

**SECTION 2
ALTERNATIVES**

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The Alternatives Section describes the alternative development and evaluation process. This 2018 **Limited Scope Supplemental Environmental Impact Statement (LS SEIS)** incorporates analyses and decisions made in the 2014 **Limited Scope Supplemental Final Environmental Impact Statement (LS SFEIS)** by reference. Specifically, this 2018 LS SEIS adopts the following decisions of the 2014 LS SFEIS **and the 2010 FEIS**:

- Eliminating the off-alignment highway alternatives from further consideration (Alternatives 2 through 6).
- Eliminating the Transportation System Management Alternative from further consideration.
- Eliminating the Transit Alternative from further consideration.
- Eliminating reconstruction of the existing 2-lane highway from further consideration.
- Selecting the No Corridor Preservation Alternative for the US 151/WIS 23 connection.

The analyses and decisions for these adopted solutions can be reviewed at the following web link: <http://wisconsin.gov/Pages/projects/by-region/ne/wis23exp/enviro.aspx> or a hard copy is available at the Wisconsin Department of Transportation (**WisDOT**) Northeast Region Office; 944 Vanderperren Way, Green Bay, WI 54304-5344.

This Alternatives Section differs from the Alternatives Section in the 2014 LS SFEIS in that it:

- Does not repeat the screening analysis used to determine feasible alternatives.
- Does not repeat a description of the alternatives presented in the 2004 EIS. This description and analysis are available in the 2014 LS SFEIS at the web link shown above.
- Carries forward for detailed study the Passing Lane and Hybrid Alternatives because they satisfy the Purpose and Need criteria related to traffic operations. These two alternatives do not fully satisfy other Purpose and Need criteria.
- **Adds corridor preservation associated with the Passing Lane and Hybrid Alternatives.**

Yellow highlight signifies updates since the May 2018 Limited Scope Supplemental Draft Environmental Impact Statement (LS SDEIS). Minor changes to grammar, punctuation, and usage are not highlighted. Highlighting of a figure or table title signifies updated or new information.

2.1 ALTERNATIVES AND ADVANCES

A. Adopted Decisions

This 2018 LS SEIS adopts the decisions made in previous NEPA documents regarding the elimination of alternatives. These decisions include the following.

- **Transit and Alternate Modes**—This alternative would establish transit service between Fond du Lac and Sheboygan where currently there is none. It would also provide a multimodal connection between Fond du Lac and Plymouth by extending Old Plank Road Trail. This alternative was eliminated from further consideration as a stand-alone solution because **it does not address several elements of the Purpose and Need.**

A portion of this alternative, extension of the Old Plank Road Trail, is incorporated as a component in the Passing Lane, Hybrid, and 4-lane On-alignment Alternatives evaluated in this document.

- **Transportation System Management (TSM)**—This alternative consists of low-cost improvements to improve traffic flow on the highway. Examples include innovative intersection designs and access management. This alternative was eliminated from further consideration as a stand-alone alternative because it does not address **several elements of the Purpose and Need.** Other alternatives discussed later in this document, such as the Passing Lane Alternative, Hybrid Alternative, and 4-lane On-alignment Alternative include TSM components in the form of

Restricted Crossing U-Turns (RCUT) intersections, access management, and measures to relieve passing demand on the highway.

- Reconstruct Existing 2-Lane Highway—This alternative would reconstruct the existing 2-lane highway while providing minor improvements to intersections. It was eliminated from further consideration because it does not satisfy **several** elements of the Purpose and Need.
- Off-alignment 4-Lane Alternatives—These alternatives would construct a new 4-lane expressway off of the existing WIS 23 alignment. Numerous alignments, both north and south of the existing WIS 23 highway, were investigated. These alternatives satisfied the Purpose and Need yet were eliminated from further consideration because there were other reasonable alternatives with fewer adverse environmental impacts.
- US 151/WIS 23 Connection Alternatives—These corridor preservation alternatives looked at converting the existing diamond interchange into a system interchange with free-flowing ramps connecting the US 151 expressway with the WIS 23 highway. The No Corridor Preservation Alternative was selected for this highway connection because the existing diamond interchange is anticipated to be sufficient for meeting the operational needs of the connection for the next 40 to 50 years.

B. Technological Advances

Rapid advances in technology are providing the opportunity for various levels of automation in motor vehicles. The automation ranges from just assisting drivers in their driving duties to fully automated control of the vehicle. Measures such as radar, Light Detection and Ranging (LIDAR), Global Positioning System (GPS), and computer vision are used to sense surroundings and then assist in driving functions. Many of these types of advancements have only recently emerged as technology that could be more broadly implemented in the near future. As such, these types of advances were not discussed in previous versions of the WIS 23 **environmental documents**.

While still in its infancy, the use of automated technology could eventually provide considerable benefits. By eliminating driver limitations and the potential for error, safer and more efficient use of roadways could occur. Potential benefits and challenges include:

- Reduced crashes previously caused by driver inattention.
- Reduced traffic congestion by allowing reduced headways between vehicles.
- Higher fuel efficiency.
- Integration of information systems to optimize routing and parking.
- Liability challenges—When a crash does occur, who is responsible?
- Computer compromise—When a computer or part of the system stops performing properly and impacts travel.

In May of 2013, the National Highway Traffic Safety Administration (NHTSA) issued a policy statement regarding automated technologies in motor vehicles. The intent of the policy statement is the safe implementation of this rapidly evolving technology. The document references the five levels of vehicle automation that are currently being used in the industry, which are summarized as follows.

- Level 0: No Automation
- Level 1: Function-Specific Automation
- Level 2: Combined Function Automation
- Level 3: Limited Self-Driving Automation
- Level 4: Full Self-Driving Automation

Some of the automated technologies have the potential to increase the vehicle carrying capacity of WIS 23. Limiting driver error could reduce crashes and make for more efficient traffic flow. For these benefits to be realized, much of the fleet using WIS 23 must be using these advanced technologies. The speed of market penetration for this technology is unclear. For example, the adoption of hybrid cars has been rapid since they were introduced to the United States on a larger scale in 1999. Yet in 2011, hybrid cars only comprised about 1 to 2 percent of the vehicles on the road. In 2016 they accounted for less than 2 percent of all cars sold in the United States.¹

Metropolitan Planning Organizations and State Department of Transportations are trying to discern how these rapid technology advances will affect vehicle miles traveled (VMT) and roadway efficiency. Some experts suggest that vehicle automation could increase VMT by keeping some driver populations (e.g., elderly) in their cars longer, and the possibility of zero-occupant vehicles. Currently there is no consensus on how to address the effect of these technologies.

WisDOT will monitor the potential benefits of this technology and potential adoption rates. At this point, it is not possible to fully understand how these technologies could influence the range of reasonable alternatives for the WIS 23 corridor.

C. Reasonable Alternatives

The Council on Environmental Quality (CEQ) recognizes in its regulations for implementing the National Environmental Policy Act (NEPA) that many alternatives may exist that address a project's Purpose and Need. The WIS 23 project team identified a range of reasonable alternatives that were presented in the 2004 EIS, the 2009 SDEIS and 2010 FEIS, and the 2013 LS SDEIS and 2014 LS SFEIS. Reasonable alternatives are those that are practical and feasible from systemwide engineering, environmental, and economic standpoints relative to meeting the Project Purpose and Need. The description and analysis of these alternatives is incorporated by reference and can be reviewed at the following web link: <http://wisconsindot.gov/Pages/projects/by-region/ne/wis23exp/enviro.aspx>

D. Range of Reasonable Alternatives

This LS SEIS re-evaluated the range of reasonable alternatives in light of current socio-economic data, crash data, and updated traffic forecasts. Because of this updated information, two alternatives that were previously dismissed in the 2014 LS SFEIS (Passing Lane and Hybrid Alternatives) satisfy more of the Purpose and Need criteria, specifically criteria related to traffic operations. These two alternatives do not satisfy all **elements** of the Purpose and Need, yet they are brought forward for detailed evaluation in this LS SEIS to provide lower impact alternatives for comparison to the 4-lane On-alignment Alternative. The following paragraphs briefly describe them.

- Passing Lane Alternative—This alternative reconstructs WIS 23 as a 2-lane highway east of County K, but adds two passing lanes in the eastbound direction and two passing lanes in the westbound direction. This alternative includes a jughandle intersection at County K and the extension of the Old Plank Road Trail (a multipurpose trail) from the city of Plymouth to the city of Fond du Lac. Two sub-options exist for this alternative. One **includes** left-turn lanes on WIS 23 at higher volume intersections **and one does not include** left-turn lanes. Section 2.3 describes this alternative in more detail.
- Hybrid Alternative—This alternative expands WIS 23 to a 4-lane expressway on the existing WIS 23 alignment from County K to just beyond County G. East of County G, WIS 23 is reconstructed as a 2-lane highway and adds one passing lane in the eastbound direction and one passing lane in the westbound direction. This alternative includes a jughandle intersection at County K and diamond interchanges at County UU and County G. The Hybrid Alternative also includes the extension of the Old Plank Road Trail from the city of Plymouth to the city of

¹ <http://www.hybridcars.com/april-2016-dashboard/>. Accessed November 2, 2017

Fond du Lac. This alternative installs left-turn lanes at several intersections in the 2-lane section east of County G. Section 2.4 describes this alternative in more detail.

The 2014 LS SFEIS included a corridor preservation alternative with the 4-lane On-alignment Alternative that would preserve right of way for future transportation improvements. It included preserving right of way for four grade separations (overpasses) as well as diamond interchanges at County W and County A. With this LS SEIS, the Passing Lane Alternative and the Hybrid Alternative also have an option to include corridor preservation with them. Corridor preservation for the Passing Lane and Hybrid Alternatives would preserve the same right of way needed for the four potential grade separations and the potential County W and County A diamond interchanges. It would also preserve the right of way needed to expand the 2-lane sections of these alternatives to four lanes. Additional environmental documentation to evaluate a range of alternatives and associated impacts and costs would be completed prior to the implementation of improvements within the preserved/mapped areas. Adopting the decisions from the 2014 LS SFEIS and adding the alternatives that are now deemed reasonable from the updated traffic forecasts produces the following Range of Alternatives Carried Forward for Detailed Study that are evaluated in this document.

1. No-Build Alternative (provides a baseline for comparison in accordance with 40 CFR 1502.14(d))
2. Passing Lane Alternative (with or without left-turn lanes)
 - a. Corridor Preservation Associated with Passing Lane Alternative
3. Hybrid Alternative
 - a. Corridor Preservation Associated with Hybrid Alternative
4. 4-lane On-alignment Alternative
 - a. Corridor Preservation Associated with 4-lane On-alignment Alternative

Figure 2.1-1 graphically summarizes the alternatives considered in WIS 23 NEPA documents and the range of reasonable alternatives addressed in this LS SEIS.

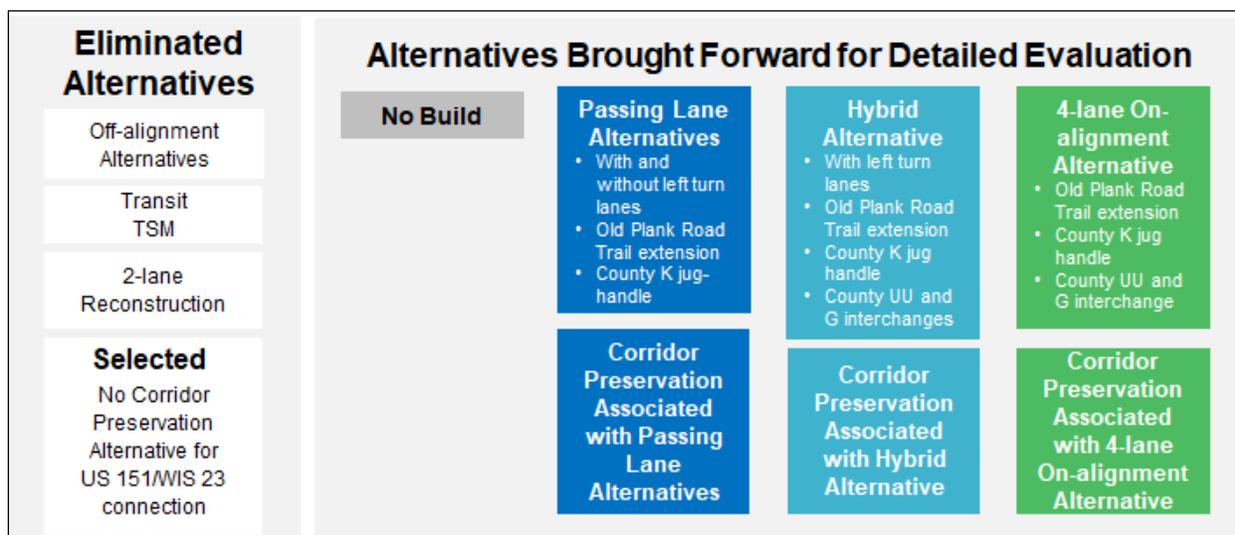


Figure 2.1-1 Range of Alternatives Carried Forward for Detailed Study

E. Preferred Alternative

WisDOT and FHWA identified a preferred alternative in the 2018 LS SDEIS. WisDOT and FHWA reviewed public and agency input from the public hearing and availability period on the 2018 LS SDEIS and confirmed the preferred alternative in the 2018 LS SFEIS (with agency concurrence). The 2018 ROD identifies the Selected Alternative.

During the process of identification of a preferred alternative prior to the release of the 2018 LS SDEIS, fifteen different evaluation criteria pertinent to the WIS 23 corridor were considered. The evaluation criteria were developed to

- Determine how well each alternative met the eight purpose and need factors, which are detailed in Section 1.3.
- Provide the specific detail on how each of the purpose and need factors would be evaluated.

The evaluation criteria were based on WisDOT and FHWA policy, standards, procedures, and/or state-of-the-practice considerations related to each factor. The discussion about the evaluation criteria considered and the reasons for identification are discussed in detail in Appendix F. Updates related to crash data and geometric design deficiencies are not shown in the May 15, 2018 Preferred Alternative Identification Memorandum presented in Appendix F, but are captured in this section and other applicable sections of this 2018 LS SEIS (see Appendix F, Pages F-1 and F-2 for more information).

The eight purpose and need factors and fifteen evaluation criteria are shown in Table 2.1-1.

Table 2.1-1 Purpose and Need Factors and Evaluation Criteria²

Purpose and Need Factor	Evaluation Criteria
System Linkage and Route Importance	How well does the alternative address truck traffic needs?
	Does the alternative provide system continuity?
Transportation Demand and Regional Economic Importance	How much does the alternative reduce travel time?
	How well does the alternative provide predictable travel?
Legislative and Transportation Planning History	Is the alternative consistent with and/or reflected in local land use and transportation plans?
	Is the alternative consistent with Wis. Stat. § 84.013(3)(ra)?
Existing and Future Traffic Volumes and Resulting Operation	How well does the alternative improve WIS 23 mainline operational efficiency and mobility by meeting desired LOS for a Corridors 2030 Connector Route?
	How well does the alternative provide a reasonable LOS for vehicles trying to access WIS 23 at highly used intersections?
Highway Geometry	How well does the alternative incorporate the appropriate design criteria for the roadway classification?
Access	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?
	How well does the alternative reduce the number of private access points through right of way acquisition?
	Does the alternative designate and preserve land for future access modifications, such as overpasses and interchanges, through official mapping?
Safety	How well does the alternative address WIS 23 mainline safety?
	How well does the alternative address intersection safety?
Accommodations for Nonmotorized Travel	Does the alternative provide accommodations for non-motorized travel?

² Table 2.1-1 Purpose and Need Factors and Evaluation Criteria was not included in the May 2018 LS SDEIS.

A summary of the Preferred Alternative Identification is presented as follows.

1. Build Alternatives

For WIS 23, the factors used in the identification of the preferred build alternative include:

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

Table 2.1-2 summarizes how well each alternative addresses these factors.

Table 2.1-2 Preferred Alternative Identification

	No-Build Alternative	Passing Lane Alternative	Hybrid Alternative	4 lane On alignment Alternative
Purpose and Need satisfaction				
Number of criteria fully or substantially satisfied	0	4-5	3	14 ^[5]
Number of criteria moderately satisfied	2	1	10	1 ^[5]
Remaining impacts ^[1]				
Construction costs remaining	\$3.8M	\$52.2M	\$85.7M	\$101.4M
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 received in October/November 2017 ^[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 before the 2014 ROD was 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] Two letters supporting construction of a generic improvement of WIS 23 are attributed to each build alternative. ^[4] No written comments received specifically mentioned support for either the No-Build or Hybrid Alternatives. ^[5] Updates to geometric design deficiencies resulted in a different number of evaluation criteria being met for 4-lane On-alignment Alternative versus what was included in the May 2018 LS SDEIS. The May 2018 LS SDEIS indicated all 15 evaluation criteria were fully or substantially satisfied by the 4-lane On-alignment Alternative. See Appendix F (Pages F-1 and F-2) for more information.				

After the public hearing and availability period on the 2018 LS SDEIS, WisDOT and FHWA reviewed public, agency, local government and tribal input as part of the process to confirm the Preferred Alternative.

The following summary provides the number of public comments received related to the alternatives.

- 342 Support 4-lane On-alignment Alternative.
13 of 342 - Number of people who support the 4-lane On-alignment Alternative and also mentioned support for corridor preservation.
- 24 Oppose the 4-lane Alternative.
- 24 Support Passing Lane Alternative.
- 7 Oppose Passing Lane Alternative.
- 1 Support Hybrid Alternative.

- 1 Oppose Hybrid Alternative.
- 1 Oppose No-Build Alternative.
- 8 Support project without specifying a specific alternative.
- 4 Oppose project without specifying support for No-Build Alternative.

There were 367 public commenters who specifically expressed support for an alternative, and more than 93 percent supported the 4-lane On-alignment Alternative. The local government and public support for each alternative since the public hearing is summarized in Table 2.1-3. See Section 7.3 for detail on local government comments and Section 7.5 for detail on public comments.

Consideration of agency input is another important aspect of the alternative selection process used by WisDOT and FHWA. State and federal regulatory agencies concurred with the identified preferred alternative, as detailed in Section 7.4.

Table 2.1-3 Local Government and Public Input Following Public Hearing³

	No-Build Alternative	Passing Lane Alternative	Hybrid Alternative	4 lane On alignment Alternative
Local government support letters following the June 19, 2018 public hearing	0	0	0	3
Public support following the June 19, 2018 public hearing ^[1]	0	24	1	342
^[1] Support was from written and verbal comments received at the public hearing as well as from comments submitted during the comment period.				

The 4-lane On-alignment Alternative with Corridor Preservation is the Preferred Alternative in this 2018 LS SEIS. It is the same Selected Alternative in the 2014 LS SFEIS/ROD. While the 2018 decision is the same as in previous documents, the 2018 decision includes consideration of additional alternatives that were not previously fully analyzed, and it reflects overwhelming support for the Preferred Alternative at the public hearing. Reasons for this selection include:

- Of the alternatives evaluated, the 4-lane On-alignment Alternative best fulfills WisDOT’s statutory mission and responsibilities:
 - It provides better traffic operations.
 - It provides the most substantial benefit to safety.
- The 4-lane On-alignment Alternative most optimally addresses the Purpose and Need factors compared to the other alternatives.
- The majority of local governmental entities, along with commenting stakeholders, support the 4-lane On-alignment Alternative.

2. Corridor Preservation

The Preferred Alternative includes corridor preservation that designates WIS 23 as a Freeway/Expressway under Wis. Stat. § 84.295(10) and preserves right of way for possible future access modifications. The possible future improvements associated with corridor preservation measures 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.

³ Table 2.1-3 Local Government and Public Input Following Public Hearing was not included in the May 2018 LS SDEIS.

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 as an element of the Preferred 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 Wis. Stat. § 84.295(10) 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.⁴

In the future, if WisDOT determines that transportation improvements are needed within these preserved areas, subsequent environmental documentation would be prepared to evaluate a range of alternatives and associated impacts and costs.

2.2 NO-BUILD ALTERNATIVE

The No-Build Alternative involves the continued use of WIS 23 without reconstruction or enhancements of the existing roadway. It includes the active and programmed WIS 23 resurfacing projects in Fond du Lac County (US 151 to County UU) and Sheboygan County (Division Road to County P). Although substandard roadway features are present in several locations and would require Design Exceptions to Standards, as noted in Section 1.3.E., they are not anticipated to impact the safety or operations of the roadway and would remain. Figure 2.2-1 schematically illustrates the No-Build Alternative.

⁴ WisDOT FDM 11-7-40-1.2, Accessed May 11, 2018.

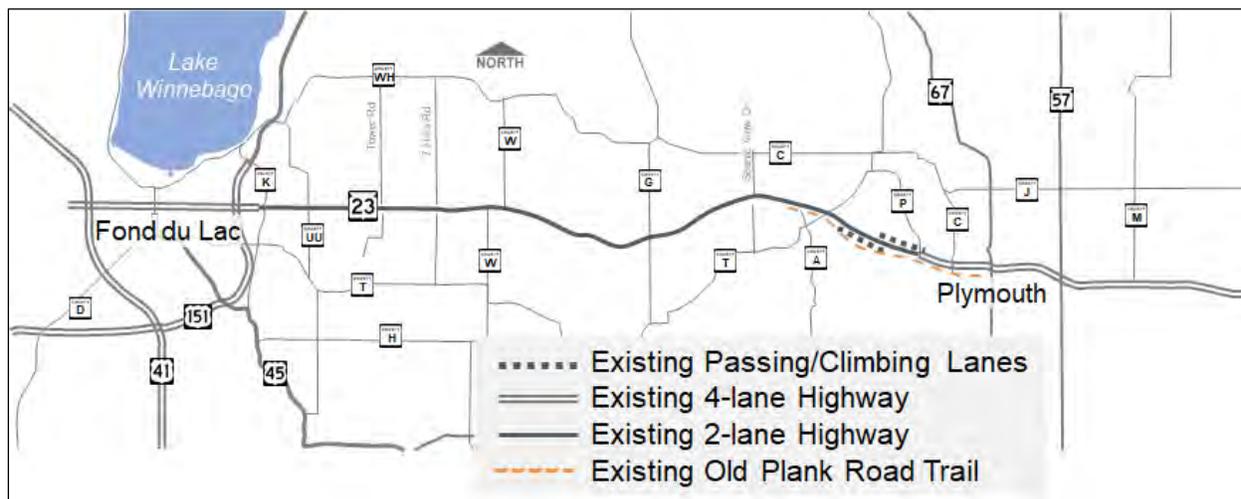


Figure 2.2-1 No-Build Alternative

Advantages of the No-Build Alternative include the following:

- Right-of-way acquisition would not be necessary.⁵
- Relocation of residences or businesses caused by construction would not occur.⁶
- Impacts to environmentally sensitive areas would be avoided.
- Infrastructure costs would be lower.

Disadvantages of the No-Build Alternative include the following:

- Current and future traffic congestion on the existing route would not be addressed.
- WIS 23 would not have highway system continuity between the 4-lane US 151 and the 4-lane section of WIS 23 to the east.
- WIS 23 would not fulfill operational objectives for a Connector route in Corridors 2030, part of the *Connections 2030 Statewide Long-Range Transportation Plan*, linking economic and tourism centers.
- This alternative does not address the dangerous mix of slow-moving farm vehicles and their difficulty crossing highway traffic.
- The 235 existing access points would continue to create crash potential along WIS 23.

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).

⁵ Note that because of the previously approved ROD, right of way was acquired prior to the vacation of the ROD. If the No-Build Alternative would be selected, this recently acquired right of way would become excess right of way.

⁶ Note that because of the previously approved ROD, residences and businesses were acquired prior to the vacation of the ROD. Most of the buildings acquired to date have been razed.

2.3 PASSING LANE ALTERNATIVE

A. Passing Lane Alternative

WIS 23 is not designated as a passing lane corridor⁷ in WisDOT's Facilities Development Manual (FDM) yet current traffic forecasts indicate design-hour volumes are within the thresholds for considering passing lanes based on FDM policy.⁸ WisDOT has criteria for locating passing lanes to provide optimal operational benefits, as found in WisDOT's FDM 11-15-10. Using this design criteria, 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 2.3-1 schematically illustrates the Passing Lane Alternative.

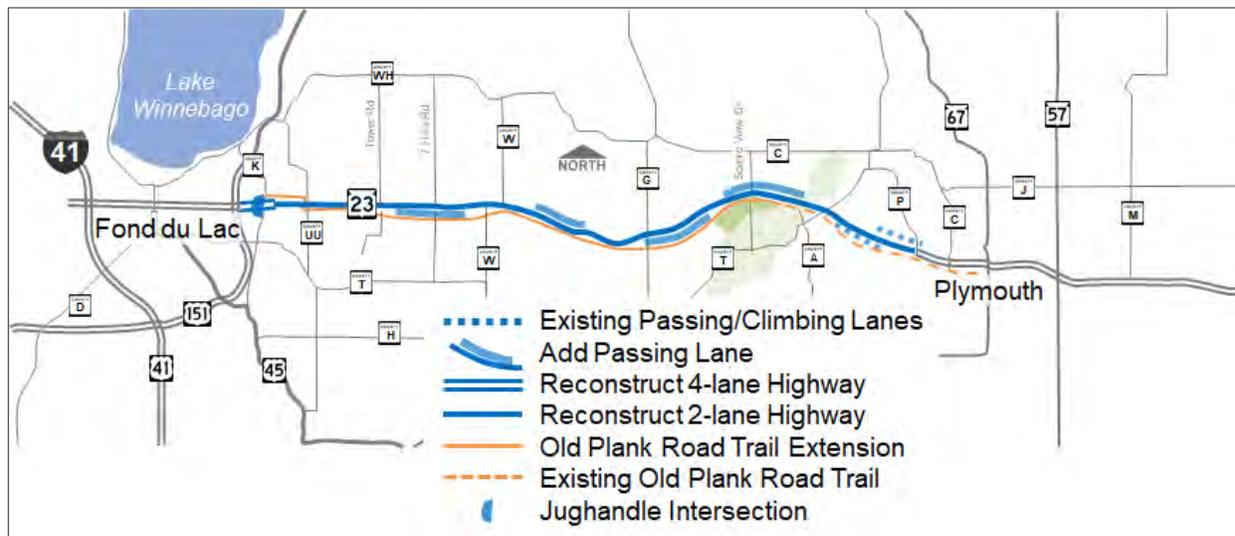


Figure 2.3-1 Passing Lane Alternative

The Passing Lane Alternative would generally, but not fully, meet design standards. Design Exceptions to Standards for grade would be required in two locations along the corridor, as noted in Table 1.3-3, because the existing substandard grades present would not be improved as part of the Passing Lane Alternative. Approval of Design Exceptions to Standards for grade is not anticipated to substantially impact the safety or operations of the roadway under this alternative and meeting the design standards for grade would result in substantial impacts to the natural environment and increased project costs. Justification of design exceptions is typical when building to full standards would result in only minor incremental benefits and the associated environmental impacts and costs would be substantial. Locations where the roadway grade is flat and will not meet the recommended minimum grade, while not requiring Design Exception to Standards, are also identified in the Design Exception to Standards reports. The other substandard items, the sight distance for northbound trucks turning left onto WIS 23 at County G and the intersection angle for Pit Road, will be documented in the Design Study Report during final design.

⁷ 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.

⁸ 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%], accessed May 11, 2018.

The Passing Lane Alternative typical section would include 8- to 10-foot shoulders and shallow sloped 34-foot clear zones beyond the outside edge of the lane. Figure 2.3-2 illustrates the Passing Lane Alternative typical section.

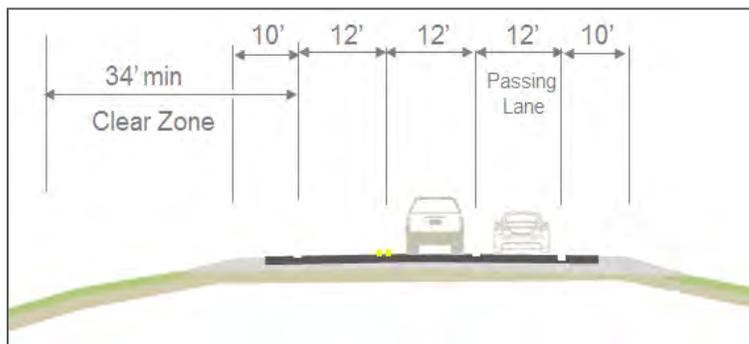


Figure 2.3-2 Passing Lane Typical Section

There are two sub-options 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 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.⁹

The sub-option with left-turn lanes adds left-turn lanes on WIS 23 at ten higher volume intersections. These intersections include County UU, Tower Road, 7 Hills Road, County W south, County W north, County G, County U, County T, County A, and County S. According to FDM guidelines, most WIS 23 side-road intersections do not have traffic volumes that warrant the

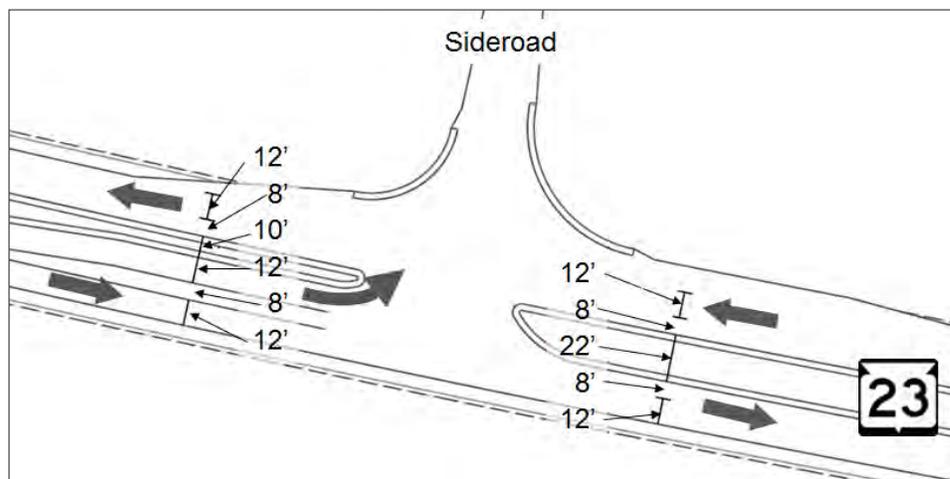


Figure 2.3-3 Typical Left-Turn Layout

installation of left-turn lanes.¹⁰ This sub-option includes left turn-lanes at ten intersections because they provide a warranted safety benefit. The left-turn lane provides a refuge for turning vehicles, removing them from exposure to the through travel stream and acting as a safety countermeasure for rear end crashes. 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 requires the development of a median for 0.2 miles of mainline for each side of the side-road intersection, which decreases the amount of roadway that is available for passing. Figure 2.3-3 illustrates a typical configuration of a WIS 23 T-intersection with a left-turn lane and associated median. 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.

⁹ Providing left-turn lanes requires the installation of a median for a portion of the highway, reducing the ability to pass in these locations.

¹⁰ FDM 11-25-5 provides warrants for the installation of left-turn lanes on rural highways. Left turn warrants are met for the County UU, County W north and south, County U, County T and County S intersections. Accessed May 11, 2018.

The Passing Lane Alternative would install a roundabout intersection at the Wisconsin American Drive 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 may incorporate roundabouts and would have a grade separation with bridges that carry WIS 23 traffic over County K. WIS 23 travelers destined for County K would have right-in/right-out access. This configuration eliminates dangerous crossing and left-turning maneuvers. The Passing Lane Alternative with left-turn lanes would modify the access at select driveways near the WIS 23 left-turn lanes. Figure 2.3-4 illustrates the Wisconsin American Drive roundabout and County K jughandle intersection. Roundabouts are shown at the jughandle intersection because they have a larger footprint, representing the greatest impacts. Determination of intersection type will be done during final design.

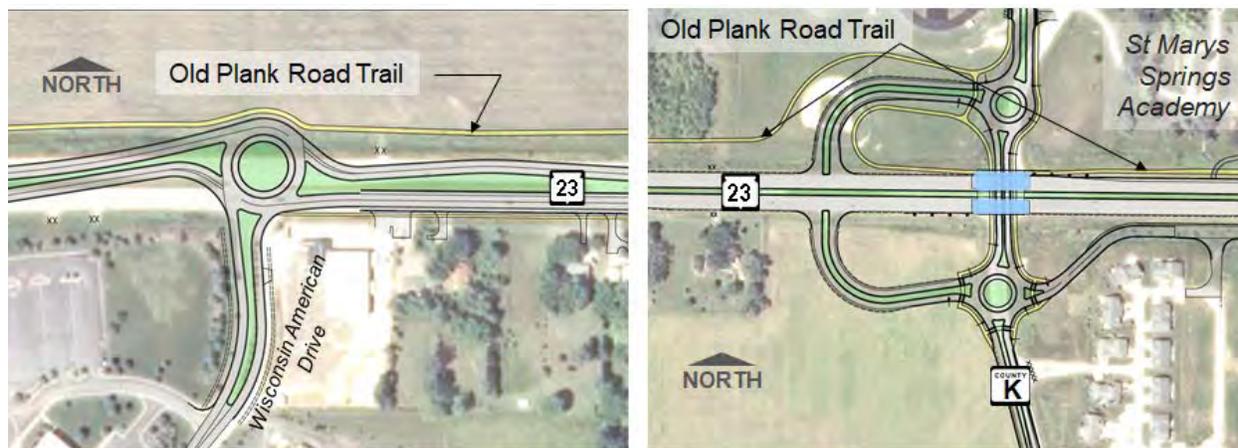


Figure 2.3-4 Wisconsin American Drive Roundabout (left) and County K Jughandle Intersection (right)

The Passing Lane Alternative would extend the Old Plank Road Trail, a multiuse path, from where it currently ends, near the Northern Unit of the Kettle Moraine State Forest (KMSF-NU), west to the Prairie Trail in Fond du Lac.¹¹ 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 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. Figure 2.3-5 schematically illustrates the Old Plank Road Trail extension in relation to other area multiuse trails. Figure 2.3-6 shows typical sections for the Old Plank Road Trail along the corridor. The analysis for the Old Plank Road Trail extension location is described in Section 2.5 of the 2014 LS SFEIS.

¹¹ 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.

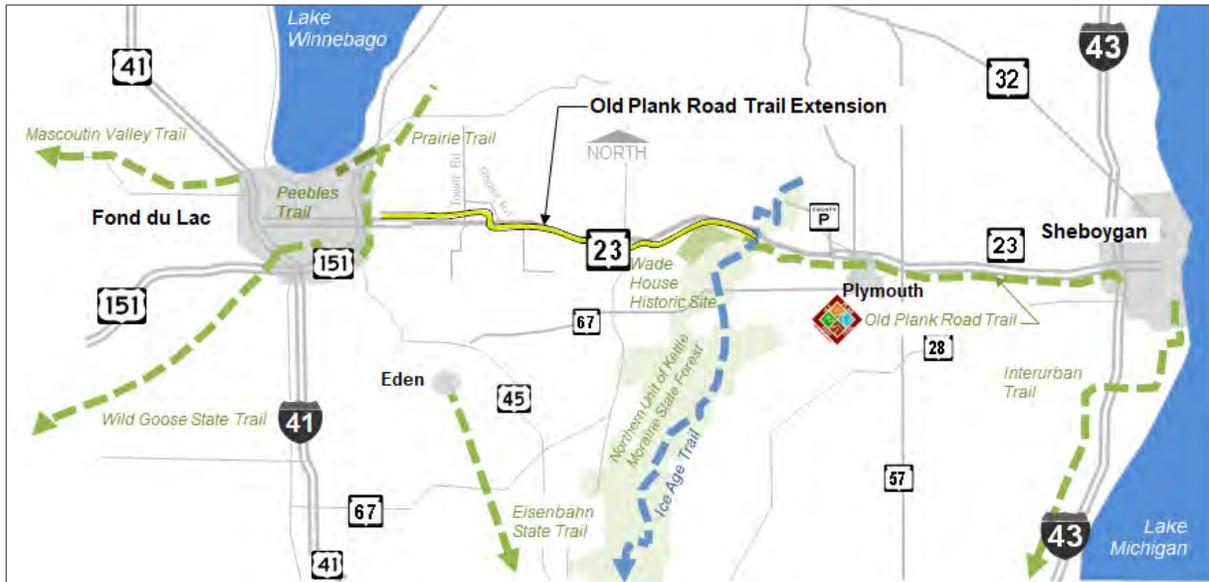


Figure 2.3-5 Old Plank Road Trail Extension

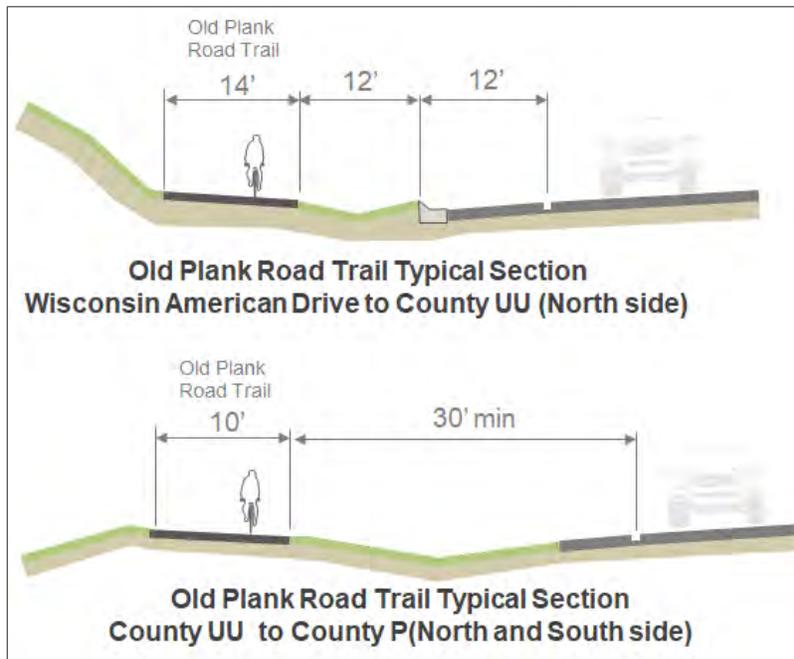


Figure 2.3-6 Old Plank Road Trail Typical Sections

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 KMSF-NU. 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. The IAT, the Equestrian Trail, and the KMSF-NU are all considered **Section 4(f)** resources that require impact evaluation according to federal law.

Because the IAT and State Equestrian Trail cross WIS 23 and the KMSF-NU 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 **that would** provide a clear width of 20 feet and a vertical clearance of 12 feet for the combined trails. The proposed crossing would be located near Julie

Lane (see Figure 2.3-7). This crossing was negotiated with the National Park Service as part of the Section 6(f) conversion request in the 2014 LS SFEIS. This commitment remains in effect.

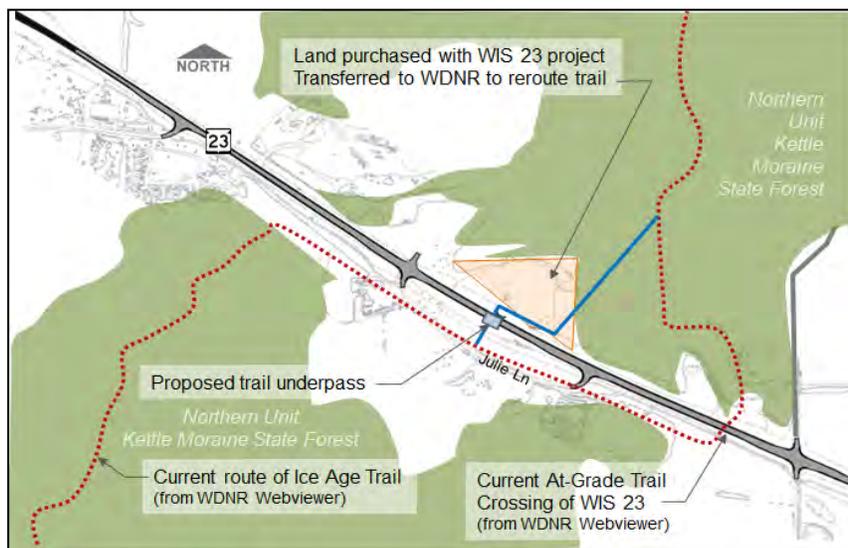


Figure 2.3-7 Ice Age Trail Treatments

B. Corridor Preservation Associated with Passing Lane Alternative

Wis. Stat. § 84.295(10) provides WisDOT authority to designate a state trunk highway as a future Freeway/Expressway. Corridor preservation seeks to preserve right of way for transportation improvements that are likely to be needed in the future. This is done through the process of Official Mapping. In Wis. Stat. § 84.295(10), WisDOT is given the authority to establish locations and right-of-way widths for future freeways or expressways and provides WisDOT the authority to purchase Officially-Mapped lands as right of way.

Through the official mapping action, conflicts with **land improvements** can be minimized or avoided within those corridor preservation areas. This reduces costs for WisDOT, which would have to purchase those land improvements if the proposed transportation improvement is implemented. It also reduces impacts to property owners, who would have to replace or relocate investments on their property with the implementation of the transportation improvement.

Resources within the corridor preservation areas 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 a 60-day notice before beginning that construction. **If WisDOT receives a notice, they will either acquire the property or approve the construction to move forward. If approval is given and in the future WisDOT determines transportation improvements are needed within the preserved area, the property owner will be compensated as part of the normal WisDOT acquisition process.** 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, subsequent environmental **documentation** would be prepared **to evaluate a range of alternatives and associated** impacts and costs.

The corridor preservation associated with the Passing Lane Alternative preserves right of way for possible future transportation improvements and designates WIS 23 as a future Freeway/Expressway under **Wis. Stat. § 84.295(10)**. Corridor preservation consists of preserving the right of way needed to expand WIS 23 to a 4-lane facility and provides access modifications to convert WIS 23 to an expressway. It would preserve right of way for the following possible future access modifications and improvements:

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

Figure 2.3-8 schematically illustrates these corridor preservation measures. As noted earlier, additional environmental documentation would need to be completed prior to the **implementation** of improvements **within the preserved/mapped areas**.

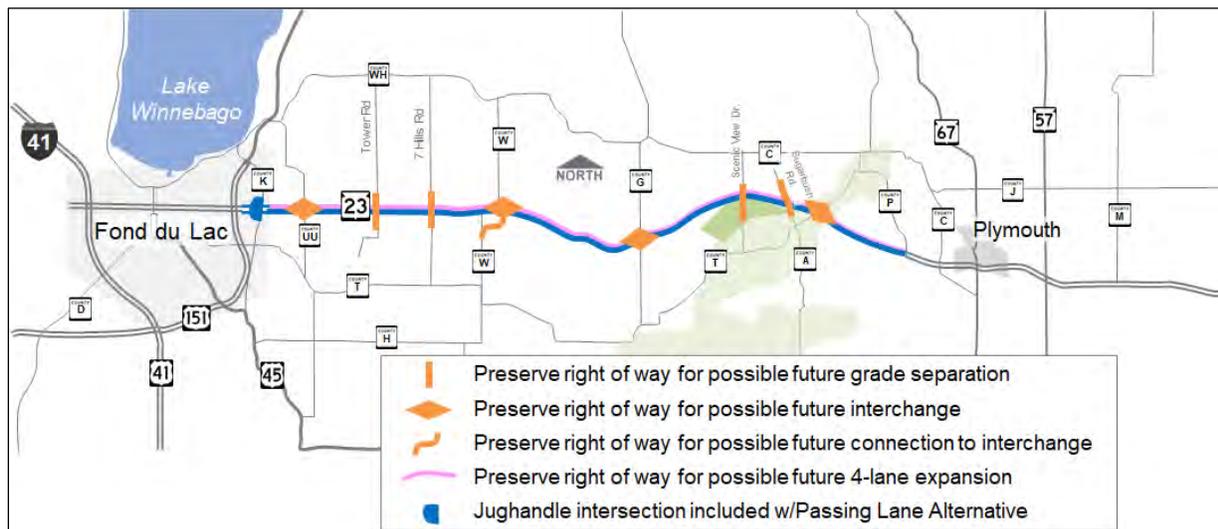


Figure 2.3-8 Corridor Preservation Associated with Passing Lane Alternative

2.4 HYBRID ALTERNATIVE

A. Hybrid Alternative

The Hybrid Alternative provides a 4-lane divided highway **for approximately 12 miles** from US 151 to County G, and a 2-lane roadway with passing lanes and left-turn lanes for **approximately 7 miles from County G to County P**. Posted speeds along WIS 23 would not be modified in this alternative. With this alternative, the eastbound passing lane east of County G overlaps with the County G interchange on-ramp. Figure 2.4-1 schematically illustrates **the Hybrid Alternative**.

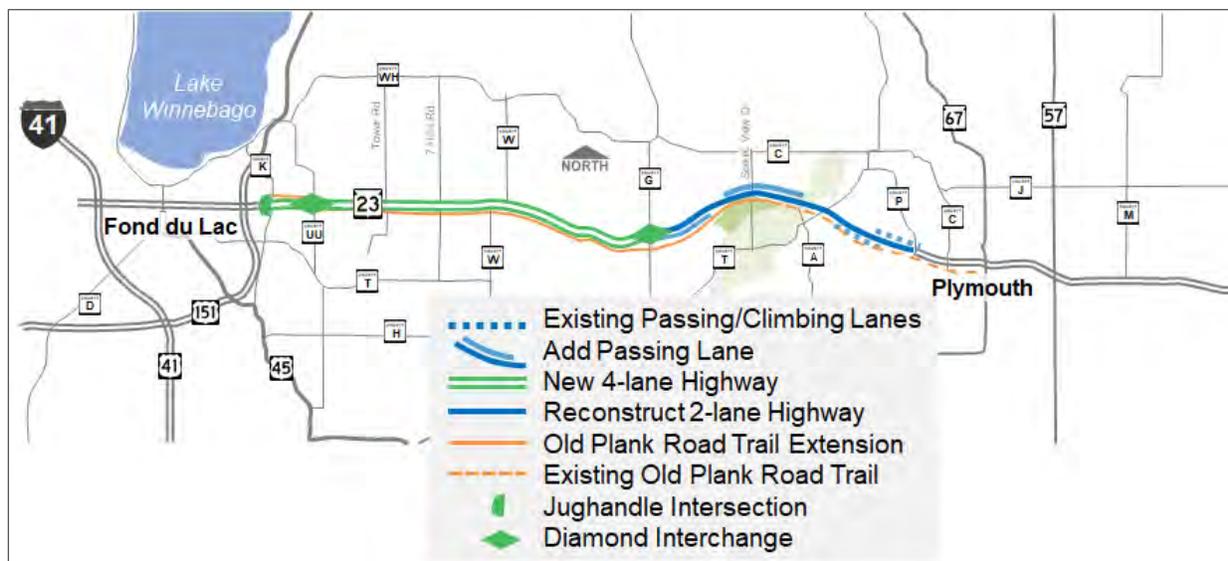


Figure 2.4-1 Hybrid Alternative—4 Lanes from US 151 to County G, 2 Lanes from County G to County P

The Hybrid Alternative would generally, but not fully, meet design standards. The proposed interchange at County G would address the substandard horizontal sight distance along northbound County G for trucks turning left onto WIS 23. Design Exceptions to Standards for grade would be required in two locations along the corridor, as noted in Table 1.3-3, because the existing substandard grades present would not be improved as part of the Hybrid Alternative. Approval of Design Exceptions to Standards for grade is not anticipated to impact the safety or operations of the roadway under this alternative and meeting the design standards for grade would result in substantial impacts to the natural environment and increased project costs. Justification of design exceptions is typical when building to full standards would result in only minor incremental benefits and the associated environmental impacts and costs would be substantial. Locations where the roadway grade is flat and will not meet the recommended minimum grade, while not requiring Design Exception to Standards, are also identified in the Design Exception to Standards reports. The substandard intersection angle for Pit Road will be documented in the Design Study Report during final design.

The Hybrid Alternative has the same roundabout intersection at Wisconsin American Drive as the Passing Lane Alternative, shown in Figure 2.3-4. It also has the same jughandle intersection at County K, also shown in Figure 2.3-4. The jughandle intersection may incorporate roundabouts and would have a grade-separation with bridges that carry WIS 23 traffic over County K. This intersection treatment is shown in Figure 2.3-4. 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 also installs a diamond interchange at County UU with County UU passing over WIS 23. This interchange may incorporate roundabouts at the ramp terminals and 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. Figure 2.4-2 illustrates the County UU interchange. Roundabouts are shown at the interchange because they have a larger footprint, representing the greatest impacts. Determination of intersection type will be done during final design.



Figure 2.4-2 County UU Interchange

The Hybrid Alternative also includes a diamond interchange at County G. The interchange **may incorporate roundabouts at the ramp terminals and includes an access road that connects to an adjacent property and a park and ride lot in the southeast quadrant.** Figure 2.4-3 illustrates the County G interchange. **Roundabouts are shown at the interchange because they have a larger footprint, representing the greatest impacts. Determination of intersection type will be done during final design.**

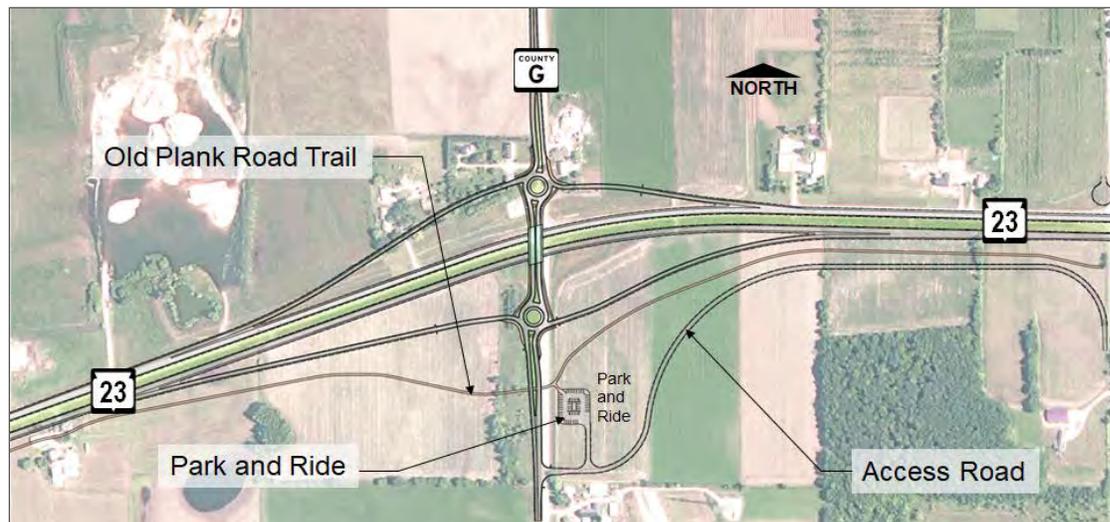


Figure 2.4-3 County G Interchange

The Hybrid Alternative makes access modifications in the 4-lane portion of the alternative. These access modifications include the installation of **RCUT intersections** at the Tower Road North, 7 Hills Road, County W **South**, and **County W North** intersections. **The RCUT concept is shown in Figure 2.4-4.** The RCUT intersection design only allows right-in/right-out/left-in movements and removes 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. At rural RCUT intersections, lighting will be installed at the U-turn movements. This type of intersection has been successfully used to improve intersection safety in several states, including seven locations in Wisconsin where they have decreased fatal and injury (KAB) crash rates by 91 percent.



Figure 2.4-4 RCUT Layout

The Hybrid Alternative would eliminate or relocate private access along WIS 23 in the 4-lane segment in Fond du Lac County, removing many mainline crossing conflicts. In the 2-lane segment, private access would be modified at six private driveways near intersections. The Hybrid Alternative would also install the same grade-separated underpass for the IAT, as described in Section 2.3 and shown in Figure 2.3-7.

B. Corridor Preservation Associated with Hybrid Alternative

The corridor preservation associated with the Hybrid Alternative preserves right of way for possible future transportation improvements and designates WIS 23 as a future Freeway/Expressway under Wis. Stat. § 84.295(10), as discussed with the corridor preservation associated with the Passing Lane Alternative in Section 2.3. It includes preserving right of way needed to expand WIS 23 from County G to County P to a 4-lane roadway and provide access modifications to convert WIS 23 to an expressway. It would preserve right of way for the following possible future access modifications:

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.
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 (overpass) at Sugarbush Road.
10. Diamond interchange at County A.

Figure 2.4-5 schematically illustrates the corridor preservation associated with the Hybrid Alternative. In the future, if WisDOT determines that transportation improvements are needed within these preserved areas, subsequent environmental documentation would be prepared to evaluate a range of alternatives and associated impacts and costs.



Figure 2.4-5 Corridor Preservation Associated with Hybrid Alternative

2.5 4-LANE ON-ALIGNMENT ALTERNATIVE

A. 4-lane On-alignment Alternative

The 4-lane On-alignment Alternative evaluated in this document was the Preferred Alternative in the 2014 LS SFEIS and is the Preferred Alternative in this 2018 LS SEIS. This alternative would provide a 4-lane divided highway on the existing alignment for the full length of the project. Like the Hybrid Alternative, it includes the roundabout at Wisconsin American Drive, the County K jughandle intersection, and diamond interchanges at County UU and County G. The County K jughandle intersection treatment is shown in Figure 2.3-4. RCUTs are also proposed at nine intersections: Tower Road, 7 Hills Road, County W South, County W North, County U, County T, Sugarbush Road, County A, and County S. 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 2.5-1 schematically illustrates the 4-lane On-alignment Alternative.

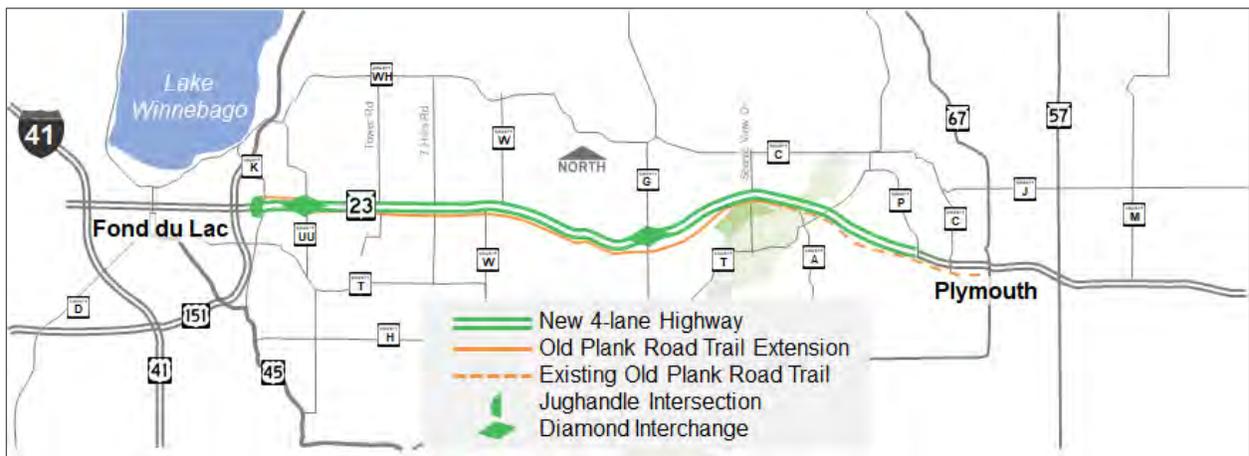


Figure 2.5-1 4-lane On-alignment Alternative

The 4-lane On-alignment Alternative would generally, but not fully, meet design standards. The proposed interchange at County G would address the substandard horizontal sight distance along northbound County G for trucks turning left onto WIS 23. Design Exceptions to Standards have been approved for the various locations of substandard grades along the corridor, as noted in Table 1.3-3, because the

proposed design grades are the same as the existing grades. Locations where the roadway grade is flat and will not meet the recommended minimum grade, while not requiring Design Exception to Standards, are also identified in the Design Exception to Standards reports.

The Design Exceptions to Standards were approved because they are not anticipated to substantially impact the safety or operations of the roadway and meeting the design standards for grade would result in substantial impacts to the natural environment and increased project costs. Justification of design exceptions is typical when building to full standards would result in only minor incremental benefits and the associated environmental impacts and costs would be substantial. The substandard intersection angle for Pit Road will be documented in the Design Study Report during final design.

From US 151 to County UU, the 4-lane On-alignment typical section would include four 12-foot lanes, 8-foot inside shoulders, 10-foot outside shoulders, and a 16-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 posted speed for this section of roadway will be 45 miles per hour (mph). Figure 2.5-2 illustrates this cross section.

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, see Figure 2.5-2. 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.

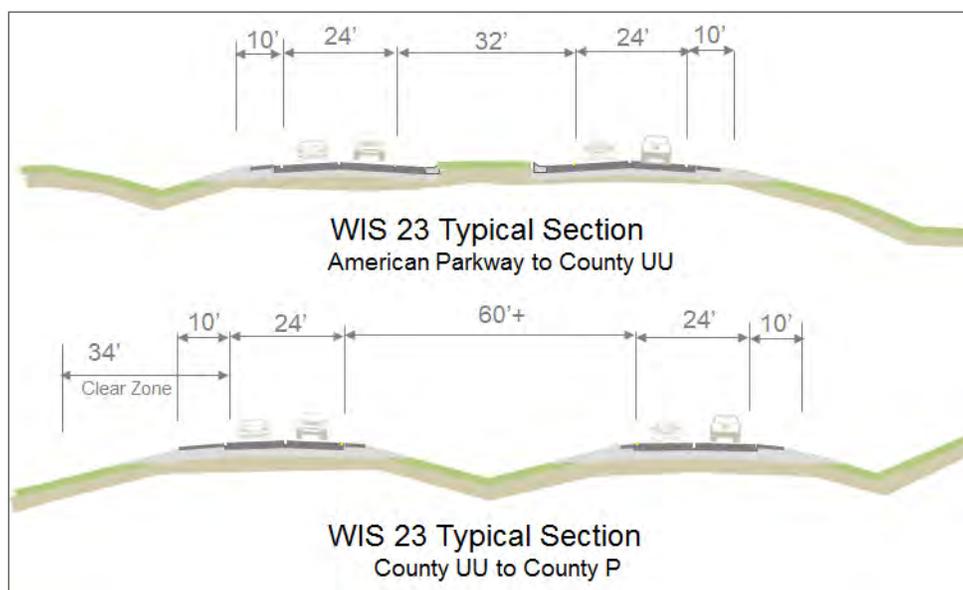


Figure 2.5-2 4-Lane On-alignment Typical Sections

The 4-lane On-alignment Alternative was designed to a 70 mph design speed (typically 5 mph above the posted speed). As a result of the design and expressway designation the facility will be posted at 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.¹² Wis. Stat. § 345.57(4) defines Wisconsin's fixed speed limits related to expressway designation.

The 4-lane On-alignment Alternative would eliminate or relocate some movements at many private access points along WIS 23 throughout the corridor, removing many mainline crossing conflicts. The

¹² The urbanized segment on the west end of the corridor will be posted at 45 mph, the same as existing. Any other areas of posted speed limits below 65 mph will be determined during final design.

4-lane On-alignment Alternative also includes a grade-separated crossing (underpass) for the IAT, as described in Section 2.3 and shown in Figure 2.5-3.

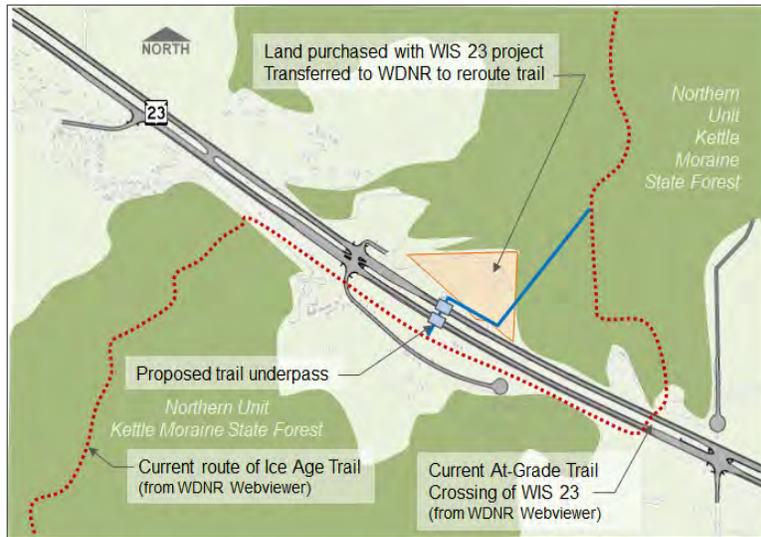


Figure 2.5-3 Ice Age Trail Crossing for 4-lane On-alignment Alternative¹³

B. Corridor Preservation Associated with 4-lane On-alignment Alternative

The corridor preservation associated with the 4-lane On-alignment Alternative includes designating WIS 23 as a Freeway/Expressway under Wis. Stat. § 84.295(10), as described in Section 2.3, and preserving right of way needed for the following possible future access modifications:

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.
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 (overpass) at Sugarbush Road.
10. Diamond interchange at County A.

In the future, if WisDOT determines that transportation improvements are needed within these preserved areas, subsequent environmental documentation would be prepared to evaluate a range of alternatives and associated impacts and costs.

Figure 2.5-4 schematically illustrates the corridor preservation associated with the 4-lane On-alignment Alternative.

¹³ Figure 2.5-3 Ice Age Trail Crossing for 4-lane On-alignment Alternative was not included in the May 2018 LS SDEIS.

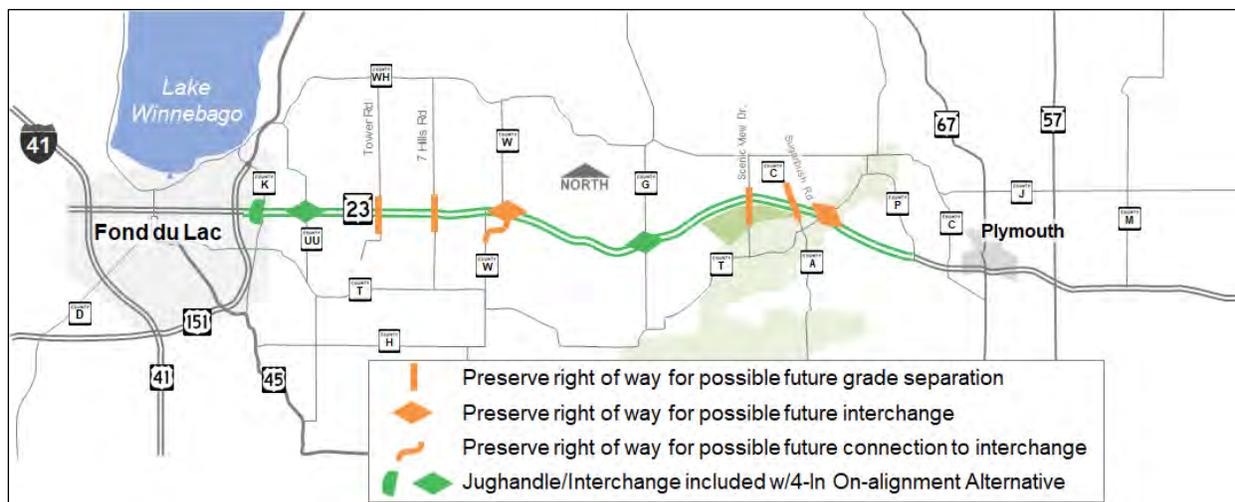


Figure 2.5-4 Corridor Preservation Associated with 4-lane On-alignment Alternative

2.6 ACCESS

Different access treatments would be applied to intersections with each alternative. Generally, the No-Build Alternative maintains full access at each intersection, unless it is already restricted as at County K. While providing full access, this alternative does not restrict the more hazardous crossing and left-turning movements from side road intersections.

The Passing Lane Alternative sub-option with left-turn lanes installs left-turn lanes on WIS 23 at County UU, Tower Road, 7 Hills Road, County W south, County W north, County G, County U, County T, County A, and County S. Most other intersections would remain the same. The Passing Lane Alternative sub-option without left-turn lanes keeps access to all movements at most intersections along the corridor. The corridor preservation associated with the Passing Lane Alternative preserves land for future access modifications at many intersections along the corridor, including a combination of cul-de-sacs, grade separations (overpasses), and interchanges.

The Hybrid Alternative restricts access at several intersections between County K and County G. East of County G, existing intersection access to and from WIS 23 is generally maintained. The improvements associated with the corridor preservation for the Hybrid Alternative preserves land for future modification of access to intersections both west and east of County G.

The 4-lane On-alignment Alternative modifies access to most intersections, with almost 85 percent of the corridor intersections receiving some type of access change. The corridor preservation associated with the 4-lane On-alignment Alternative further modifies access by preserving land for future grade separations (overpasses) and interchanges.

Table 2.6-1 lists the proposed intersection access for the Passing Lane, Hybrid, and 4-lane On-alignment Alternatives, and the possible future access changes if corridor preservation measures are implemented in the future. These access modifications were developed considering traffic volumes, spacing, and crash history for each intersection.

Table 2.6-1 Intersection Access Treatment for Each Alternative

Access Treatment (At-grade = full access intersection, RI/RO = right in/right out, LI = left in, RCUT = Restricted Crossing U-Turn)

Intersection	No-Build Alternative	Passing Lane Alternatives	Possible Future Improvements with the Corridor Preservation Associated with Passing Lane Alternatives	Hybrid Alternative	Possible Future Improvements with the Corridor Preservation Associated with Hybrid Alternative	4 lane On alignment Alternative	Possible Future Improvements with the Corridor Preservation Associated with 4 lane On alignment Alternative
Wisconsin American Drive	At-grade	Multi-Lane Roundabout	No change	Multi-Lane Roundabout	No change	Multi-Lane Roundabout	No change
County K	RI/RO/LI	Jughandle Intersection	No change	Jughandle Intersection	No change	Jughandle Intersection	No change
Mary Hill Park Drive	At-grade	At-grade	Access removed	Access removed	No change	Access removed	No change
Whispering Springs Drive	At-grade	RI/RO	No change	RI/RO	No change	RI/RO	No change
Hilltop Drive	At-grade	Cul-de-sac	No change	Cul-de-sac	No change	Cul-de-sac	No change
Northway Drive	At-grade	At-grade	Access removed	Access removed	No change	Access removed	No change
County UU	At-grade	At-grade	Diamond Interchange	Diamond Interchange	No change	Diamond Interchange	No change
Taft Road	At-grade	At-grade	RI/RO	RI/RO	No change	RI/RO	No change
Tower Road North	At-grade	At-grade	Overpass	RCUT	Overpass	RCUT	Overpass
Tower Road South	At-grade	At-grade	Overpass	RI/RO	Overpass	RI/RO	Overpass
Poplar Road North	At-grade	At-grade	Cul-de-sac	RI/RO	Cul-de-sac	RI/RO	Cul-de-sac
Poplar Road South	At-grade	At-grade	Cul-de-sac	RI/RO	Cul-de-sac	RI/RO	Cul-de-sac
7 Hills Road North	At-grade	At-grade	Overpass	RCUT	Overpass	RCUT	Overpass
7 Hills Road South	At-grade	At-grade	Overpass	RCUT	Overpass	RCUT	Overpass
Hinn Road	At-grade	At-grade	Cul-de-sac	RI/RO	Cul-de-sac	RI/RO	Cul-de-sac
County W South	At-grade	At-grade	Rerouting of County W	RCUT	Rerouting of County W	RCUT	Rerouting of County W
County W North	At-grade	At-grade	Diamond Interchange	RCUT	Diamond Interchange	RCUT	Diamond Interchange
Loehr Road	At-grade	At-grade	Diamond Interchange (via County W)	RCUT (via County W)	Diamond Interchange (via County W)	RCUT (via County W)	Diamond Interchange (via County W)
Log Tavern Road North	At-grade	At-grade	No change	At-grade	No change	At-grade	No change
Log Tavern Road South	At-grade	At-grade	Cul-de-sac	Cul-de-sac	No change	Cul-de-sac	No change
Triple T	At-grade	At-grade	Rerouted to Pit Road South	Rerouted to Pit Road South	No change	Rerouted to Pit Road South	No change
Pit Road North	At-grade	At-grade	No change	At-grade	No change	At-grade	No change
Pit Road South	At-grade	At-grade	No change	At-grade	No change	At-grade	No change
Banner Road	At-grade	At-grade	Cul-de-sac	Cul-de-sac	No change	Cul-de-sac	No change
Triple T Road North	At-grade	At-grade	No change	At-grade	No change	At-grade	No change

Table 2.6-1 Intersection Access Treatment for Each Alternative

Access Treatment (At-grade = full access intersection, RI/RO = right in/right out, LI = left in, RCUT = Restricted Crossing U-Turn)

Intersection	No-Build Alternative	Passing Lane Alternatives	Possible Future Improvements with the Corridor Preservation Associated with Passing Lane Alternatives	Hybrid Alternative	Possible Future Improvements with the Corridor Preservation Associated with Hybrid Alternative	4 lane On alignment Alternative	Possible Future Improvements with the Corridor Preservation Associated with 4 lane On alignment Alternative
Hillview Road North	At-grade	At-grade	RCUT	RI/RO/LI	RCUT	RI/RO/LI	RCUT
Hillview Road South	At-grade	At-grade	RI/RO	RI/RO	No change	RI/RO	No change
Hickory Road	At-grade	At-grade	Cul-de-sac	Cul-de-sac	No change	Cul-de-sac	No change
County G	At-grade	At-grade	Diamond Interchange	Diamond Interchange	No change	Diamond Interchange	No change
Division Road North	At-grade	At-grade	Cul-de-sac	At-grade	Cul-de-sac	Cul-de-sac	No change
Division Road South	At-grade	At-grade	Access Road to County G	At-grade	Access Road to County G	Access Road to County G	No change
Chickadee Drive	At-grade	At-grade	RI/RO	At-grade	RI/RO	RI/RO	No change
County U	At-grade	At-grade	RCUT	At-grade	RCUT	RCUT	No change
Sunrise Road	At-grade	At-grade	No change	At-grade	No change	At-grade	No change
Spring Valley Drive	At-grade	At-grade	No change	At-grade	No change	At-grade	No change
Scenic View Drive North	At-grade	At-grade	Overpass	At-grade	Overpass	At-grade	Overpass
Scenic View Drive South	At-grade	At-grade	Overpass	At-grade	Overpass	At-grade	Overpass
County T	At-grade	At-grade	RCUT	At-grade	RCUT	RCUT	No change
Plank Road West	At-grade	At-grade	Cul-de-sac	At-grade	Cul-de-sac	RI/RO	Cul-de-sac
Sugarbush Road North	At-grade	At-grade	Overpass	At-grade	Overpass	RCUT	Overpass
Sugarbush Road South	At-grade	At-grade	Overpass	At-grade	Overpass	RI/RO with Dedicated Left lane-RCUT	Overpass
County A North	At-grade	At-grade	Interchange	At-grade	Interchange	RCUT	Interchange
County A South	At-grade	At-grade	Interchange	At-grade	Interchange	RCUT	Interchange
Plank Road East	At-grade	At-grade	RI/RO	At-grade	RI/RO	RI/RO	No change
Castle Rock Court	At-grade	At-grade	No change	At-grade	No change	At-grade	No change
Julie Lane West	At-grade	At-grade	No change	At-grade	No change	At-grade	No change
Julie Lane East	At-grade	At-grade	Cul-de-sac	At-grade	Cul-de-sac	Cul-de-sac	No change
Ridge Road North	At-grade	At-grade	Cul-de-sac	At-grade	Cul-de-sac	Cul-de-sac	No change
Ridge Road South	At-grade	At-grade	No change	At-grade	No change	At-grade	No change
County S North	At-grade	At-grade	RCUT	At-grade	RCUT	RCUT	No change

Table 2.6-1 Intersection Access Treatment for Each Alternative

Access Treatment (At-grade = full access intersection, RI/RO = right in/right out, LI = left in, RCUT = Restricted Crossing U-Turn)

Intersection	No-Build Alternative	Passing Lane Alternatives	Possible Future Improvements with the Corridor Preservation Associated with Passing Lane Alternatives	Hybrid Alternative	Possible Future Improvements with the Corridor Preservation Associated with Hybrid Alternative	4 lane On alignment Alternative	Possible Future Improvements with the Corridor Preservation Associated with 4 lane On alignment Alternative
County S South	At-grade	At-grade	RCUT	At-grade	RCUT	RCUT	No change
Coary Lane	At-grade	At-grade	Removed from WIS 23–Sandstone Lane extended and cul-de-sac	At-grade	Removed from WIS 23–Sandstone Lane extended and cul-de-sac	Removed from WIS 23–Sandstone Lane extended and cul-de-sac	No change
Twinkle Lane	At-grade	At-grade	Removed from WIS 23–Valley Lane extended and cul-de-sac	At-grade	Removed from WIS 23–Valley Lane extended and cul-de-sac	Removed from WIS 23–Valley Lane extended and cul-de-sac	No change
County P North and South	At-grade	At-grade	No change	At-grade	No change	At-grade	No change
Inez Court	At-grade	At-grade	No change	At-grade	No change	At-grade	No change
Branch Road	At-grade	At-grade	Removed from WIS 23–Extended to Inez Court	At-grade	Removed from WIS 23–Extended to Inez Court	Removed from WIS 23–Extended to Inez Court	No change

2.7 TRAFFIC FORECASTS AND RESULTING OPERATIONS

A. Traffic Forecasts

For this WIS 23 study, traffic volumes are expressed as average annual daily traffic (AADT). The AADT volumes reflect average annual traffic conditions rather than daily or seasonal variations. The most recent traffic volumes, also referred to as the existing traffic volumes, were derived from WisDOT traffic count data taken during the summer of 2017.

The traffic forecasting results presented in the main body of this LS SEIS (the formal NEPA study) were derived using 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 no-build forecast analysis was conducted based on the Traffic Analysis Forecasting Information System (TAFIS), standard regression modeling, and the NERTDM to establish reasonableness of the no-build forecast results presented in the formal NEPA study.

Full details of the separate analysis can be found in Attachment B of Appendix B of this LS SEIS. Full details of the formal no-build forecast analysis are presented in Attachment A of Appendix B of this LS SEIS. Forecast values from the two analyses are consistent.¹⁴

Once the NERTDM no-build forecast was developed, WisDOT constructed the alternatives in 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 illustrated in the Passing Lane Alternative. The Hybrid Alternative and 4-lane On-alignment 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 provides a more detailed explanation of the traffic forecasting procedures and results. Figure 2.7-1 shows the WIS 23 corridor 2040 forecasts for each of the alternatives being considered.

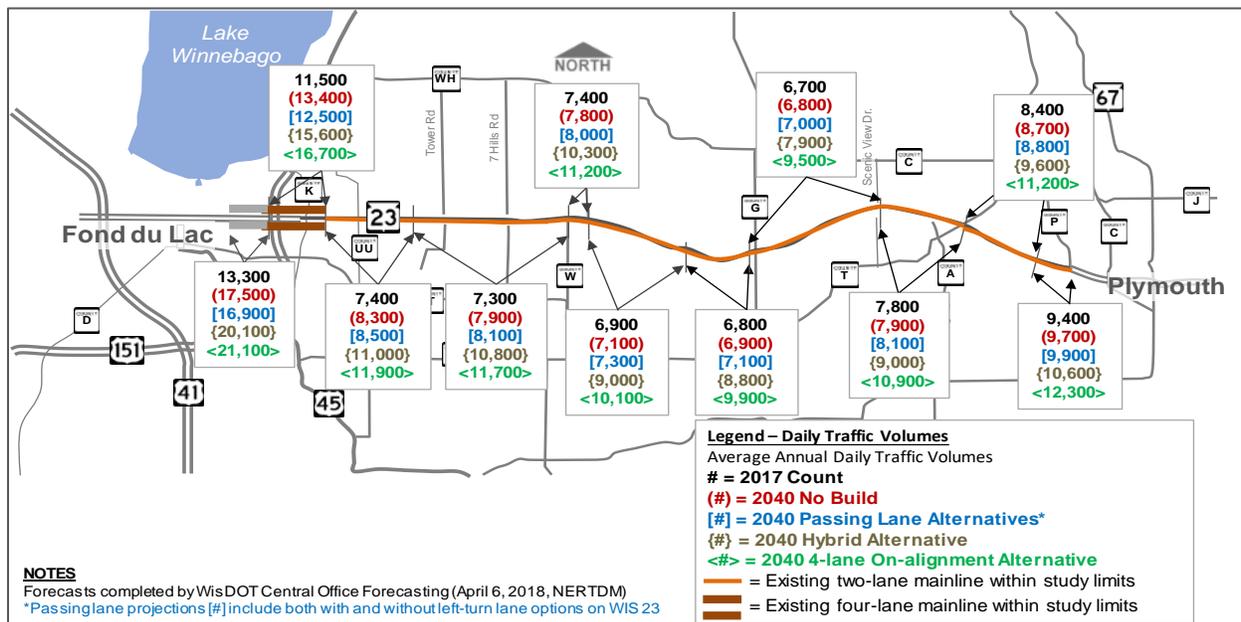


Figure 2.7-1 2040 Traffic Forecast Volumes for Alternatives

¹⁴ Refer to traffic forecast memorandum in Appendix B for additional information.

B. Operational Analysis

WisDOT performed an operational analysis for each alternative using Highway Capacity Software (HCS). The analyses included WIS 23 mainline operations analysis as well as side road operations analysis. Appendix A contains two memoranda describing the inputs and methodology used for the operational analyses.

The HCS results report Level of Service (LOS), which is a measure of how well a highway or intersection is able to serve the travel demands placed on it. Traffic and roadway design factors such as AADT volumes, peak-hour volumes, peak-hour truck percentages, number of driving lanes, lane widths, vertical grades, passing opportunities, and number of access points affect the LOS for the mainline. Turning movements, amount of cross traffic, truck percentages, and lane configurations affect the LOS for side road intersections.

LOS ranges from A to F in order of decreasing operational quality, with LOS A representing good operations, and LOS F representing poor operations. For 2-lane roads, the percent time spent following another vehicle, and in some conditions, average speed,¹⁵ are the metrics that determine the LOS. The 4-lane highway LOS uses controlling (i.e. highest volume) 2040 peak-hour volumes to determine the **mainline operations near** proposed interchanges. The LOS is determined by the density of the segment. The LOS for intersections is determined by the average delay a vehicle experiences exiting from a side road during the peak hours of the day.

WIS 23 is a Connector route in Corridors 2030, part of the *Connections 2030 Statewide Long-Range Transportation Plan*. One design requirement of a Corridors 2030 Connector route is maintaining acceptable traffic operations. WisDOT's FDM provides the operational goals for Corridors 2030 (formerly Corridors 2020) routes. The FDM states "The highest LOS thresholds are applied to the Interstate system routes and other Corridors 2030 system routes in recognition of their importance from a mobility and economic development perspective." For Corridors 2030 Connector routes **like WIS 23**, the desirable LOS threshold is LOS C for rural and small urban areas as outlined in the FDM.¹⁶ The desirable LOS on this route (**LOS C**) is above the operational threshold between LOS C and LOS D (the numeric LOS ≤ 4.0). The majority of the WIS 23 study corridor is outside of the urban areas of Fond du Lac and Sheboygan.¹⁷

Tables 2.7-1 and 2.7-2 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. Values for 2017 are not shown for the Passing Lane, Hybrid, and 4-lane On-alignment Alternatives since 2017 represents an existing condition. The tables show LOS using fully uniform peaking characteristics for 2040 conditions. This assumes that WIS 23 would experience the exact same amount of traffic for each 15-minute period of the peak hour, consistent with current WisDOT policy for future operational analysis **as noted in FDM 11-5-3.5.2.1**. The combination of the small increase in the forecast average annual daily traffic volumes (2 to 7 percent) and the **uniform distribution** 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. **Highlighted values in Table 2.7-1 and 2.7-2 do not meet the desirable LOS threshold for the WIS 23 corridor.**

¹⁵ 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 for more information.

¹⁶ Facilities Development Manual 11-5-3.2.1 Congestion and Facility LOS. Accessed March 23, 2018

¹⁷ <http://wisconsin.gov/Pages/projects/data-plan/plan-res/boundaries.aspx>, Accessed April 10, 2018

Table 2.7-1 Alternative Operations—County UU to County G

	No-Build Alternative		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. The 4-lane highway LOS is based on mainline density (in passenger cars per mile per lane) near proposed interchanges. A specific numeric LOS is not shown because multiple highway segments were reviewed for each proposed interchange.

Table 2.7-2 Alternative Operations—County G to County P

	No-Build Alternative		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. The 4-lane highway LOS is based on mainline density (in passenger cars per mile per lane) near proposed interchanges. A specific numeric LOS is not shown because multiple highway segments were reviewed for each proposed interchange.
 [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.

The FDM states that the desirable LOS for side road intersections associated with Corridors 2030 and NHS routes is LOS D or better for the intersection as a whole and for all turning movements.¹⁸ Because WIS 23 is a Corridors 2030 Connector route and a NHS route, WisDOT seeks to provide LOS D or better operation levels at all intersections. Higher volume intersections along WIS 23 include county trunk highways that are classified either as minor arterials or rural collectors. Operation levels tend to deteriorate at more highly used intersections because there is a higher demand for access, which leads to queuing.

Table 2.7-3 lists the LOS for side road intersections in the 2040 design year. Note that the traffic operations for the Passing Lane Alternative with left-turn lanes is better than the traffic operations for the Passing Lane Alternative without left-turn lanes. This is because the left-turn lane requires establishment of a median for the left-turn bay. The median opening allows left-turning and through vehicles from the side road to make the maneuver in two stages, improving the operations. Figure 2.7-2 illustrates this maneuver.

¹⁸ FDM 11-5-3.2.2 Congestion and Intersection LOS. Accessed May 9, 2018.

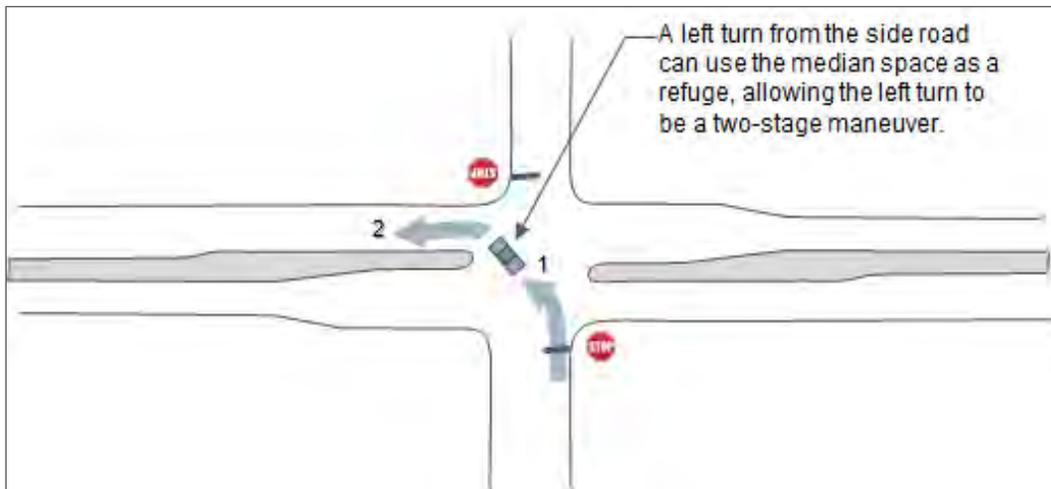


Figure 2.7-2 Two-stage Left-Turn Maneuver with the Passing Lane Alternative with Left-Turn Lanes

The RCUT operations results in Table 2.7-3 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 a RCUT, as shown in Figure 2.4-4, 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. This results in extra travel time, in addition to the stop-control delay, for movements that would use the U-turn.

Table 2.7-3 Side Road Operations

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

Intersection and Movement (unless otherwise noted)	No-Build Delay (s)	No-Build LOS	Passing Lane w/o Left Turn Lanes Delay (s)	Passing Lane w/o Left Turn Lanes LOS	Passing Lane w/Left Turn Lanes Delay (s)	Passing Lane w/Left Turn Lanes 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 Pk								Interchange w/ 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 Pk								Interchange w/ 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 Pk								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 Pk								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 Pk								Interchange w/ 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 Pk								Interchange w/ 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. The desired LOS is D or above for all movements at intersections. The higher volume intersections of County UU, County W/Loehr Road, and County G provide an estimate of how well the desired LOS is met by the alternatives. Movements shaded do not meet the desired LOS.

2.8 SAFETY¹⁹

A. Statewide Average Crash Rates

The WIS 23 crash rate for the entire two-lane portion of the corridor is lower than the statewide average crash rate on similar highways. However, some segments have higher crash rates than statewide average total and KAB (fatal and injury) crash rates. See Section 1.3.G for more information related to the existing crash trends throughout the corridor.

Wisconsin’s statewide average crash rates are classified into different roadway peer group categories intended to represent a group of roadway segments throughout the state with similar characteristics (e.g., number of lanes, amount of access, and presence of median). Table 2.8-1 summarizes the statewide average crash rates for different facility types.

Table 2.8-1 Comparison of Statewide Average Crash Rates by Facility Type²⁰

Facility Type	2013-2017 Crash Rate ^[1]		Similar WIS 23 Build Alternative
	Overall	KAB	
Statewide Rural 2-lane Roadways (AADT >7,000 vpd)	98.9	19.6	Passing Lane Alternative ^[2]
4-lane Expressways Posted at 55 mph	77.7 <i>(~21% lower than rural 2-lane statewide average)</i>	12.6 <i>(~36% lower than rural 2-lane statewide average)</i>	Hybrid Alternative ^[3]
4-lane Expressways Posted at 65 mph	49.3 <i>(~50% lower than rural 2-lane statewide average)</i>	9.1 <i>(~54% lower than rural 2-lane statewide average)</i>	4-lane On-alignment Alternative ^[4]

[1] Crash rates are expressed in crashes per hundred million vehicle miles traveled.
 [2] Separate Wisconsin statewide average crash rates are not available for 2-lane rural roadways with passing lanes. See countermeasures discussion in Section 2.8 for more detail on potential safety benefits of passing lanes.
 [3] For the Hybrid Alternative, a 4-lane roadway, anticipated to have a posted speed of 55 mph, would be provided between US 151 and County G.
 [4] The 4-lane On-alignment Alternative was designed to a 70 mph design speed (typically 5 mph above the posted speed). As a result the design and expressway designation the facility will be posted at 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.²¹ Wis. Stat. § 345.57(4) defines Wisconsin’s fixed speed limits related to expressway designation.

For the WIS 23 build alternatives being evaluated, the statewide average crash rates were used as a tool to compare what type of trends may occur when the facility type is changed with each of the build alternatives. For example, 4-lane expressways posted at 65 mph show a lower statewide average KAB crash rate than rural 2-lane roadways with AADT volumes above 7,000 vehicles per day. These trends indicate that if WIS 23 is expanded from a 2-lane facility to a 4-lane 65 mph expressway, it is reasonable to assume a reduction in the KAB crash rate with the change in facility type if the characteristics of the facility in the build condition are similar to those included in the statewide average for 65 mph expressways. It should be noted that statewide average crash rates are not exclusively available for 2-lane roadways with passing lanes, therefore the effect of adding passing lanes in the Passing Lane and Hybrid Alternatives is not fully captured in this comparison. Using the statewide average crash rate as a basis of comparison for the alternatives indicates that the 4-lane On-alignment Alternative may provide a substantial benefit to safety along WIS 23. See the next section, which considers specific countermeasures for a more detailed analysis of safety aspects included with each alternative.

¹⁹ This section has been updated to reflect crash data that became available after the publication of the May 2018 LS SDEIS and to provide additional detail in response to submitted comments regarding safety considerations of each alternative, which were previously discussed in Appendix F of the May 2018 LS SDEIS.

²⁰ Table 2.8-1 Comparison of Statewide Average Crash Rates by Facility Type was not included in the May 2018 LS SDEIS.

²¹ The urbanized segment on the west end of the corridor will be posted at 45 mph, the same as existing. Any other areas of posted speed limits below 65 mph will be determined during final design.

B. Countermeasures

Safety improvements are often termed countermeasures because they counter specific safety issues. WisDOT frequently considers and incorporates countermeasures in highway improvements to address safety issues. 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 Officials (AASHTO);²² and the *2008 Desktop Reference for Crash Reduction Factors*²³ 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 build alternatives addressed in this 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.

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.²⁴ For the purposes of evaluating the potential safety benefits of the alternatives, CMFs are converted to CRFs, for comparison sake, meaning they indicate the percent reduction of that type of crash the countermeasure may produce.

All of the build alternatives include safety countermeasures that address crash types to varying degrees. Table 2.8-2 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. Further discussion of each build alternative follows Table 2.8-2.

²² *2010 Highway Safety Manual*, (American Association of State Highway and Transportation Officials, First Edition, 2010, <http://www.highwaysafetymanual.org/Pages/default.aspx>)

²³ *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/>

²⁴ 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 2.8-2 WIS 23 Crash Types and Countermeasures²⁵

Crash Type	Number 2013-2017	Countermeasure	AASHTO CRF ^{a, c}	FHWA CRF ^c	Is Countermeasure Incorporated in Alternative?			
					No Build	Passing Lane	Hybrid	4 lane On alignment
Head-On	6	Install median	12% injury 18% non-injury	15%	No	No	Partially	Yes
Sideswipe, Opposite Direction	12	Install median	12% injury 18% non-injury	15%	No	No	Partially	Yes
Sideswipe, Same Direction	27	Install passing lanes	25%	25% ^d	No	Yes	Partially	No
		Expand to 4 lanes	None given	35%	No	No	Partially	Yes
Angle Crashes at Intersection	28	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% ^e	No	Partially	Partially	Yes
Rear-End Crashes ^b	61	Install left-turn lane	48%	48%	No	Partially	Yes	Yes
Run-off-the-Road	68	Expanding shoulder beyond 6 feet	13%	4% (8') 18% (10')	No	Yes	Yes	Yes

^a Converted from CMF. 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 $1 - (23/100) = 0.77$.

^b Total rear-end crashes shown, of which 17 involved stopped left-turning vehicles and 10 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.

^d Assumed passing lanes in both directions

^e 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.

1. Passing Lane Alternative

Safety is improved, but not for all crash types. Adding passing lanes provides the opportunity to address same direction sideswipes (potential 25 percent crash reduction, see Table 2.8-2 [typical]) by providing wider shoulders and rear end crashes (48 percent reduction) with the suboption that provides left-turn lanes at 10 higher volume intersections. Wider shoulders also act as a safety countermeasure to address run-off-road crashes by providing a greater recovery area for errant cars. Access is modified at private driveways under the left-turn suboption near select intersections.

The Passing Lane Alternative does not provide any safety countermeasures for rear-end crashes at unimproved intersections and private driveways. Most intersection crossing conflicts remain. Access reduction measures to reduce the number of intersection crossing conflicts would require introducing a median that restricts crossing movements, RCUTs, and/or consolidating access points at intersections. Restricting turning movements with a median that restricts crossing movements or consolidating access points would introduce indirection for drivers. Treatments such as RCUTs are not as feasible, or common, with a 2-lane roadway as compared to a 4-lane divided roadway because a wider roadway is required to accommodate U-turn movements. For these reasons, RCUTs were not considered for the 2-lane portions of the roadway and extensive access reduction measures were not considered in detail for the Passing Lane Alternative.

²⁵ Table 2.8-2 WIS 23 Crash Types and Countermeasures was not included in the May 2018 LS SDEIS.

This alternative does not address head-on or sideswipe opposite direction and only partially addresses angle crashes. In addition, crashes and other incidents are likely to greatly 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.

2. Hybrid Alternative

In the 4-lane segment from US 151 to County G, the Hybrid Alternative provides safety countermeasures for the types of crashes experienced on WIS 23. About half of the KAB crashes and one-fourth of all crashes that occurred in the evaluation period can be tied to a vehicle crossing the centerline. Medians, a safety countermeasure to these types of crashes, address head-on and opposite direction sideswipe crashes (12 to 18 percent reduction). Added lanes address same direction sideswipes (35 percent reduction). Left turn lanes address rear end crashes (48 percent reduction). Wider shoulders (6-10 feet wide) address run off road crashes (4 to 18 percent reduction). Median refuge (27 percent reduction), RCUTS (18 to 20 percent reduction) and interchanges (42 percent reduction) address angle crashes. RCUTS in Wisconsin (7 sites) have decreased KAB crashes by 91 percent. In addition, the 4-lane segment modifies access on for a majority of the public access intersections in this area, removing many mainline crossing conflicts. A 4-lane cross section provides greater flexibility for incident management.

In the passing-lane segment from County G to County P, the Hybrid Alternative improves safety but not for all types of crashes. Adding passing lanes provides the opportunity to address same direction sideswipes (25 percent reduction) by providing wider shoulders and rear end crashes (48 percent reduction) with the suboption that provides left turn lanes at 4 higher volume intersections. Wider shoulders also act as a safety countermeasure to address run off road crashes by providing a greater recovery area for errant cars. Access is not modified at public access intersections and is modified at six private driveways near intersections.

The passing-lane segment does not provide any safety countermeasures for rear end crashes at unimproved intersections and private driveways. Most intersection crossing conflicts remain. Access reduction measures to reduce the number of intersection crossing conflicts would require introducing a median that restricts crossing movements, RCUTs, and/or consolidating access points at intersections. Restricting turning movements with a median that restricts crossing movements or consolidating access points would introduce indirection for drivers. Treatments such as RCUTs are not as feasible, or common, with a 2-lane roadway as compared to a 4-lane divided roadway because a wider roadway is required to accommodate U-turn movements. For these reasons, RCUTs were not considered for the 2-lane portions of the roadway and extensive access reduction measures were not considered in detail for the passing-lane segment of the Hybrid Alternative.

Adding passing lanes does not address head-on, sideswipe opposite direction and angle crashes. In addition, crashes and other incidents in the passing-lane segment are likely to greatly 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.

3. 4-lane On-alignment Alternative

The 4-lane On-alignment Alternative provides safety countermeasures for all types of crashes experienced on WIS 23. Approximately half of the KAB crashes can be tied to vehicles crossing the centerline and either colliding with another vehicle or departing the roadway altogether. Medians, a safety countermeasure to these types of crashes, address head-on and opposite direction sideswipe crashes (12 to 18 percent reduction).

Other measures included added lanes, left-turn lanes, wider shoulders, and various intersection treatments. Added lanes address same direction sideswipes (35 percent reduction). Left turn

lanes address rear-end crashes (48 percent reduction). Wider shoulders (6-10 feet wide) address run off road crashes (4 to 18 percent reduction). Median refuge (27 percent reduction), RCUTS (18 to 20 percent reduction) and interchanges (42 percent reduction) address angle crashes. RCUTS in Wisconsin (7 sites) have decreased KAB crashes by 91 percent. In addition, this alternative improves, limits, or removes access at all but five public access intersections and at the majority of private access points, removing many mainline crossing conflicts. A 4-lane cross section provides flexibility for incident management and incidents are likely to affect only one direction of travel. A consistent 4-lane cross section between US 151 and I-43 is expected to help with speed limit adherence and enforcement.

C. Summary of Safety Analysis

In summary, the 4-lane On-alignment Alternative provides more safety countermeasures than the other alternatives. The safety countermeasure analysis, combined with the relative comparison between statewide average crash rates between different facility types, indicates that the 4-lane On-alignment Alternative may provide the most substantial benefit to safety along WIS 23 and the adjoining crossroad intersections of the alternatives considered in this LS SEIS.

2.9 SUMMARY OF IMPACTS

The tables summarizing the impacts associated with the No-Build, Passing Lane, Hybrid, and 4-lane On-alignment Alternatives have been revised since the 2018 LS SDEIS. Changes within the tables include dividing the original Alternative Comparison Matrix into two tables for readability. Cost information has been reorganized to clarify the costs expended prior to and after vacating the 2014 ROD. Costs for all alternatives have been updated. Clarifications for land impacts have been made and these include defining the acreage purchased prior to vacating the 2014 ROD that was needed for right of way, and the acreage not needed for right of way. Finally, the Corridor Preservation Comparison table was clarified to include the acreage purchased prior to vacating the 2014 ROD and needed for Wis. Stat. § 84.295(10) mapping.

Table 2.9-1a and 2.9-1b summarize the impacts associated with the No-Build, Passing Lane, Hybrid, and 4-lane On-alignment Alternatives.

Table 2.9-1a summarizes project costs. Costs are shown in six categories for each alternative.

1. Costs expended prior to vacating the 2014 ROD.
2. Costs expended after vacating the 2014 ROD and through August 2018.
3. Total costs expended through August 2018 (sum of categories 1 and 2).
4. Costs remaining to complete design and construction of the alternative (in Fiscal Year (FY) 2019 dollars).
5. Total project costs in FY 2019 dollars (sum of categories 3 and 4 in FY 2019 dollars).
6. Total project costs in year of expenditure (YOE) dollars (sum of categories 3 and 4 in FY 2019 to 2023 dollars).

These categories are provided to show the design, real estate acquisition, utility relocation, and construction costs expended for the previously selected 4-lane On-alignment Alternative both before and after the 2014 ROD was vacated. After the 2014 ROD was vacated, WisDOT resurfaced WIS 23 in Fond du Lac County from 7 Hills Road to Division Road; the costs expended after vacating the 2014 ROD and through August 2018 include the resurfacing project cost. No-Build construction costs include active and programmed WIS 23 resurfacing projects in Fond du Lac County (US 151 to County UU) and Sheboygan County (Division Road to County P). The table also designates remaining costs to complete the improvements associated with each alternative in FY 2019 and YOE dollars. Costs have been updated from those presented in the May 2018 LS SDEIS to include recent design

efforts, increases in real estate costs, decreases in utility costs, and increased construction costs to include delivery and construction contingencies.

Table 2.9-1b summarizes the land and relocation impacts and is shown in four categories for each alternative:

1. Total amount needed.
2. Amount purchased or relocated prior to vacating the 2014 ROD (and needed for the alternative).
3. Amount of land or relocations still needed.
4. Amount purchased or relocated prior to vacating the 2014 ROD but not needed for the alternative (comprised of excess right of way or wetland mitigation areas).

These categories are provided because WisDOT purchased right of way for the 4-lane On-alignment Alternative between 2010 and 2015, before the 2014 ROD was vacated. About 38 percent of the acquisition is completed in Fond du Lac County, and 100 percent of the acquisition is completed in Sheboygan County. Much of the land, and corresponding residential and farm relocations associated with the 4-lane On-alignment Alternative was purchased. Therefore, the table designates how much is needed based on the existing right of way prior to 2010, as well as how much was purchased before the 2014 ROD was vacated. In some instances, more land was purchased than was needed because not purchasing the land would leave an uneconomic remnant.²⁶ The land purchased but not needed for improvements is considered excess right of way (see Figures 2.9-1 through -44).

Describing impacts for the Passing Lane and Hybrid Alternatives is more complicated. Some of the right of way previously purchased for the 4-lane On-alignment Alternative is not required for the Passing Lane Alternative or the Hybrid Alternative. However, portions of that right of way will be part of the corridor preservation area associated with Passing Lane and Hybrid Alternatives. The WisDOT expenditures for right of way already acquired were not considered in the identification of the Preferred Alternative since they are a sunk cost.²⁷ This is because the land could be resold to abutting landowners, although the cost of the buildings razed is irretrievable. Additionally, since no construction has taken place, impacts to natural and physical environmental resources within the already acquired right of way have not occurred nor has mitigation for potential impacts progressed beyond the conceptual evaluation stage other than the Section 6(f) land conversion and boundary update.

Table 2.9-2 summarizes the resources, land types, residences, and businesses within the corridor preservation area for the Passing Lane, Hybrid, and 4-lane On-alignment Alternatives. In Wis. Stat. § 84.295(10), WisDOT is given the authority to establish locations and right-of-way widths for future freeways or expressways. These resources 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 a 60-day notice before beginning that construction. If WisDOT receives a notice, they will either acquire the property or approve the construction to move forward. If approval is given and in the future WisDOT determines transportation improvements are needed within the preserved area, the property owner will be compensated as part of the normal WisDOT acquisition process. 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

²⁶ 42 USC 61 Section 4651 states "(9) If the acquisition of only a portion of a property would leave the owner with an uneconomic remnant, the head of the Federal agency concerned shall offer to acquire that remnant. For the purposes of this chapter, an uneconomic remnant is a parcel of real property in which the owner is left with an interest after the partial acquisition of the owner's property and which the head of the Federal agency concerned has determined has little or no value or utility to the owner."

²⁷ A sunk cost is a cost that WisDOT has incurred, and which it can no longer recover, or has great difficulty recovering. See Appendix F, Section 6, for more detail on sunk costs.

improvements are needed within these preservation areas, subsequent environmental documentation would be prepared to evaluate a range of alternatives and associated impacts and costs.

Figures 2.9-1 through -44 show the Passing Lane, Hybrid, and 4-lane On-alignment Alternatives superimposed on aerial photographs. The figures also show the areas of right of way already acquired and those still needed for the various alternatives, as well as lands that would be needed for corridor preservation associated with the alternatives.

Table 2.9-1a Alternative Comparison Matrix - Costs²⁸

		UNIT	No-Build Alternative	Passing Lane Alternatives ¹	Hybrid Alternative	4-lane On-alignment Alternative
Road Length		Miles	19.1	19.1	19.1	19.1
COST						
Costs expended prior to vacating 2014 ROD	Design	Millions \$			9.1	
	Real Estate	Millions \$			19.1	
	Utility	Millions \$			0.0	
	Construction	Millions \$			1.7	
	Total	Millions \$			29.9	
Costs expended after vacating 2014 ROD and through August 2018	Design	Millions \$			2.5	
	Real Estate	Millions \$			0.8	
	Utility	Millions \$			0.4	
	Construction	Millions \$			2.5	
	Total	Millions \$			6.2	
Total costs expended through August 2018	Design	Millions \$			11.6	
	Real Estate	Millions \$			19.9	
	Utility	Millions \$			0.4	
	Construction	Millions \$			4.2	
	Total	Millions \$			36.1	
Costs remaining (FY 2019 dollars)	Design	Millions \$	0.3	6.3	4.1	2.8
	Real Estate	Millions \$	0.0	1.6	5.6	5.6
	Utility	Millions \$	0.0	3.0	4.6	4.6
	Construction	Millions \$	3.8	52.2	85.7	101.4
	Total	Millions \$	4.1²	63.1	100.0	114.4
Total Project Costs (FY 2019 dollars)		Millions \$	40.2	99.2	136.1	150.5
Total Project Costs (Year of Expenditure)³		Millions \$	40.2	100.7	138.1	153.1

¹ Passing Lane impacts are presented using the higher impact option: Passing Lane Alternative with Left-Turn Lanes.

² No-Build construction costs include active and programmed WIS 23 resurfacing projects in Fond du Lac County (US 151 to County UU) and Sheboygan County (Division Road to County P).

³ "Year of Expenditure" is 2019-2023.

²⁸ Table 2.9-1a Alternative Comparison Matrix - Costs was not included in the May 2018 LS SDEIS.

Table 2.9-1b Alternative Comparison Matrix- Land, Relocations, and Other Impacts					
	UNIT	No-Build Alternative	Passing Lane Alternatives¹	Hybrid Alternative	4-lane On-alignment Alternative
Area Converted to Highway R/W for Alternative					
Cropland and Pasture needed for R/W	Acres	0	24	171	218
- Purchased prior to vacating 2014 ROD and needed for R/W	Acres	0	6	119	119
- Remaining to be purchased for needed R/W	Acres	0	18	99	99
- Purchased prior to vacating 2014 ROD but not needed for R/W (comprised of either excess R/W ⁴ or wetland mitigation acres)	Acres	318	312	199	199
Wetland Area needed for R/W	Acres	0	5	21	26
- Purchased prior to vacating 2014 ROD and needed for R/W	Acres	0	3	10	15
- Remaining to be purchased for needed R/W	Acres	0	2	11	11
- Purchased prior to vacating 2014 ROD but not needed for R/W (comprised of either excess R/W ⁴ or wetland mitigation acres)	Acres	30	27	20	15
Woodland/Upland Area to R/W	Acres	0	5	9	38
- Purchased prior to vacating 2014 ROD and needed for R/W	Acres	0	3	5	34
- Remaining to be purchased for needed R/W	Acres	0	2	4	4
- Purchased prior to vacating 2014 ROD but not needed for R/W (comprised of either excess R/W ⁴ or wetland mitigation acres)	Acres	44	41	39	10
Other Area needed for R/W ⁵	Acres	0	45	120	128
- Purchased prior to vacating 2014 ROD and needed for R/W	Acres	0	9	41	49
- Remaining to be purchased for needed R/W	Acres	0	36	79	79
- Purchased prior to vacating 2014 ROD but not needed for R/W (comprised of either excess R/W ⁴ or wetland mitigation acres)	Acres	136	127	98	87
Total Area needed for Highway R/W	Acres	0	79	321	410
Total Area Already Purchased for Highway R/W ⁶	Acres	528	528	528	528
Total Area Still Needed for Highway R/W	Acres	0	58	193	193
Excess R/W⁴ and Wetland Mitigation					
Excess R/W purchased prior to vacating 2014 ROD and not required for Alternative	Acres	369	348	241	152
Wetland Mitigation	Acres	159	159	159	159
Relocations					
Total Residential Relocations needed	Number	0	12	28	30
- Residences relocated prior to vacating 2014 ROD	Number	30	30	30	30
- Residential Relocations where buildings were razed	Number	27	27	27	27
- Residential Relocations Still Needed	Number	0	0	0	0
Total Business Relocations Required (Not Including Farms)	Number	0	0	4	4
- Business relocated prior to vacating 2014 ROD	Number	3	3	3	3
- Business Relocations where buildings were razed	Number	3	3	3	3
- Business Relocations Still Needed	Number	0	0	1	1
Total Farm Relocations Required (One or more farm buildings)	Number	0	6	13	18
- Farms relocated prior to vacating 2014 ROD	Number	17	17	17	17
- Farm Relocations where buildings were razed	Number	16	16	16	16
- Farm Relocations Still Needed	Number	0	0	1	1
Farms Severed	Number	0	1	5	5
Other Impacts					
Eligible Historic Structures/Archeological Sites identified	Yes/No	Yes	Yes	Yes	Yes
Section 106 MOA Required	Yes/No	No	Yes	Yes	Yes
Section 4(f) Evaluation Required	Yes/No	No	Yes	Yes	Yes
Section 6(f) Land Conversion Required	Yes/No	No	No ⁷	No ⁷	Yes
Floodplain Encroachment	Yes/No	No	Yes	Yes	Yes
Total Wetlands to be Filled (includes wetlands in existing and new R/W)	Acres	0	29.9	45.9	51.8
Stream Crossings	Number	3	3	3	3
Threatened/Endangered Species	Yes/No	No	Yes	Yes	Yes
Noise Analysis Required	Yes/No	No	Yes	Yes	Yes
Receptors Impacted in the design year	Number	44	ND ⁸	ND ⁸	47
Contaminated Sites	Number	0	4	6	6

⁴ Excess right of way is a result of parcels purchased because they have uneconomic remnants or are land-locked parcels. The purchase of right of way and excess right of way is consistent with normal procedures and is typical for this type of project.

⁵ Other Area includes: Single- and Multi-Family Residential, Commercial, Industrial, Community, Institutional, Manufacturing, Mining, Retail Trade, Parks/Recreation, Undeveloped, and Transportation.

⁶ 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.

⁷ While technically not required, the land conversion has already taken place. Correspondence with National Park Service indicates they expect the provisions of the 6(f) conversion agreement to be honored through the process.

⁸ ND - Not Determined. The traffic noise analysis in the 2014 LS SFEIS modeled the 4-lane On-alignment Alternative and shows the worst case situation compared to the Passing Lane and Hybrid Alternatives. The Passing Lane and the Hybrid Alternatives (in Sheboygan County) would have a larger separation distance between the roadway traffic and the receptor and therefore the same or fewer receptors impacted in the design year.

Table 2.9-2 Corridor Preservation Comparison				
	UNIT	Corridor Preservation associated with Passing Lane Alternatives ¹	Corridor Preservation associated with Hybrid Alternative ²	Corridor Preservation associated with 4-lane On-alignment Alternative ³
Land Types within Corridor Preservation Limits				
Cropland and Pasture	Acres	244	97	50
Wetland Area	Acres	22	6	1
Woodland/Upland Area	Acres	40	36	7
Other Area ⁴	Acres	101	26	18
Total Land Required for Mapping/Corridor Preservation	Acres	407	165	76
Purchased prior to vacating 2014 ROD and needed for 84.295(10) Mapping	Acres	196	90	1
Area Still Needed for 84.295(10) Mapping	Acres	211	75	75
Excess R/W⁵ and Wetland Mitigation				
Excess R/W purchased prior to vacating 2014 ROD and not required for Alternative	Acres	152		
Wetland Mitigation	Acres	159		
Potential Restriction of Property Improvement (Relocations)⁶				
Residences within Corridor Preservation Area	Number	21	5	3
Residences within Corridor Preservation Area relocated prior to vacating 2014 ROD	Number	18	2	0
Residential relocations where buildings were razed	Number	17	2	0
Businesses within Corridor Preservation Area	Number	6	2	2
Businesses within Corridor Preservation Area relocated prior to vacating 2014 ROD	Number	3	0	0
Business relocations where buildings were razed	Number	3	0	0
Farms within Corridor Preservation Area (One or more farm buildings)	Number	16	9	4
Farm Relocations completed prior to vacating 2014 ROD	Number	11	5	0
Farm Relocations where buildings were razed	Number	10	4	0
Other Impacts (if potential future improvements are implemented)				
Wetlands within Corridor Preservation Area (includes wetlands in existing and new R/W)	Acres	24.1	8.1	2.2
¹ Corridor Preservation consists of preserving the right of way needed to convert WIS 23 to a 4-lane facility. It also includes preserving right of way needed for future access modifications and improvements for possible future overpasses and interchanges.				
² Corridor Preservation consists of preserving the right of way needed to convert WIS 23 to a 4-lane facility from County G to County P. It also includes preserving right of way needed for future access modifications and improvements for possible future overpasses and interchanges.				
³ Corridor Preservation consists of preserving right of way needed for future access modifications and improvements for possible future overpasses and interchanges.				
⁴ Other Area includes: Single- and Multi-Family Residential, Commercial, Industrial, Community, Institutional, Manufacturing, Mining, Retail Trade, Parks/Recreation, Undeveloped, and Transportation.				
⁵ Excess right of way is a result of parcels purchased because they have uneconomic remnants or are land-locked parcels. The purchase of right of way and excess right of way is consistent with normal procedures and is typical for this type of project.				
⁶ Right of way impacts have occurred on the project. These impacts were not to facilitate mapping, but for the construction of the previously identified selected alternative under the 2014 LS SFEIS and ROD.				