4-lane section and 58-59 mph in the 2-lane section. Because of the remaining 8 miles of 2-lane section, the speed limit would not be raised to 65 mph (and therefore further improve travel times).	Substantially Travel time savings over the No-Build alternative during 2040 peak periods is about 3 minutes and 5 seconds. A full 4-lane facility provides free flow speeds throughout the corridor by allowing for the corridor to be posted at 65 mph. This provides consistency with portions of WIS 23 east of the study corridor that would have posted speeds of 65 mph.
b. How well does the alternative provide predictable travel? <i>No = No change to predictability of travel Minimally = Provides more predictable travel by providing passing opportunities and/or improving safety for some portions of the corridor. Moderately = Provides more predictable travel by providing passing opportunities and/or improving safety for most of the corridor. Yes = Provides predicable travel by providing passing opportunities and improving safety for the entire corridor.</i>	No Traffic will still be impeded by slow moving agricultural, truck, and recreational vehicles.	Minimally Traffic will still be affected by slow moving agricultural, truck, and recreational vehicles. Yet approximately 2.35 miles of additional passing lanes would be available on the 19.1-mile corridor, in each direction, to disperse platoons. Crashes also impact predictable travel and are discussed under safety.	Minimally Traffic will still be affected by slow moving agricultural, truck, and recreational vehicles. Yet approximately 2.35 miles of additional passing lanes would be available on the 19.1-mile corridor, in each direction, to disperse platoons. Crashes also impact predictable travel and are discussed under safety.	Moderately Approximately 12.75 miles of added lanes (including passing lanes) are available on the 19.1-mile corridor, in each direction which will help disperse platoons. Crashes also impact predictable travel and are discussed under safety.	Yes A 4-lane facility provides the opportunity for high speed traffic to travel around slow-moving vehicles. The 4-lane section provides flexibility for incident management, where a greater potential exists for traffic to only affect one direction of travel when an incident does occur.
3. Legislative and Transportation Planning History					
a. Is the alternative consistent with and/or reflected in local land use and transportation plans? <i>The Fond du Lac MPO and Sheboygan Area plans indicate the desire to improve mobility along WIS 23 and to provide 4-lane expansion along WIS 23. No = Does not reflect the plans. Minimally = Improves mobility, does not include new 4-lane expansion for any portion of corridor. Moderately = Improves mobility, includes new 4-lane expansion for portion of corridor. Yes = Reflects the plans.</i>	No Contradicts MPO long range plans.	Minimally Improves the mobility of WIS 23 yet does not provide the 4-lane expansion mentioned in the MPO plans.	Minimally Improves the mobility of WIS 23 yet does not provide the 4-lane expansion mentioned in the MPO plans.	Moderately Improves the mobility of WIS 23 and provides 4-lane expansion discussed in the Fond du Lac Area MPO plan. It does not contain the 4-lane expansion discussed in the 2035 update to the Sheboygan Area Plan.	Yes Improvement is consistent with that mentioned in both the Fond du Lac Area MPO and Sheboygan Area plans.

Table 5.0-1 WIS 23 Purpose and Need Evaluation Matrix					
Purpose and Need Evaluation Criteria	No Build Alternative	Passing Lane Alternative Without Left-Turn Lanes	Passing Lane Alternative With Left-Turn Lanes (and Median Refuge)	Hybrid Alternative 4-Lane to County G Passing Lane County G to County P	4-lane On-alignment Alternative
<p>b. Is the alternative consistent with Wisconsin State Statute 84.013(3)(ra)? <i>Wisconsin State Statute 84.013(3)(ra) includes authorization for major highway improvements along the portion of WIS 23 from WIS 67 to US 41 in Sheboygan and Fond du Lac Counties.</i> No = Is not consistent with 84.013(3)(ra). Moderately = Consistent with 84.013(3)(ra) for a portion of the corridor. Yes = Consistent with 84.013(3)(ra).</p>	<p>No Does not provide an improvement to WIS 23 from Fond du Lac to Plymouth that meets 84.013(3)(ra).</p>	<p>No Does not provide an improvement to WIS 23 from Fond du Lac to Plymouth that meets 84.013(3)(ra).</p>	<p>No Does not provide an improvement to WIS 23 from Fond du Lac to Plymouth that meets 84.013(3)(ra).</p>	<p>Moderately Provides 4 lanes in Fond du Lac County but does not provide 4 lanes in Sheboygan County.</p>	<p>Yes Provides 4 lanes from Fond du Lac to Plymouth, which meets 84.013(3)(ra).</p>
<p>4. Existing and Future Traffic Volumes and Resulting Operations a. How well does the alternative improve WIS 23 mainline operational efficiency and mobility by meeting desired LOS for a Corridors 2030 Connector Route? <i>Desirable LOS C (numeric LOS of less than 4.0) in 2040.</i> No = Does not provide LOS C throughout the corridor. Moderately = Provides LOS C throughout portions of the corridor. Yes = Provides LOS C or better throughout the corridor.</p>	<p>No The WIS 23 mainline operates at LOS D from County UU to County G in 2040 and at LOS C from County G to County P in 2040 for both directions of travel.</p>	<p>Yes The WIS 23 mainline operates at LOS C in 2040 for both segments of the corridor and for both directions of travel.</p>	<p>Yes The WIS 23 mainline operates at LOS C in 2040 for both segments of the corridor and for both directions of travel.</p>	<p>Moderately The WIS 23 mainline operates at LOS A within the 4-lane section and at LOS C-D within the 2-lane section with passing lanes in 2040.</p>	<p>Yes WIS 23 mainline will operate at LOS A in both directions in 2040. Interchange merge and diverge segments at the proposed interchanges operate at LOS B or better.</p>
<p>b. How well does the alternative provide a reasonable LOS for vehicles trying to access WIS 23 at highly used intersections? <i>Desired LOS of D or above for all movements at intersections. The higher volume intersections of County G, County UU, and County W provide a metric of how well this criterion is satisfied.</i> No = Does not meet intersection LOS D goal. Moderately = Most intersections meet LOS D goal. Yes = Meets intersection LOS D goal.</p>	<p>Moderately All movements at County W and County G operate at LOS C or better. At County UU the northbound left-turn and through movement operate at LOS E (39.1 secs delay) in 2040.</p>	<p>Moderately All movements at County W and County G operate at LOS C or better. At County UU the northbound left-turn and through movement operate at LOS E (41.8 secs delay) in 2040.</p>	<p>Yes Side road movements at County UU, County W, and County G will operate at LOS C or better in 2040 with the introduction of a median refuge.</p>	<p>Yes Side road movements at County UU and County G will operate at LOS B or better in 2040 with the introduction of an interchange. Movements that are rerouted in the proposed Restricted Crossing U-Turn (RCUT) at County W operate at LOS D or better, which includes the extra travel time.</p>	<p>Yes Side road movements at County UU and County G will operate at LOS B or better in 2040 with the introduction of an interchange. Movements that are rerouted in the proposed RCUT at County W operate at LOS D or better, which includes the extra travel time.</p>
<p>5. Highway Geometry a. How well does the alternative incorporate the appropriate design criteria for the roadway classification? <i>Design criteria includes roadway standards for the design class and desirable LOS for the facility type.</i> No = Does not meet design criteria for all or most of corridor. Moderately = Meets design criteria for portions of corridor. Yes = Meets design criteria throughout the corridor.</p>	<p>Moderately Yes-Roadway generally meets standards for a 2-lane facility No-Cross section is not able to maintain LOS C in 2040 between County UU and County G (see above).</p>	<p>Yes Yes-Roadway is reconstructed to standards for Design Class A2 (2-lane).¹</p>	<p>Yes Yes-Roadway is reconstructed to standards for Design Class A2 (2-lane) Yes-Cross section is able to maintain LOS C in 2040 on eastbound WIS 23 between County G and County P (see above).</p>	<p>Moderately Yes-Roadway is reconstructed to standards for Design Class A3 (4-lane) and A2 (2-lane) No-Cross section is not able to maintain LOS C in 2040 on eastbound WIS 23 between County G and County P (see above).</p>	<p>Yes Roadway is reconstructed to standards for Design Class A3 (4-lane). Desired LOS criteria is met.</p>
<p>6. Access Management a. How well does the alternative reduce the number of hazardous movements (left turns or crossing from sideroads) at public access points through the installation of access restrictions or interchanges? No = No improvement, removal, or relocation of public access points. Minimally = Low number of public access points improved, removed, or relocated. Moderately = Some public access points improved, removed, or relocated. Substantially = Majority of public access points improved, removed, or relocated.</p>	<p>No All 67 existing public access (county or local road) intersections remain within the project limits where vehicles entering and exiting WIS 23 interrupt the flow of traffic, creating potential for conflict and subsequent crashes.</p>	<p>Minimally All existing public access intersections remain except for 5 intersections in the Fond du Lac urban area. Remaining intersections have full access with corresponding traffic conflict points or hazardous movements.</p>	<p>Minimally to Moderately All existing public access intersections remain except for 5 intersections in the Fond du Lac urban area. Some intersections are improved by providing of left turn lanes. Remaining intersections have full access with corresponding traffic conflict points or hazardous movements.</p>	<p>Moderately All public access intersections from County K to County G are improved, limited, or removed. From County G to County P all public access intersections remain full access with corresponding traffic conflict points or hazardous movements.</p>	<p>Substantially All public access intersections except for five low volume intersections are improved, limited, or removed.</p>

¹ See <http://wisconsindot.gov/rdwy/fdm/fd-11-15-att.pdf#fd11-15a1.1>. Accessed May 11, 2018.

Table 5.0-1 WIS 23 Purpose and Need Evaluation Matrix					
Purpose and Need Evaluation Criteria	No Build Alternative	Passing Lane Alternative Without Left-Turn Lanes	Passing Lane Alternative With Left-Turn Lanes (and Median Refuge)	Hybrid Alternative 4-Lane to County G Passing Lane County G to County P	4-lane On-alignment Alternative
b. How well does the alternative reduce the number of private access points through right of way acquisition? <i>No = No access points removed.</i> <i>Minimally = Low number of private access points removed.</i> <i>Moderately = Some private access points removed.</i> <i>Substantially = Majority of private access points removed.</i>	No All 168 private access points remain.	Minimally The private access points combined or removed are limited to each one mile passing lane segment.	Minimally The private access points combined or removed are limited to each one mile passing lane segment.	Moderately Many private access points removed from County K to County G. Some private access points removed from County G to County P. Those are limited to areas of purchase for passing lanes.	Substantially Majority of private access points removed from County K to County P.
c. Does the alternative designate and preserve land for future access modifications, such as overpasses and interchanges, through official mapping?	No	Yes	Yes	Yes	Yes
7. Improve Safety a. How well does the alternative adequately address WIS 23 mainline safety? <i>No = No safety countermeasures are introduced.</i> <i>Minimally = Limited safety countermeasures are introduced.</i> <i>Moderately = Some safety countermeasures are introduced.</i> <i>Substantially = Many safety countermeasures are introduced.</i>	No No safety countermeasures are introduced. Overall WIS 23 crash rates are currently approximately 30 and 10 percent below the total and KAB (fatal and severe injury crashes) statewide averages, respectively, along the two-lane sections. There are locations with higher than the statewide average KAB rate: County K-Whispering Springs (EB, 4-lane), 7 Hills Rd-County W/Loehr (2-lane), County W/Hinn-County W-Loehr (2-lane); and statewide average total crash rate: County K-Whispering Springs (EB, 4-lane) and County W/Hinn-County W/Loehr (2-lane). From 2012 to 2016, 53 of the 207 crashes (26%) along the corridor involved vehicles crossing the centerline. Incidents (crashes) are likely to affect traffic flow for one or both directions of travel, leading to potential secondary incidents. Speed limit adherence and law enforcement concerns are expected to remain.	Minimally Wider shoulders address run off road and same direction sideswipe type crashes. Passing lanes do not provide opportunity to build countermeasures for head on, opposite direction sideswipe and rear end crashes. Incidents (crashes) are likely to affect traffic flow for one or both directions of travel, leading to potential secondary incidents. Speed limit adherence and law enforcement concerns are expected to remain.	Minimally Wider shoulders address run off road and same direction sideswipe type crashes. Left turn lanes at high volume intersections help address rear end crashes. Passing lanes do not provide opportunity to build countermeasures for head on, opposite direction sideswipe and rear end crashes. Incidents are likely to affect traffic flow for one or both directions of travel, leading to a higher probability of secondary incidents. Speed limit adherence and law enforcement concerns are expected to remain.	Moderately From County K to County G countermeasures address all major type of crashes (head on, sideswipe opposite direction, same direction sideswipe, rear end, and run off road). About half of the KAB crashes and one quarter of all the crashes in the evaluation period can be tied to vehicles crossing the centerline. The 4-lane section provides a median – a safety countermeasure to address these types of crashes. Incidents are more likely to only affect one direction of travel. From County G to County P safety is improved but not for all crash types. Countermeasures introduced address run off and same direction sideswipe type crashes. Passing lanes do not provide opportunity to build countermeasures for head on, opposite direction sideswipe and rear end crashes. Incidents are likely to affect traffic flow for one or both directions of travel, leading to a higher probability of secondary incidents. Speed limit adherence and law enforcement concerns are likely to remain. Based on statewide average crash rates, the KAB crash rate for 65 mph expressways is approximately half that of 2-lane rural highways with AADTs greater than or equal to 7,000 vehicles per day.	Substantially Countermeasures address all major type of crashes (head on, sideswipe opposite direction, same direction sideswipe, rear end, and run off road). About ½ the KAB crashes and ¼ of all the crashes in the evaluation period can be tied to vehicles crossing the centerline. The 4-lane section provides a median – a safety countermeasure to address these types of crashes. The 4-lane section provides flexibility for incident management. Incidents are more likely to only affect one direction of travel. A consistent 4-lane cross section between US 151 and I-43 is expected to help speed limit adherence and enforcement. Based on statewide average crash rates, the KAB crash rate for 65 mph expressways is approximately half that of 2-lane rural highways with AADTs greater than or equal to 7,000 vehicles per day.
b. How well does the alternative address intersection safety? (e.g. the reduction of angle crashes) <i>No = All crossing conflicts remain.</i> <i>Minimally = Nearly all crossing conflicts remain.</i> <i>Moderately = Some crossing conflicts remain.</i> <i>Substantially = Few crossing conflicts remain.</i>	No No safety countermeasures are introduced. From 2012 to 2016, 88 of the 207 crashes (42%) along the corridor were intersection related.	No Nearly all crossing conflicts remain at intersections throughout the corridor. No safety countermeasures are introduced for angle crashes.	Minimally Nearly all crossing conflicts remain at intersections throughout the corridor. A median refuge is provided for vehicles making a left or crossing maneuver from a side road at 9 intersections. No other safety countermeasures are introduced for angle crashes.	Moderately Crossing conflicts remain at intersections for about half of the corridor. This alternative provides countermeasures that include removing street access, interchange or RCUT construction, and the provision of a median refuge for intersections from US 151 to County G. No safety countermeasures are introduced for angle crashes on WIS 23 between County G and County P. RCUTs have been shown in Wisconsin (7 sites) to decrease KAB crash rates by 91 percent. RCUTs and interchanges are expected to improve safety at intersections. Proposed interchanges would increase the number of crossing conflicts; however, they would be with lower volumes and lower speeds.	Substantially Crossing conflicts are removed for nearly all intersections. Only five low-volume intersections retain full access. This alternative provides countermeasures that include removing side road access, interchange or RCUT construction, and the provision of a median refuge for intersections throughout the corridor. RCUTs have been shown in Wisconsin (7 sites) to decrease KAB crash rates by 91 percent. RCUTs and interchanges are expected to improve safety at intersections. Proposed interchanges would increase the number of crossing conflicts; however, they would be with lower volumes and lower speeds.

Table 5.0-1 WIS 23 Purpose and Need Evaluation Matrix					
Purpose and Need Evaluation Criteria	No Build Alternative	Passing Lane Alternative Without Left-Turn Lanes	Passing Lane Alternative With Left-Turn Lanes (and Median Refuge)	Hybrid Alternative 4-Lane to County G Passing Lane County G to County P	4-lane On-alignment Alternative
8. Accommodations for Nonmotorized Travel a. Does the alternative provide accommodations for non-motorized travel?	No No additional accommodations are provided for non-motorized users.	Yes Old Plank Road Trail is extended from Plymouth to Fond du Lac.	Yes Old Plank Road Trail is extended from Plymouth to Fond du Lac.	Yes Old Plank Road Trail is extended from Plymouth to Fond du Lac.	Yes Old Plank Road Trail is extended from Plymouth to Fond du Lac.
EVALUATION GENERALIZATIONS How well does the alternative satisfy the project's Purpose and Need? <i>No = No criteria are fully or Substantially met and few are Moderately met.</i> <i>Minimally = Majority are either No or Minimally.</i> <i>Moderately = Majority are either Moderately, Substantially, or Yes.</i> <i>Substantially = All criteria are fully or Substantially met.</i>	NO	MINIMALLY	MINIMALLY	MODERATELY	SUBSTANTIALLY

6.0 IMPACTS

WisDOT already purchased some of the right of way and completed most relocations needed for the WIS 23 4-lane On-alignment Alternative between 2010 and 2015, based on the decision from the 2014 LS SFEIS. These investments include 528 acres³² of right of way and 50 relocations. These purchases represent sunk costs. A sunk cost is a cost that WisDOT has incurred, and which it can no longer recover, or has great difficulty recovering. Sunk costs should not be considered when making the decision to continue investing in an ongoing project, since these costs cannot be recovered. Instead, only relevant costs should be considered.

Caution needs to be exercised to avoid the “sunk cost fallacy” in decision making. This fallacy inclines agencies and decision makers to continue a project because of the previous investments. Decision makers do not want to lose the initial investment by curtailing future funding to the project. To avoid this fallacy, agencies and decision makers consider earlier investments to be sunk costs, and therefore exclude them from consideration when deciding whether to continue with future investments. The following bullets summarize which impacts are sunk costs and no longer relevant, and which impacts are still relevant to the decision-making process.

- Right of way that has already been purchased is a sunk cost. While it is possible for the excess right of way to be auctioned off, the auctioned price is likely to be a small portion of the original purchase price.
- Relocations that have already occurred are a sunk cost. Of the 50 residential, business, and farm relocations that have already occurred, 46 sites have had their buildings razed. Previous owners cannot return to their homes, and the disruption to their families and businesses has already occurred.
- Right of way and relocations that have not already occurred are a legitimate impact consideration. They are impacts that would be incurred if an alternative is selected and constructed.
- Impacts to wetlands, uplands, threatened and endangered species, and other natural resources are a legitimate impact consideration. While these resources may now be in WisDOT ownership, the resources are largely intact and undisturbed. Construction of an alternative would degrade or remove these resources within the alternative’s proposed right of way.
- Impacts to farmland that has already been purchased is considered a sunk cost. WisDOT is not currently leasing the farmland along the corridor that has been purchased.³³
- Impacts to Section 4(f) resources are considered a sunk cost. The right of way needed from park Section 4(f) resources has already been acquired. Data collection efforts and Memorandum Of Agreement stipulations needed for Section 4(f) approval from Section 106 resources have largely been completed, with only minor revisions to the MOA being needed.

Table 6.0-1 lists the impacts associated with each alternative that would yet be incurred if that alternative was selected as the Preferred Alternative.

³² Actual surveyed amount is 530 acres between excess right of way and wetland mitigation. Value shown represents the approximate amount calculated using GIS parcel line files, not surveyed right of way lines. This also includes 159 acres for wetland mitigation sites, which would not be considered excess right of way.

³³ Note that some farmland purchased for wetland mitigation sites is being leased until the wetland mitigation has occurred.

Table 6.0-1 Remaining Impacts of WIS 23 Alternatives

	Unit	No Build	Passing Ln*	Hybrid	4-lane On-alignment
Construction Costs	\$million	\$4.5	\$45.2	\$72.7	\$85.8
Right of Way still needed	Acres	0	58	193	193
Residential relocations still needed	Number	0	0	0	0
Business relocations still needed	Number	0	0	1	1
Farm relocations still needed	Number	0	0	1	1
Resource Impacts					
Wetlands filled	Acres	0	29.9	45.9	51.8
Upland/Woodland	Acres	0	5	9	38
New stream crossings **	Each	0	1	4	5

* Passing Lane impacts are for sub-alternative with left-turn lanes.

** New stream crossings indicate where the Old Plank Trail or a new set of 2-lanes would cross a stream/river. This could be accomplished through bridges or culvert extensions.

7.0 PUBLIC AND LOCAL GOVERNMENT COMMENT

Since the issuance of the Notice of Intent to Prepare an LS SEIS on August 29, 2017; WisDOT has had one agency meeting, one public involvement meeting, one local government officials meeting, and one workshop to determine indirect and cumulative effects. The following paragraph summarizes the results of this coordination.

A. Summary of October 12, 2017 Public Involvement Meeting Comments

The following summarizes are comments received at the public involvement meeting and during the comment period, which went from October 12, 2017 to November 12, 2017.

- Over 700 comments were received during the comment period.
- 615 residents supported a 4-lane On-alignment Alternative.
- 24 residents supported a Passing Lane Alternative.
- 14 supported either a 4-lane On-alignment Alternative or a Passing Lane Alternative.
- 408 residents used the comment form to mention that WIS 23 is dangerous.
- 104 residents used the comment form to mention that WIS 23 is dangerous because of trucks/farm equipment and slow-moving traffic.
- 90 residents used the comment form to mention that WIS 23 is dangerous because of bad drivers and illegal maneuvers.
- 37 residents used the comment form to mention that WIS 23 is dangerous because of the curves, low passing opportunities, and grades.
- 52 residents take other routes to avoid WIS 23 altogether (many others stated that people they know avoid WIS 23).
- 63 residents used the comment form to mention that improvements to WIS 23 would help economic development.
- 32 residents requested the Old Plank Road Trail allow snowmobiles.

B. Summary of Recent Local Government Comments

Table 7.0-1 summarizes recent comments from local governments. Most comments were in response to the October 12, 2017 Public Involvement Meeting.

Table 7.0-1 Recent Local Government Comments

Local Government	Comment
Sheboygan County October 24, 2017	Resolution No. 15 (2017/2018): The Sheboygan County Board of Supervisors supports all state and federal efforts to improve State Highway 23 and encourages all necessary studies, including a new LS SEIS that will address the issues raised in the US District Court decision, to be completed promptly and accurately so that the needed construction of WIS 23 can be commenced and completed.
City of Sheboygan (Director of Planning & Development) October 27, 2017	Expansion of the WIS 23 corridor from Sheboygan to Fond du Lac is extremely important for the vitality and economic growth of the Sheboygan and region. Supports the efforts to expand WIS 23 both for the quality of life for our residents and the economic vitality of the community.
City of Plymouth October 31, 2017	Resolution No. 25 of 2017: It is the opinion of the city of Plymouth that the 4-lane divided highway project would improve safety and operational capacity. Therefore, be it resolved, that the city of Plymouth Common Council, supports and recommends the WIS 23 4-lane expansion from US 151 to County P.
City of Sheboygan Falls November 1, 2017	Resolution No. 10 (2017, 2018): The Sheboygan Falls City Council supports all state and federal efforts to improve State Highway 23 and encourages all necessary studies, including a new LS SEIS that will address the issues raised in the US District Court decision, to be completed promptly and accurately so that the needed construction of WIS 23 can be commenced and completed.
Fond du Lac County November 7, 2017	Resolution No. 58-17: The Fond du Lac County Board of Supervisors continues to support WisDOT's proposed construction of a 4-lane facility and opposes anything less than a 4-lane facility from Plymouth to Fond du lac to significantly improve safety, advance economic growth, and support efficient travel throughout the state and requests that WisDOT continues full effort with getting this project back on line for immediate construction.
Fond du Lac County (County Highway Commission) November 9, 2017	Fully reconstructing the corridor to a four-lane facility will allow safe passage of vehicles. The slotted left turn lanes, removal of lesser traveled at-grade intersections, and construction of full interchanges will reduce the conflict points and provide for safer overall travel movements. The construction of the bike path (Old Plank Road Trail) will connect the existing Sheboygan facility with Fond du Lac and eliminate any on road bike and pedestrian conflicts.
Fond du Lac County (Office of the County Executive) November 10, 2017	I strongly request that the DOT and those who make the policy decisions in this state, move forward with the four-lane expansion as soon as it can be done. Delays will be costly to the people who use the road and to the businesses and communities that are supported by the highway.
Town of Marshfield November 13, 2017	Resolution No 2017-05: Safety is a critical factor in the scope of this project and by widening the existing two-lane highway to a four-lane highway, safety would improve. The Town Board of Marshfield supports and endorses this resolution for the purpose of expediting and completing the Wisconsin Highway 23 project in Sheboygan and Fond du Lac counties.

8.0 PREFERRED ALTERNATIVE IDENTIFICATION

For WIS 23, the factors used in the identification of the Preferred Alternative include:

- How well the alternative addresses the Project Purpose and Need.
- The magnitude and significance of impacts.
- Public and stakeholder support.

Table 8.0-1 summarizes how well each alternative addresses these factors.

Table 8.0-1 Preferred Alternative Identification

	No Build	Passing Ln	Hybrid	4-lane On-alignment
Purpose and Need Satisfaction				
Number of factors fully or substantially satisfied	0	4-5	3	15
Number of factors moderately satisfied	2	1	10	0
Remaining Impacts ^[1]				
Construction costs	\$4.5	\$45.2M	\$72.7M	\$85.8M
Business and farm relocations still needed	0	0	2	2
Right of Way still needed	0 ac	58 ac	193 ac	193 ac
Wetlands filled	0	29.9 ac	45.9 ac	51.8 ac
Upland/Woodland	0	5 ac	9 ac	38 ac
New stream crossings ^[2]	0	1	4	5
Local governmental support letters ^[3]	0	2	2	8
Public support from Oct 12, 2017 Meeting comments ^[4]	0	38	0	629
^[1] Much of the right of way for the 4-lane On-alignment Alternative, the Preferred Alternative in the 2014 LS SFEIS, has been purchased and buildings razed. This occurred prior to the 2014 ROD being vacated. These represent sunk costs that are not supposed to influence future actions. ^[2] New stream crossings indicate where the Old Plank Trail or a new set of 2-lanes would cross a stream/river. This could be accomplished through bridges or culvert extensions. ^[3] Letters supporting a generic improvement of WIS 23 are attributed to all Build alternatives. ^[4] No written comments received specifically mentioned support for either the No-Build or Hybrid Alternatives.				

In the CEQ’s 40 Questions, Question 4 discusses the selection of the Preferred Alternative.

4a. Agency's Preferred Alternative. What is the "agency's preferred alternative"?

A. The "agency's preferred alternative" is the alternative which the agency believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors. The concept of the "agency's preferred alternative" is different from the "environmentally preferable alternative," although in some cases one alternative may be both. See Question 6 below. It is identified so that agencies and the public can understand the lead agency's orientation.

Question 4 indicates that the Preferred Alternative is the alternative the sponsoring agency believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, and other factors. It also states that the Preferred Alternative does not necessarily need to be the environmentally preferable alternative. Based on this guidance, the Preferred Alternative for WIS 23 is the 4-lane On-alignment Alternative with Corridor Preservation. Reasons for this selection include:

- The 4-lane On-alignment Alternative best fulfills WisDOT’s statutory mission and responsibilities:
 - It provides better traffic operations.
 - It provides more opportunities to incorporate safety countermeasures.
- The 4-lane On-alignment Alternative most optimally addresses the Purpose and Need factors compared to the other alternatives.
- The impacts do not outweigh the benefit derived from the 4-lane On-alignment Alternative.

- The majority of local governmental entities, along with commenting stakeholders, support the 4-lane On-alignment Alternative.

Corridor Preservation that also designates WIS 23 as an expressway will be included with the 4-lane On-alignment Alternative, which preserves right of way for future improvements. These include:

1. Grade separation (overpass) at Tower Road.
2. Cul-de-sacs at Poplar Road.
3. Grade separation (overpass) at 7 Hills Road.
4. Cul-de-sac at County W south and Hinn Road.
5. Rerouting of County W south to County W north roughly along Poplar Road and Loehr Road.
6. Diamond interchange at County W north intersection.
7. Grade separation (overpass) at Scenic View Drive.
8. Cul-de-sac at Plank Road.
9. Grade separation at Sugarbush Road.
10. Diamond interchange at County A.

Reasons for including Corridor Preservation with the 4-lane On-alignment Alternative include:

- WIS 23 Corridor Preservation will protect right of way for transportation improvements that are likely to be needed in the future. In preserving these areas for future transportation improvements, development within those areas can be minimized or avoided, reducing costs for WisDOT.
- WIS 23 Corridor Preservation, while having some current effect on property owners, will reduce impacts to the property owners in the long term. Without corridor preservation, these property owners may invest in improvements that may later need to be removed or relocated for transportation improvements.
- Implementation of the improvements associated with the WIS 23 Corridor Preservation measures is likely to occur within the planning horizon (30 years from official mapping).
- WIS 23 Corridor Preservation provides information useful to local property owners and governments as they make property acquisition and development approval decisions.
- WIS 23 Corridor Preservation measures will facilitate future access reductions. Without preserving right of way needed for future access roads, development could make access removal prohibitively expensive. This in turn would diminish the future safety and mobility of the corridor.
- Designating WIS 23 as an expressway will provide cost savings in the future as right of way can be purchased before development can occur, will allow for fully conceptualized design concepts to be developed and approved, and will help local units of government in planning their development along the corridor.³⁴

Additional environmental documentation would be completed prior to construction of improvements associated with any of the corridor preservation measures.

³⁴ WisDOT FDM 11-7-40-1.2, Accessed May 11, 2018.