Example 1

A complete walkthrough of the Safety Certification Process and Safety Certification Document. Includes network screening documentation, countermeasure selection, safety evaluations and economic appraisals. Demonstrates Method 2 and Method 3 analyses.

Example 2

An abbreviated example to show a Method 1 analysis and the associated Highway Safety Benefit-Cost Analysis spreadsheet.

Example 3

An abbreviated example to show how to complete the Safety Certification Process when an alternative has a lower cost than perpetuation of the existing conditions (i.e. Future No Build).

Example 1

This example provides a walkthrough of the Safety Certification Process. Included in this example is a complete Safety Certification Document with associated Safety Evaluations and Economic Appraisals for the proposed alternatives. This example was created to show what level of detail is needed within the document.

The information within this example was adjusted and modified for example purposes only and is not representative of the actual conditions.

Project Description:
An 18-mile resurfacing project is programmed for a rural highway. When performing the *Network Screening for Safety Sites of Promise*, several intersections and segments were identified as Safety Sites of Promise. A *Diagnosis of Safety Sites of Promise* was performed on these locations.

Example Description:
This example shows a mixture of intersection and segment treatments.

- For the intersection treatments:
  - Demonstrate when Method 2 (Predictive Crash Frequency) is used.
  - Demonstrate when Method 3 (Expected Crash Frequency) is used.
- For the segment treatments:
  - Demonstrate analysis of a single curve.
  - Demonstrate analysis of individual segment sections with treatments based on logical termini.
  - Demonstrate analysis of entire project limits due to similar crash patterns throughout.

To: **EXAMPLE**
The data within this example was adjusted and modified for example purposes only and is not representative of the actual conditions.

From: WisDOT – Bureau of Traffic Operations

Date: 6/1/2023
RE: Design ID: XXXX-XX-XX
Construction ID: XXXX-XX-XX
Highway: USH 45
Project Title: Antigo - Monico
Project Subtitle: STH 52/64 to CTH B
Langlade County
Scheduled Construction Year: 2025
Improvement Concept Code: RSRF30

Having considered the safety performance of the existing corridor and any proposed improvements, we believe this document reflects the intent of the policy and guidelines described in section 11-38 of the Wisconsin Facilities Development Manual.

If applicable, having considered the operational performance of the existing corridor and any proposed improvements, we believe this document reflects the intent of the policy and guidelines described in section 11-52 of the Wisconsin Facilities Development Manual.

Preparer:

______________________________________ ________
Region Analyst Date

Approval:

______________________________________ ________
Bureau of Traffic Operations Date
Traffic Engineering and Safety Section

______________________________________ ________
Region Supervisor Date

1. Certification Processes Completed

1.1. According to FDM 11-1-10 Attachment 10.1, does the improvement concept code and scope of work require the Safety Certification Process to be completed? Yes ☒ No ☐

If yes is selected and alternatives are evaluated as indicated in Section 5, send to BTO at DOTBTOSafetyEngineering@dot.wi.gov

1.2. Was the Operations Certification Process (FDM 11-52-15) completed for proposed improvements within this project? Yes ☐ No ☒

If yes, send to BTO at DOTTrafficAnalysisModeling@dot.wi.gov

2. Network Screening

2.1. Safety Sites of Promise

2.1.1. Did the project have Safety Sites of Promise from the network screening? Yes ☒ No ☐

List Safety Sites of Promise:
There were 8 flagged segments located within the project limits:
PDP_ID: 10082: CTH B to 0.20 miles north of CTH B
PDP_ID: 10083: 0.20 miles north of CTH B t o CTH C
PDP_ID: 10084: CTH C to Branch Rd
PDP_ID: 10085: Branch Rd to CTH V
PDP_ID: 10086: CTH V to CTH J/Forman Rd
PDP_ID: 10089: South of CTH J/Koepenick Rd to CTH J/Koepenick Rd
PDP_ID: 10090: CTH J/Koepenick Rd to USH 45 Wayside Driveway
PDP_ID: 10095: CTH T to CTH B

This example includes a variety of analyses done utilizing both site sets and alignments within IHSDM.

There were 4 flagged intersections located within the project limits:
IX_34_01665: USH 45 at Amron Ave
IX_34_01843: USH 45 at CTH I
IX_34_01894: USH 45 at CTH B
IX_34_01953: USH 45 at CTH C

2.2 Operational Sites of Promise (If Applicable)

2.2.1 Did the project identify Operational Sites of Promise from the network screening? Yes ☐ No ☐ N/A ☒

2.2.2 Did the project identify Operational Sites of Promise based on local knowledge? Yes ☐ No ☐ N/A ☒

List Operational Sites of Promise:

2.3 Additional Sites

2.3.1 Were additional sites evaluated? Yes ☒ No ☐

List sites:
The entire project within the rural project limits will be evaluated for wider paved shoulders and shoulder rumble strips.

3. Diagnosis

3.1. Diagnosis of Crashes

3.1.1. Did relevant crashes remain after crash vetting? Yes ☒ No ☐

3.1.2. If yes, list each site and discuss the crashes and contributing factors (including geometric conditions) for the remaining crash(es) or note that no crashes remained after the vetting process.

Segment: CTH B to CTH C (PDP_ID 10082, 10083)

PDP_ID: 10082: CTH B to 0.20 miles north of CTH B

- Four crashes remain after vetting. There is a lane departure crash trend within this segment.
  - One crash was a run-off-road crash relating to snow/ice conditions.
  - Three crashes were northbound run-off-road crashes where the vehicle left the roadway, overcorrected and overturned.
  - Eight crashes were intersection-related and are evaluated within IX_34_01894 (USH 45 and CTH B).

PDP_ID: 10083: 0.20 miles north of CTH B to CTH C

- Six crashes remain after vetting. There is a lane departure crash trend within this segment.
  - Four crashes were run-off-road crashes. Two of these crashes occurred during snow/ice conditions and the remaining crashes occurred during dry conditions.
  - One crash occurred when a southbound vehicle slowed to turn into a driveway and was rear-ended.
  - One crash occurred when a vehicle leaving a driveway failed to yield to a southbound vehicle.

Contributing Factors:

- The roadway has 12' travel lanes and 10' shoulders (3' paved shoulders with 7' gravel shoulders).
- The roadway shoulder has pavement edge drop-offs which are likely contributing to the crashes.
- USH 45 is posted at 55 mph within this segment.

PDP_ID: 10084: CTH C to Branch Road

Zero crashes remain after vetting.

- All 11 crashes were intersection-related and are evaluated within IX_34_01953 (USH 45 and CTH C).

Segment: Branch Road to CTH J/Forman Road (PDP ID 10085, 10086)

PDP_ID: 10085: Branch Road to CTH V

- Five crashes remain after vetting. There is a lane departure crash trend within this segment.
  - Two crashes were northbound run-off-road crashes.
  - One crash was a southbound run-off-road crash where the vehicle left the roadway, overcorrected and overturned.
  - One crash was a northbound vehicle that crossed the centerline and hit a southbound vehicle head-on.
  - One crash was a rear-end at Branch Rd where a vehicle was waiting to perform a left turn and was struck.

PDP_ID: 10086: CTH V to CTH J/Forman Road

- Ten crashes remain after vetting. There is a lane departure crash trend within this segment.
  - Two crashes were northbound vehicles that crossed the centerline and hit a southbound vehicle head-on.
  - One crash occurred when a southbound vehicle was turning left into a driveway and was rear-ended.
  - Two crashes were southbound run-off-road crashes.
  - Three crashes were northbound run-off-road crashes. Two crashes occurred during snow/ice conditions.
  - Two crashes occurred at the intersection of CTH V:
    - One crash occurred when a westbound vehicle failed to stop for the stop sign and struck a

northbound vehicle.
    - One crash occurred when a northbound vehicle was slowing to perform a left turn and was rear-ended.

Contributing Factors:
- The roadway has 12' travel lanes and 10' shoulders (3' paved shoulders with 7' gravel shoulders).
- The roadway shoulder has pavement edge drop-offs which are likely contributing to the crashes.
- USH 45 is posted at 55 mph within this segment.

<u>Segment: CTH J/Forman Road to CTH J/Koepenick Road (PDP ID 10089, 10090)</u>

PDP_ID: 10089: South of CTH J/Koepenick Road to CTH J/Koepenick Road
- Three crashes remain after vetting. There is a lane departure crash trend within this segment.
    - One crash was a northbound run-off-road crash where the vehicle left the roadway, overcorrected and overturned.
    - Two crashes were northbound run-off-road crashes.

PDP_ID: 10090: CTH J/Koepenick Road to USH 45 Wayside Driveway
- Five crashes remain after vetting. There is a lane departure crash trend within this segment. There is also a pattern of failure to yield crashes at the intersection of CTH J.
    - Three crashes occurred at the intersection of CTH J:
        - One crash occurred when an eastbound vehicle failed to yield to a northbound vehicle.
        - One crash occurred when a westbound vehicle failed to yield to a northbound vehicle.
        - One crash occurred when an ATV was crossing the intersection and was struck by a southbound vehicle.
    - Two crashes involved a southbound vehicle crossing the centerline and striking a northbound vehicle head-on.

Contributing Factors:
- The intersection of CTH J has several overgrown trees that are impacting the sight distance of vehicles at the intersection. These trees are all located within the existing right-of-way. It is recommended to perform brushing at the intersection to improvement sight distance.
- The roadway has 12' travel lanes and 10' shoulders (3' paved shoulders with 7' gravel shoulders).
- The roadway shoulder has pavement edge drop-offs which are likely contributing to the crashes.
- USH 45 is posted at 55 mph within this segment.
- There is a horizontal curve located within this segment with a radius of 17,188 feet and exceeds standards for a 55 mph roadway. The crash trend is not associated with the curve.

<u>Segment: CTH B to CTH T (Rural Project Limits)</u>
- The majority of the roadway within corridor is 55 mph and has 12' travel lanes and 10' shoulders (3' paved shoulders and 7' gravel shoulders).
- The corridor has a trend associated with lane departure crashes. Each segment was evaluated separately, but the overall corridor was evaluated based on logical termini due to a similar crash trend and similar geometrics.

<u>CTH T Curve (PDP_ID: 10095)</u>

Five crashes remain after vetting. There is a lane departure crash trend that is occurring within the horizontal curve between CTH T and CTH B.
- Five crashes were run-off-the-road crashes and occurred within the horizontal curve between CTH T and CTH B intersection. Four of the five crashes occurred during snow/ice/wet conditions.

Contributing Factors:
- The posted speed limit along this curve is 55 mph.

- Crashes were due to snow/ice/wet conditions.
- The existing horizontal curve has a 4,584-foot radius, which exceeds standards for a 55 mph roadway.

IX_34_01665: USH 45 at Amron Avenue
Zero crashes remain after vetting.

IX_34_02171: USH 45 at CTH J/Koepenick Road
This intersection was identified within a flagged segment.
Contributing Factors:
- There is a pattern of failure to yield crashes at this intersection.
- USH 45 is a multi-lane divided highway at this location.
- There are several large bushes and other vegetation that reduce sight distance.
- The crash trend is attributed to poor visibility.
- It is recommended that maintenance perform brushing at the intersection to improve visibility. A safety evaluation will not be performed for this alternative.

IX_34_01843: USH 45 at CTH I
Seven crashes remain after vetting. There is a pattern of vehicles failing to yield at this intersection.
- Three crashes were eastbound vehicles that failed to yield and struck northbound vehicles.
- One crash was a westbound vehicle that failed to yield and struck a northbound vehicle.
- One crash was a westbound vehicle that failed to stop, avoided striking a northbound vehicle and struck a power pole.
- Two crashes were northbound vehicles that were turning left and struck a southbound vehicle.

Contributing Factors:
- USH 45 is a multi-lane divided highway at this location.
- The intersection has a skew angle of 1.5 degrees.
- USH 45 has both northbound and southbound left and right-turn lanes and is located within a tangent section and meets sight distance requirements.
- USH 45 is posted at 55 mph.
- CTH I is a 2-lane undivided highway.
- The crash trend is attributed to poor gap selection, the wide cross section of the roadway and the speed limit.

IX_34_01894: USH 45 at CTH B
Two crashes remain after vetting. There was not a crash trend observed at this intersection. No improvements were considered.
- One crash was a northbound run-off-road crash where a vehicle struck a sign post.
- One crash was a westbound rear-end.

IX_34_01953: USH 45 at CTH C
Eight crashes remain after vetting. The primary crash trend associated with this intersection is traffic on USH 45 failing to yield to oncoming traffic when making a left-turning maneuver.
- One crash was a westbound vehicle that failed to yield and struck a northbound vehicle.
- Four rear-end crashes occurred due to vehicles slowing to perform a left turn. Three occurred in the northbound direction and one occurred in the southbound direction.
- Two crashes were southbound vehicles that ran-off-the-road and struck guardrail.
- One crash was an eastbound vehicle that lost control during snow/ice conditions and struck a sign post.

Contributing Factors:

- USH 45 is a 2-lane undivided highway at this location.
- CTH C is a 2-lane undivided highway.
- The intersection has a skew angle of 6.5 degrees. There are no apparent sight distance concerns.
- USH 45 has northbound and southbound right-turn lanes.
- USH 45 is posted at 55 mph.
- The majority of the crashes at this location could be mitigated with installing dedicated left-turn lanes on USH 45.

3.2 Diagnosis of Operational Issues (If Applicable)

3.2.1. Provide a narrative of existing operational concerns and geometric deficiencies contributing to the delay or queuing.

N/A

4. Countermeasure/Alternative Identification

4.1 Were alternatives analyzed in this project? Yes ☒ No ☐

For intersections only, a Phase I: Scoping Intersection Control Evaluation (ICE) is required if traffic control changes are considered. See FDM 11-25-3 for more information.

An ICE is required when considering a change in traffic control. It is recommended to perform the ICE prior to any safety analyses as the ICE process may eliminate alternatives that are not reasonable for the location.

4.2. Provide a brief description of the alternative(s) and the contributing factors that are being targeted:

Location: CTH B to CTH C

Reason for improvement (check all that apply): Safety ☒ Operations ☐

Alternative(s)	General Description	How improvements address safety/operational issues
Alternative Name: Future No Build	This alternative will follow the programmed improvement concept and will maintain the existing 3’ paved shoulder width. Centerline rumble strips will be included.	This alternative will not fully address the existing crash issues and trends.
Alternative Name: Widen Shoulders (3’ to 5’) and Install Shoulder Rumble Strips	This alternative will widen the paved shoulder width from 3’ to 5’ and install shoulder rumble strips. Centerline rumble strips will be included.	This alternative would address the run-off-roadway crashes that are occurring.

Location: Branch Road to CTH J/Forman Road

Reason for improvement (check all that apply): Safety ☒ Operations ☐

Alternative(s)	General Description	How improvements address safety/operational issues
Alternative Name: Future No Build	This alternative will follow the programmed improvement concept and will maintain the	This alternative will not fully address the existing crash issues and trends.

	existing 3' paved shoulder width. Centerline rumble strips will be included.	
Alternative Name: Widen Shoulders (3' to 5') and Install Shoulder Rumble Strips	This alternative will widen the paved shoulder width from 3' to 5' and install shoulder rumble strips. Centerline rumble strips will be included.	This alternative would address the run-off-roadway crashes that are occurring.

Location: CTH J/Forman Road to CTH J/Koepenick Road

Reason for improvement (check all that apply): Safety ☒ Operations ☐

Alternative(s)	General Description	How improvements address safety/operational issues
Alternative Name: Future No Build	This alternative will follow the programmed improvement concept and will maintain the existing 3' paved shoulder width. Centerline rumble strips will be included.	This alternative will not fully address the existing crash issues and trends.
Alternative Name: Widen Shoulders (3' to 5') and Install Shoulder Rumble Strips	This alternative will widen the paved shoulder width from 3' to 5' and install shoulder rumble strips. Centerline rumble strips will be included.	This alternative would address the run-off-roadway crashes that are occurring.

Location: CTH B to CTH T (Rural Project Limits)

Reason for improvement (check all that apply): Safety ☒ Operations ☐

Alternative(s)	General Description	How improvements address safety/operational issues
Alternative Name: Future No Build	This alternative will follow the programmed improvement concept and will maintain the existing 3' paved shoulder width. Centerline rumble strips will be included.	This alternative will not fully address the existing crash issues and trends.
Alternative Name: Widen Shoulders (3' to 5') and Install Shoulder Rumble Strips	This alternative will widen the paved shoulder width from 3' to 5' and install shoulder rumble strips. Centerline rumble strips will be included.	This alternative would address the run-off-roadway crashes that are occurring.

Location: CTH T Curve

Reason for improvement (check all that apply): Safety ☒ Operations ☐

Alternative(s)	General Description	How improvements address safety/operational issues
Alternative Name: Future No Build	This alternative will follow the programmed improvement concept and will maintain the existing 3' paved shoulder width.	This alternative will not address the existing crash issues and trends.
Alternative Name: Widen Shoulders (3' to 5') and Install Shoulder Rumble Strips	This alternative will widen the paved shoulder width from 3' to 5' within the curve and install shoulder rumble strips.	This alternative would address the run-off-roadway crashes that are occurring.

Alternative Name: Install High Friction Surface Treatment (HFST)	This alternative would install High Friction Surface Treatment on the curve.	This alternative would provide higher friction levels on the horizontal curve which would address the run-off-roadway crashes that are occurring.

Location: USH 45 at CTH I

Reason for improvement (check all that apply): Safety ☒ Operations ☐

Alternative(s)	General Description	How improvements address safety/operational issues
Alternative Name: Future No Build	This alternative will follow the programmed improvement concept and maintain existing conditions.	This alternative will not address the existing crash issues and trends.
Alternative Name: Restricted Crossing U-Turn	This alternative would reconstruct the intersection into a Restricted Crossing U-Turn intersection.	This alternative would address the right-angle crashes that are occurring at the intersection.
Alternative Name: Multi-lane Roundabout	This alternative would reconstruct the intersection into a multi-lane roundabout.	This alternative would address the right-angle crashes that are occurring at the intersection.

Location: USH 45 at CTH C

Reason for improvement (check all that apply): Safety ☒ Operations ☐

Alternative(s)	General Description	How improvements address safety/operational issues
Alternative Name: Future No Build	This alternative will follow the programmed improvement concept and maintain existing conditions.	This alternative will not address the existing crash issues and trends.
Alternative Name: Left Turn Lanes	This alternative would construct mainline left turn lanes at the intersection.	This alternative would reduce the potential for rear-end crashes where vehicles are attempting to turn left.

Location: USH 45 at CTH J

Reason for improvement (check all that apply): Safety ☒ Operations ☐

Alternative(s)	General Description	How improvements address safety/operational issues
Alternative Name: Future No Build	This alternative will follow the programmed improvement concept and maintain existing conditions.	This alternative will not address the existing crash issues and trends.
Alternative Name: Improve Intersection Sight Distance	Remove several trees and vegetation to improve sight distance.	This would remove several large obstacles and improve the intersection sight distance. This improvement could be addressed within the project or through a maintenance effort. This is not expected to require a benefit-cost analysis.

5. Analysis Results and Economic Appraisal

Analysis Location:	CTH B to CTH C
Safety Analysis Method:	Method 3
External CMF Value:	Alternative 1: 0.92 for KABC Crashes
External CMF Source:	WisDOT CMF Table
Unique Safety Analysis Notes:	None

		Base	Alt. 1
Alternative Name		Future No Build	Widen Shoulders (3' to 5') and Install Shoulder Rumble Strips
Safety Certification Process (See FDM 11-38)	Fatal & Injury Crashes	5.5	5.1
	Property Damage Only Crashes	10.7	9.7
	Total Crashes	16.2	14.8
	Crash Cost Value	$3,113,607	$2,843,988
	Project Cost	$0	$50,000
	Net Safety Benefit	-	$269,619
	Net Cost	-	$50,000
	Safety B/C	-	5.4

When shoulder widening is evaluated, spot treatment or corridor treatment should be considered based on need. This example shows both a corridor analysis, including all segments, and spot treatment(s) which covers only the safety sites of promise based on logical termini. Both analyses are not required, but at minimum, the safety site of promise needs to be evaluated. If locations that aren't flagged are evaluated, include information within the "Additional Sites" portion of the document in Section 2.

Analysis Location:	Branch Road to CTH J/Forman Road
Safety Analysis Method:	Method 3
External CMF Value:	Alternative 1: 0.92 for KABC Crashes
External CMF Source:	WisDOT CMF Table
Unique Safety Analysis Notes:	None

		Base	Alt. 1
Alternative Name		Future No Build	Widen Shoulders (3’ to 5’) and Install Shoulder Rumble Strips
Safety Certification Process (See FDM 11-38)	Fatal & Injury Crashes	11.8	10.8
	Property Damage Only Crashes	19.7	18.0
	Total Crashes	31.5	28.8
	Crash Cost Value	$6,629,057	$6,055,021
	Project Cost	$0	$94,000
	Net Safety Benefit	-	$574,036
	Net Cost	-	$94,000
	Safety B/C	-	6.1

Analysis Location:	CTH J/Forman Road to CTH J/Koepenick Road
Safety Analysis Method:	Method 3
External CMF Value:	Alternative 1: 0.92 for KABC Crashes
External CMF Source:	WisDOT CMF Table
Unique Safety Analysis Notes:	None

		Base	Alt. 1
Alternative Name		Future No Build	Widen Shoulders (3’ to 5’) and Install Shoulder Rumble Strips
Safety Certification Process (See FDM 11-38)	Fatal & Injury Crashes	15.1	13.8
	Property Damage Only Crashes	30.7	28.1
	Total Crashes	45.8	41.9
	Crash Cost Value	$8,501,812	$7,765,607
	Project Cost	$0	$182,000
	Net Safety Benefit	-	$736,205
	Net Cost	-	$182,000
	Safety B/C	-	4.0

Analysis Location:	CTH B to CTH T (Rural Project Limits)
Safety Analysis Method:	Method 3
External CMF Value:	Alternative 1: 0.92 for KABC Crashes
External CMF Source:	WisDOT CMF Table
Unique Safety Analysis Notes:	None

		Base	Alt. 1
Alternative Name		Future No Build	Widen Shoulders (3’ to 5’) and Install Shoulder Rumble Strips
Safety Certification Process (See FDM 11-38)	Fatal & Injury Crashes	81.1	39.1
	Property Damage Only Crashes	42.8	74.1
	Total Crashes	123.9	113.2
	Crash Cost Value	$24,048,745	$21,966,272
	Project Cost	$0	$538,000
	Net Safety Benefit	-	$2,082,474
	Net Cost	-	$538,000
	Safety B/C	-	3.9

Analysis Location:	CTH T Curve
Safety Analysis Method:	Method 3
External CMF Value:	Alternative 1: 0.92 for KABC Crashes Alternative 2: 0.43 for All Crashes
External CMF Source:	WisDOT CMF Table
Unique Safety Analysis Notes:	None

		Base	Alt. 1	Alt. 2
Alternative Name		Future No Build	Widen Shoulders (3’ to 5’) and Install Shoulder Rumble Strips	Install High Friction Surface Treatment (HFST)
Safety Certification Process (See FDM 11-38)	Fatal & Injury Crashes	3.9	3.5	1.6
	Property Damage Only Crashes	5.6	5.1	2.2
	Total Crashes	9.5	8.6	3.8
	Crash Cost Value	$2,170,317	$1,982,381	$877,242
	Project Cost	$0	$48,000	$349,000
	Net Safety Benefit	-	$187,936	$1,293,075
	Net Cost	-	$48,000	$349,000
	Safety B/C	-	3.9	3.7

Analysis Location:	IX_34_01843: USH 45 at CTH I
Safety Analysis Method:	Method 2
External CMF Value:	Alternative 1: 0.37 for KABC Crashes
External CMF Source:	WisDOT CMF Table
Unique Safety Analysis Notes:	None

		Base	Alt. 1	Alt. 2
Alternative Name		Future No Build	Restricted Crossing U-Turn	Multi-lane Roundabout
Safety Certification Process (See FDM 11-38)	Fatal & Injury Crashes	2.5	1.8	6.2
	Property Damage Only Crashes	5.3	6.0	39.2
	Total Crashes	7.8	7.8	45.4
	Crash Cost Value	$1,561,006	$1,108,868	$2,283,622
	Project Cost	$354,000	$788,000	$2,000,000
	Net Safety Benefit	-	$452,138	-$722,616
	Net Cost	-	$434,000	$1,646,000
	Safety B/C	-	1.0	-0.4

Analysis Location:	IX_34_01953: USH 45 at CTH C
Safety Analysis Method:	Method 3
External CMF Value:	-
External CMF Source:	-
Unique Safety Analysis Notes:	None

		Base	Alt. 1
Alternative Name		Future No Build	Install left-turn lanes
Safety Certification Process (See FDM 11-38)	Fatal & Injury Crashes	5.7	3.0
	Property Damage Only Crashes	11.2	5.8
	Total Crashes	16.9	8.8
	Crash Cost Value	$3,526,873	$1,833,974
	Project Cost	$45,000	$238,000
	Net Safety Benefit	-	$1,692,899
	Net Cost	-	$193,000
	Safety B/C	-	8.8

6. Other Information

6.1. Describe other information relevant to the project such as community considerations, unique features, potential funding sources, etc.

All investigated alternatives will be reviewed for Highway Safety Improvement Program (HSIP) funding.

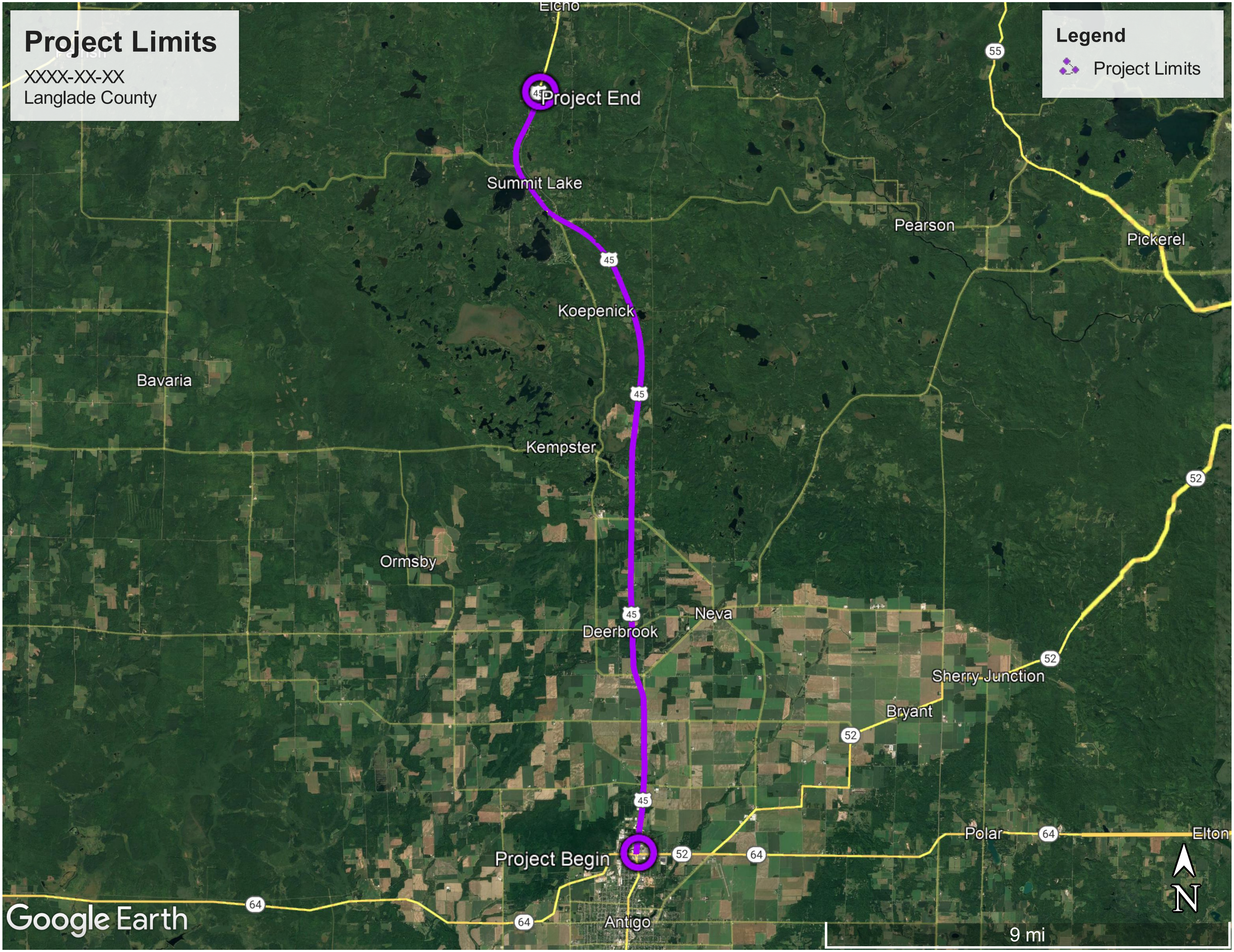
ATTACHMENTS

Include all attachments in the final Safety & Operations Certification Document and submit as a single PDF.

A. Project Information
   a. Project Location/Overview Map
B. Network Screening Documentation
   a. Meta-Manager spreadsheet
   b. Intersection Network Screening spreadsheet
   c. Overview Map of Safety Sites of Promise Locations (optional)
C. Diagnosis Documentation
   a. WisTransPortal crash data spreadsheet with vetting comments
   b. Crash Diagram(s)
D. Countermeasure/Alternative Identification
   a. Safety Certification Worksheet
   b. Layout/Schematic for each alternative
E. Analysis Results and Economic Appraisal
   a. Cost estimate for each alternative
   b. IHSDM Crash Prediction Evaluation Report for each alternative
   c. IHSDM Economic Analysis Report
   ~~d. Highway Safety Benefit-Cost Analysis Tool results (if applicable)~~
~~F. Operations Certification Summary (if applicable)~~
   ~~a. Turning movement counts~~
   ~~b. Diagram of traffic volumes for each analysis period~~
   ~~c. AWSC warrants~~
   ~~d. Signal warrants~~
   ~~e. Software reports for operation analysis~~
   ~~f. DT 1887~~
   ~~g. Exhibit highlighting queues vs. available storage for each analysis period~~
   ~~h. OCP Benefit-Cost Tool printouts~~

APPENDIX A
PROJECT INFORMATION

PROJECT MAP



Project Limits
XXXX-XX-XX
Langlade County
Legend
Project Limits
Project End
Project Begin
Elcho
Summit Lake
Pearson
Pickerel
Koepenick
Bavaria
Kempster
Ormsby
Neva
Deerbrook
Sherry Junction
Bryant
Polar
Elton
Antigo
45
52
55
64
N
9 mi
Google Earth

APPENDIX B
NETWORK SCREENING DOCUMENTATION

MetaManager Spreadsheet (2016-2020 Crash Data)

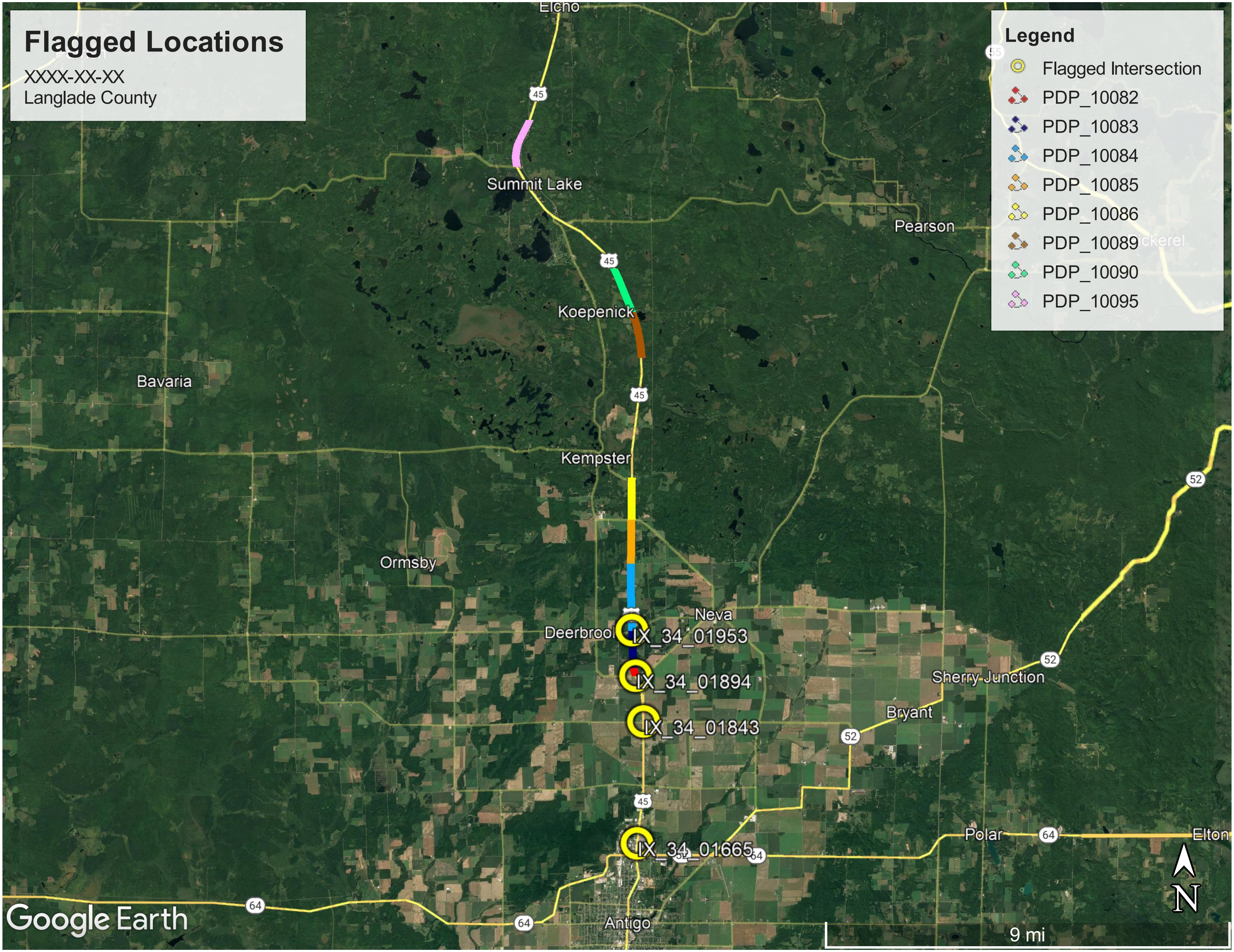
PDP_ID	PDP_FRM	PDP_TO	PDP_MILE	ACSI_INTS_NM	DIVUND	HWY&DIR	RATEFLAG	MMGR_KAB_CRSH_RT_FL	MMGR_BIKE_CRSH_TOT	MMGR_PED_CRSH_TOT	HSTL_AADT_5_YR
10075	045N256 000	045N256 026	0.26	STH 64 EB	D	045N	0.00	0.00	0	0	9510
10076	045N256 026	045N256 044	0.18	AMRON AVE	D	045N	0.00	0.00	0	0	7910
10077	045N256 044	045N256 097	0.53		D	045N	0.00	0.00	0	0	7910
10078	045N256 097	045N258 000	0.57		D	045N	0.00	0.00	0	0	7910
10079	045N258 000	045N260H000	1.42	CTH N	D	045N	0.00	0.00	0	0	7700
10080	045N260H000	045N260M000	0.56	CTH I	D	045N	0.00	0.00	0	0	7700
10081	045N260M000	045N261 000	0.48	CTH A	D	045N	0.00	0.00	0	0	6236
10082	045N261 000	045N261 020	0.20	CTH B	D	045N	3.12	0.00	0	0	3620
10083	045N261 020	045N262 000	0.82		U	045N	1.42	0.00	0	0	3620
10084	045N262 000	045N264 000	1.48	CTH C	U	045N	0.00	1.03	0	0	4030
10085	045N264 000	045N265 000	0.97	BRANCH RD	U	045N	1.07	0.00	0	0	4030
10086	045N265 000	045N266 000	0.94	CTH V	U	045N	1.85	1.11	0	0	4030
10087	045N266 000	045N266 158	1.58	CTH J	U	045N	0.00	0.00	0	0	3780
10088	045N266 158	045N266 265	1.07		U	045N	0.00	0.00	0	0	3780
10089	045N266 265	045N270 000	1.06		U	045N	0.00	1.36	0	0	3780
10090	045N270 000	045N271G009	1.05	CTH J	U	045N	1.15	1.32	0	0	4300
10091	045N271G009	045N272 000	1.46		U	045N	0.00	0.00	0	0	4300
10092	045N272 000	045N273 000	0.32	CTH T	U	045N	0.00	0.00	0	0	3720
10093	045N273 000	045N273 066	0.66	CTH B	U	045N	0.00	0.00	0	0	3850
10094	045N273 066	045N275 000	0.73		U	045N	0.00	0.00	0	0	3860
10095	045N275 000	045N276 000	1.06		U	045N	0.00	1.77	0	0	3450
10096	045N276 000	045N278 000	1.25	CTH B	U	045N	0.00	0.00	0	0	3450
10097	045N278 000	045N279 041	1.32	CTH B	U	045N	0.00	0.00	0	0	3450
10098	045N279 041	045N280 000	0.17	COMMERCIAL DRWY	U	045N	0.00	0.00	0	0	3450
10173	045S261 000	045S260T009	0.49	CTH B	D	045S	0.00	0.00	0	0	6236
10174	045S260T009	045S260H000	0.56		D	045S	0.00	0.00	0	0	7700
10175	045S260H000	045S258 000	1.41	CTH I	D	045S	0.00	0.00	0	0	7700
10176	045S258 000	045S258 056	0.56	CTH N	D	045S	0.00	0.00	0	0	7910
10177	045S258 056	045S258 110	0.54		D	045S	0.00	0.00	0	0	7910
10178	045S258 110	045S258 128	0.18		D	045S	0.00	0.00	0	0	7910
10179	045S258 128	045S256 000	0.26		D	045S	0.00	0.00	0	0	9510

Intersection Network Screening (2016-2020 Crash Data)

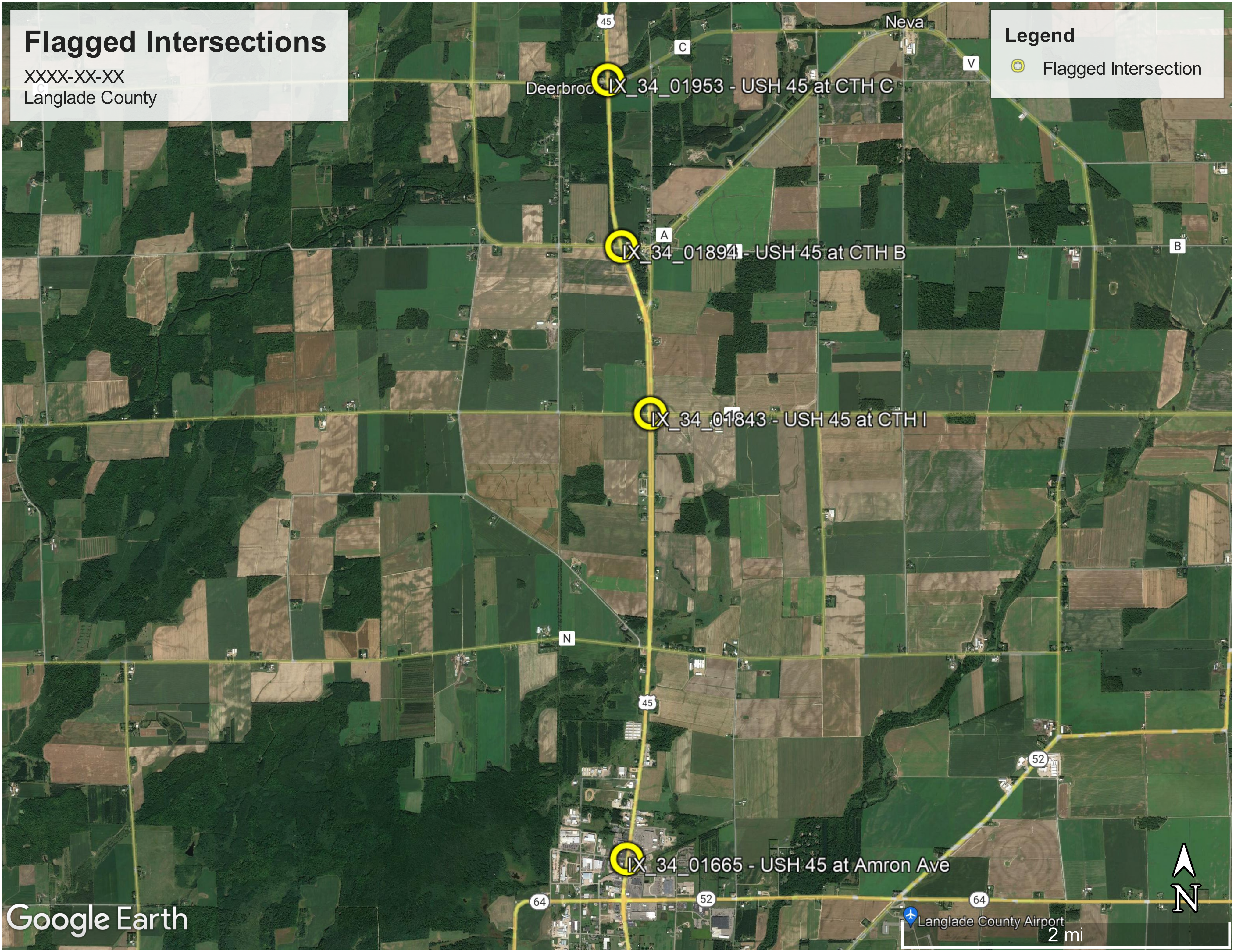
Intersection Network Screening

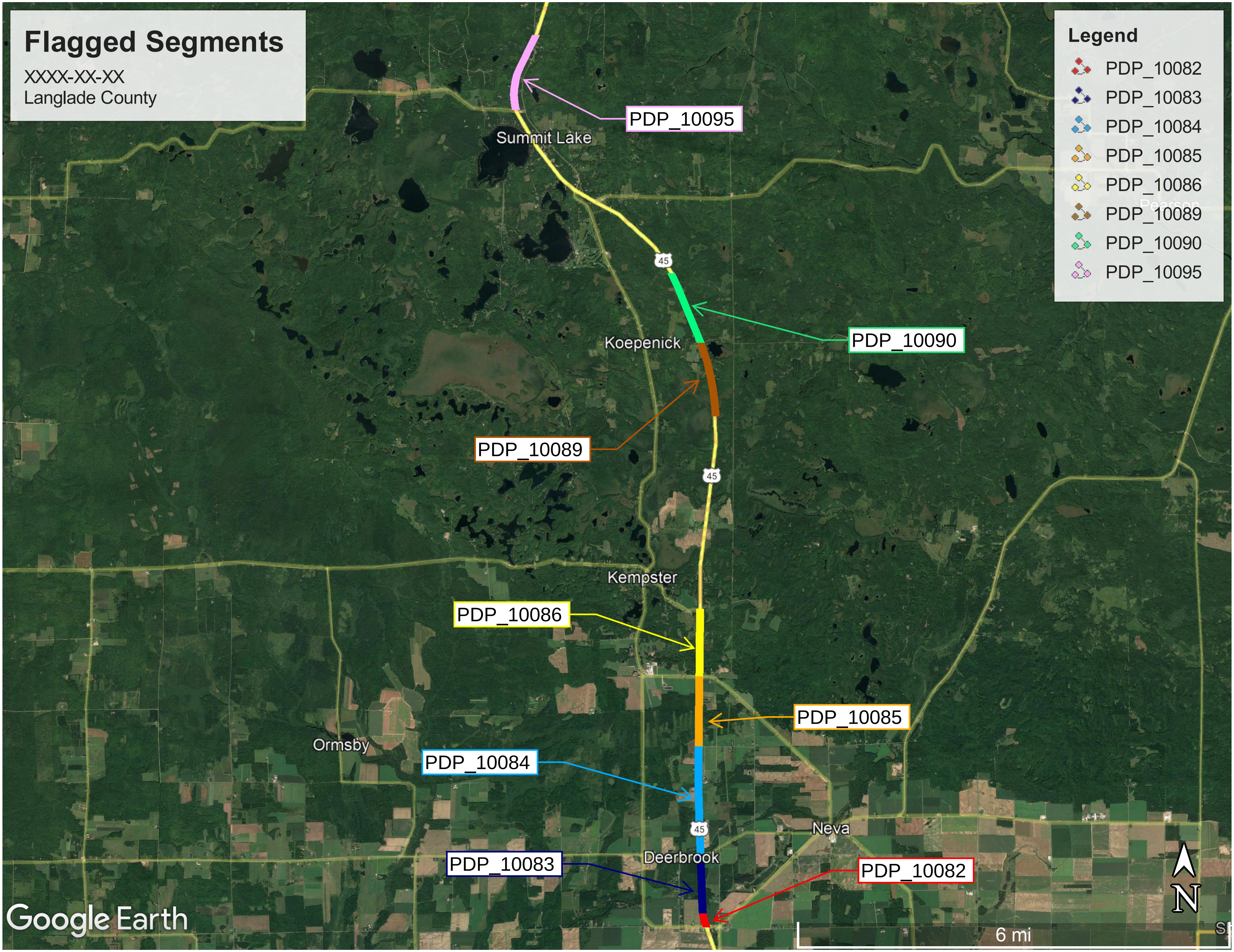
Updated: 1/3/2020

Safety Certification Worksheet Information							Data Needed for SPFs									
INT_ID	Intersection Name (IX_NAME)	LOSS (TOTAL)	PSI (TOTAL)	LOSS (KABC)	PSI (KABC)	Flagged Location (Yes/No)	Region	County	Area Type	Ramp Terminal	Number of Legs	Control Type	Median Type	Number of Lanes	Major AADT	Minor AADT
IX_34_01623	USH 45 & STH 52 & STH 64	LOSS 3	6.54	LOSS 3	0.89	No	NC	Langlade	URBAN	FALSE	4	SIGNAL	RAISED	2	13824	5540
IX_34_01653	USH 45 & Prosser Pl	LOSS 2	-0.25	LOSS 3	0.06	No	NC	Langlade	URBAN	FALSE	3	TWSC	TWLTL	2	10644	407
IX_34_01665	USH 45 & Amron Ave	LOSS 3	0.35	LOSS 4	0.81	Yes	NC	Langlade	URBAN	FALSE	3	TWSC	TWLTL	2	10644	1119
IX_34_01680	USH 45 & Memory Ln & Rusch Rd	LOSS 2	-2.35	LOSS 2	-0.58	No	NC	Langlade	URBAN	FALSE	4	TWSC	TWLTL	2	8404	407
IX_34_01715	USH 45 & Industrial Park Rd	LOSS 2	-0.49	LOSS 3	0.13	No	NC	Langlade	URBAN	FALSE	3	TWSC	TWLTL	2	8404	124
IX_34_01770	USH 45 & CTH N & Cherry Rd	LOSS 2	-1.61	LOSS 2	-0.29	No	NC	Langlade	RURAL	FALSE	4	TWSC	CH+TL	2	8404	108
IX_34_01843	USH 45 & CTH I	LOSS 4	2.97	LOSS 4	0.49	Yes	NC	Langlade	RURAL	FALSE	4	TWSC	DITCH	2	8112	85
IX_34_01876	USH 45 & CTH A	LOSS 2	-1.71	LOSS 2	-0.33	No	NC	Langlade	RURAL	FALSE	3	TWSC	DITCH	2	5950	1425
IX_34_01894	USH 45 & CTH B	LOSS 4	2.33	LOSS 3	0.28	Yes	NC	Langlade	RURAL	FALSE	4	TWSC	UNDIVIDED	1	6010	1273
IX_34_01953	USH 45 & CTH C	LOSS 4	4.58	LOSS 4	0.91	Yes	NC	Langlade	RURAL	FALSE	4	TWSC	UNDIVIDED	1	4936	1273
IX_34_01984	USH 45 & Bagly Ln	LOSS 2	-0.12	LOSS 2	-0.04	No	NC	Langlade	RURAL	FALSE	3	TWSC	UNDIVIDED	1	4306	108
IX_34_02006	USH 45 & Branch Rd	LOSS 2	-0.12	LOSS 3	0.12	No	NC	Langlade	RURAL	FALSE	3	TWSC	UNDIVIDED	1	4306	108
IX_34_02036	USH 45 & CTH V	LOSS 2	-0.24	LOSS 2	-0.10	No	NC	Langlade	RURAL	FALSE	4	TWSC	UNDIVIDED	1	4306	85
IX_34_02051	USH 45 & CTH J & Forman Rd	LOSS 3	0.06	LOSS 3	0.15	No	NC	Langlade	RURAL	FALSE	4	TWSC	UNDIVIDED	1	4306	153
IX_34_02062	USH 45 & Mark Ln	LOSS 2	-0.53	LOSS 2	-0.04	No	NC	Langlade	RURAL	FALSE	3	TWSC	UNDIVIDED	1	4132	108
IX_34_02094	USH 45 & Knight Rd	LOSS 3	0.16	LOSS 2	-0.11	No	NC	Langlade	RURAL	FALSE	4	TWSC	UNDIVIDED	1	4132	108
IX_34_02160	USH 45 & Noboken Ln	LOSS 2	-0.11	LOSS 2	-0.04	No	NC	Langlade	RURAL	FALSE	3	TWSC	UNDIVIDED	1	4132	108
IX_34_02171	USH 45 & CTH J & Koepenick Rd	LOSS 2	-0.68	LOSS 3	0.12	No	NC	Langlade	RURAL	FALSE	4	TWSC	UNDIVIDED	1	4132	345
IX_34_02219	USH 45 & CTH T	LOSS 3	0.19	LOSS 2	-0.09	No	NC	Langlade	RURAL	FALSE	3	TWSC	UNDIVIDED	1	4090	345
IX_34_02236	USH 45 & CTH B	LOSS 2	-1.04	LOSS 2	-0.36	No	NC	Langlade	RURAL	FALSE	4	TWSC	UNDIVIDED	1	4730	478
IX_34_02261	USH 45 & Forest Rd	LOSS 2	-0.18	LOSS 2	-0.24	No	NC	Langlade	RURAL	FALSE	4	TWSC	UNDIVIDED	1	4730	256
IX_34_02270	USH 45 & TN RD 96	LOSS 2	-0.54	LOSS 2	-0.04	No	NC	Langlade	RURAL	FALSE	3	TWSC	UNDIVIDED	1	4200	108
IX_34_02272	USH 45 & Merlin St	LOSS 2	-0.11	LOSS 2	-0.04	No	NC	Langlade	RURAL	FALSE	3	TWSC	UNDIVIDED	1	4200	108
IX_34_02275	USH 45 & TN RD 97	LOSS 2	-0.54	LOSS 2	-0.04	No	NC	Langlade	RURAL	FALSE	3	TWSC	UNDIVIDED	1	4200	108
IX_34_02278	USH 45 & Summit Lake Rd	LOSS 2	-0.28	LOSS 2	-0.11	No	NC	Langlade	RURAL	FALSE	4	TWSC	UNDIVIDED	1	4200	108
IX_34_02282	USH 45 & TN RD 98	LOSS 2	-0.54	LOSS 2	-0.04	No	NC	Langlade	RURAL	FALSE	3	TWSC	UNDIVIDED	1	4200	108
IX_34_02287	USH 45 & Rasmussen St	LOSS 2	-0.54	LOSS 2	-0.04	No	NC	Langlade	RURAL	FALSE	3	TWSC	UNDIVIDED	1	4200	108
IX_34_02304	USH 45 & CTH T	LOSS 2	-1.22	LOSS 2	-0.25	No	NC	Langlade	RURAL	FALSE	4	TWSC	UNDIVIDED	1	4200	345
IX_34_02326	USH 45 & CTH B	LOSS 3	0.36	LOSS 3	0.10	No	NC	Langlade	RURAL	FALSE	3	TWSC	UNDIVIDED	1	3250	85



Flagged Locations
XXXX-XX-XX
Langlade County
Legend
Flagged Intersection
PDP_10082
PDP_10083
PDP_10084
PDP_10085
PDP_10086
PDP_10089
PDP_10090
PDP_10095
Elcho
Summit Lake
Pearson
Koepenick
Bavaria
Kempster
Ormsby
Neva
Deerbrook
IX_34_01953
IX_34_01894
IX_34_01843
IX_34_01665
Sherry Junction
Bryant
Polar
Elton
Antigo
45
52
64
9 mi
N
Google Earth


Flagged Intersections
XXXX-XX-XX
Langlade County
Legend
Flagged Intersection
Neva
Deerbrook
IX_34_01953 - USH 45 at CTH C
IX_34_01894 - USH 45 at CTH B
IX_34_01843 - USH 45 at CTH I
IX_34_01665 - USH 45 at Amron Ave
45
C
V
A
B
N
52
64
Langlade County Airport
2 mi
N
Google Earth

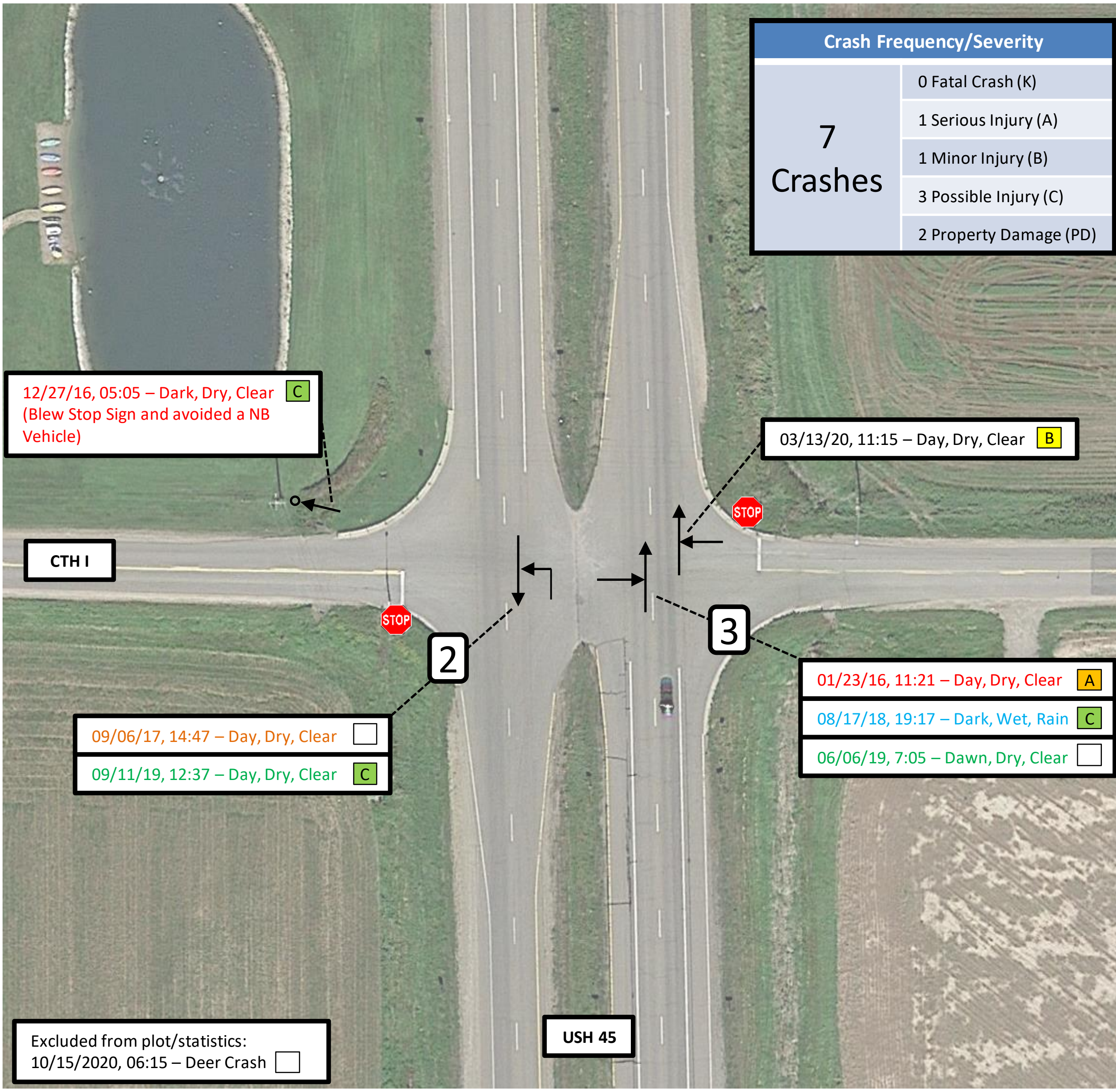

Flagged Segments
XXXX-XX-XX
Langlade County
Legend
PDP_10082
PDP_10083
PDP_10084
PDP_10085
PDP_10086
PDP_10089
PDP_10090
PDP_10095
PDP_10095
Summit Lake
45
PDP_10090
Koepenick
PDP_10089
45
Kempster
PDP_10086
PDP_10085
Ormsby
PDP_10084
45
Neva
Deerbrook
PDP_10083
PDP_10082
N
6 mi
Google Earth

APPENDIX C
DIAGNOSIS DOCUMENTATION

Sample crash data is not provided for this example.

See FDM 11-38 for sample of crash data documentation with vetting comments.

CRASH DIAGRAMS

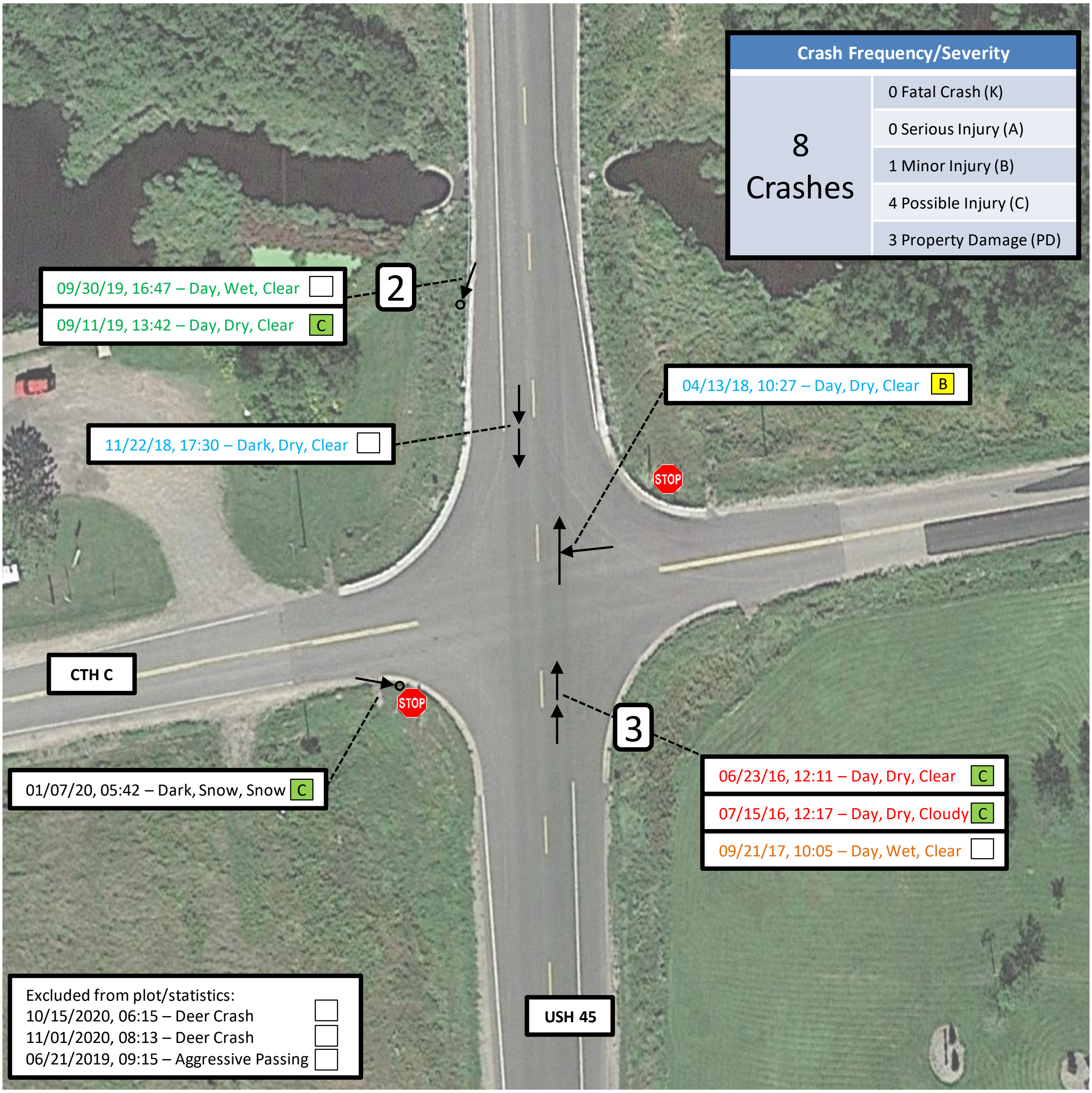


LEGEND

CRASH YEAR	SEVERITY		CRASH TYPE
2016 = Red	Fatal (K)	K	Angle
2017 = Orange	Serious Injury (A)	A	Rear-end
2018 = Cyan	Minor Injury (B)	B	Head-on
2019 = Green	Possible Injury (C)	C	SS Same
2020 = Black	Property Damage (PD)		SS Opposite
			ROR Fixed Object
	Alcohol or Drug Flag		ROR Overturn
			ROR
			Pedestrian
			Bicycle

N

16-20 Crash Diagram
USH 45 at CTH I
Langlade County



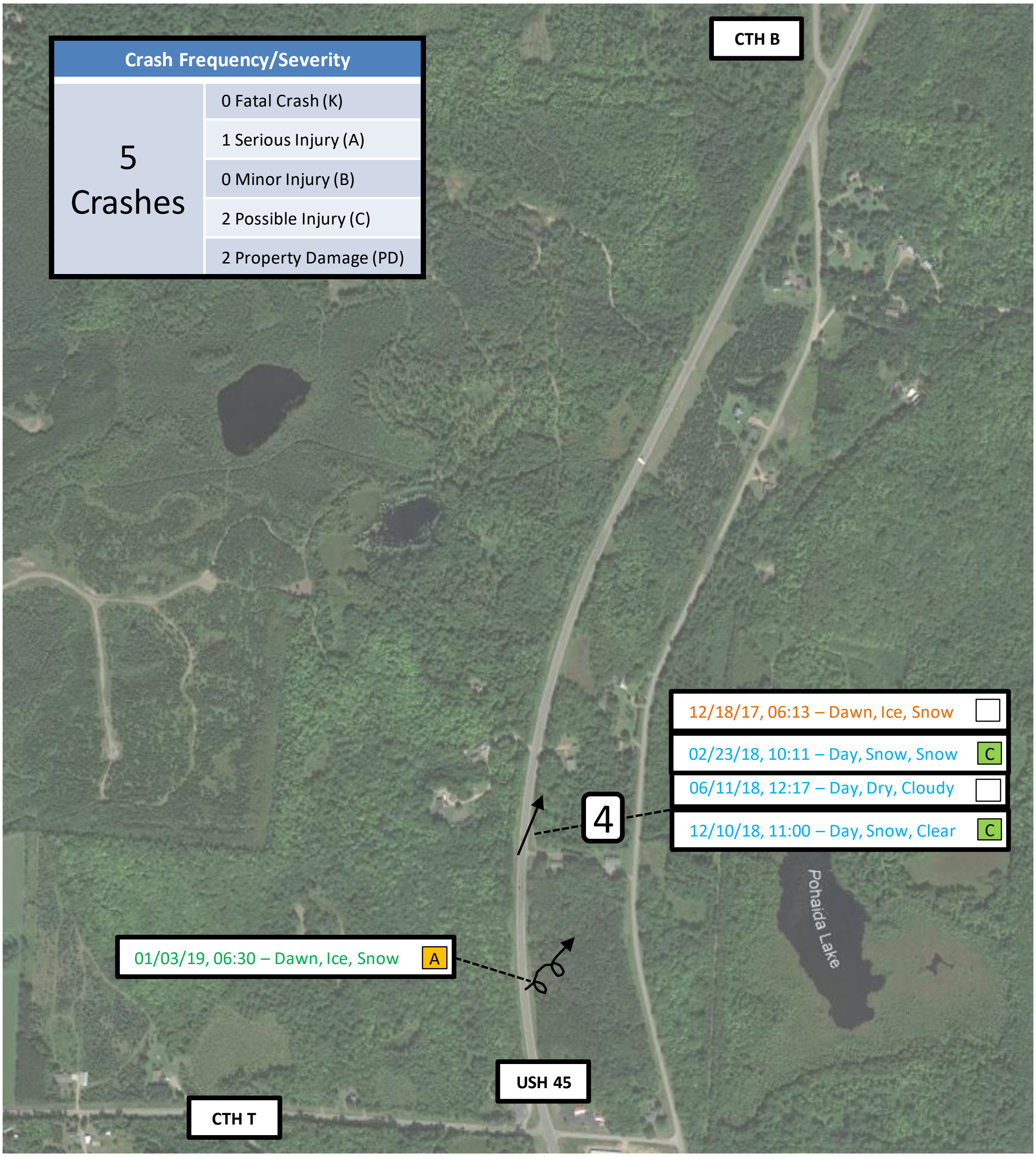
LEGEND

CRASH YEAR	SEVERITY		CRASH TYPE
2016 = Red	Fatal (K)	K	Angle
2017 = Orange	Serious Injury (A)	A	Rear-end
2018 = Cyan	Minor Injury (B)	B	Head-on
2019 = Green	Possible Injury (C)	C	SS Same
2020 = Black	Property Damage (PD)		SS Opposite
			ROR Fixed Object
	Alcohol or Drug Flag		ROR Overturn
			ROR
			Pedestrian
			Bicycle

N

16-20 Crash Diagram
USH 45 at CTH C
Langlade County

Crash Frequency/Severity	
5 Crashes	0 Fatal Crash (K)
	1 Serious Injury (A)
	0 Minor Injury (B)
	2 Possible Injury (C)
	2 Property Damage (PD)



LEGEND

CRASH YEAR	SEVERITY		CRASH TYPE
2016 = Red	Fatal (K)	K	Angle
2017 = Orange	Serious Injury (A)	A	Rear-end
2018 = Cyan	Minor Injury (B)	B	Head-on
2019 = Green	Possible Injury (C)	C	SS Same
2020 = Black	Property Damage (PD)		SS Opposite
			ROR Fixed Object
	Alcohol or Drug Flag		ROR Overturn
			ROR
			Pedestrian
			Bicycle

N

16-20 Crash Diagram
USH 45 Curve
Btwn CTH T & CTH B
Langlade County

APPENDIX D
COUNTERMEASURE IDENTIFICATION, SAFETY EVALUATION AND ECONOMIC APPRAISAL DOCUMENTATION

FDM 11-38 Attachment 10.4 - Safety Certification Worksheet

Safety Certification Worksheet

Analyst:	BTO	Design ID:	XXXX-XX-XX
Agency:	WisDOT	Highway:	USH 45
Date of Analysis:	1/1/2022	Project Title:	Example
Meta Manager Version:	7/6/2021	Project Subtitle:	
Meta Manager Crash Years:	2016-2020	Worksheet ID:	(if using WisTransPortal SCM tool)

Network Screening for Safety Sites of Promise See FDM 11-38-10.2 for guidance									Diagnosis of Safety Sites of Promise See 11-38-10.3 for guidance			Countermeasure Identification See FDM 11-38-10.4 for guidance	
Segments: Meta-Manager													
PDP_ID	From RP	RP Description	To RP	Length (PDP_Mile)	Crash Rate Flag (RATEFLAG) (Insert value if ≥ 1.0)	KAB Crash Rate Flag (MMGR_KAB_CRSH_RT_FL) (Insert value if ≥ 1.0)	Pedestrian Flag (MMGR_PED_CRSH_TOT) (Insert value if ≥ 1.0)	Bicycle Flag (MMGR_BIKE_CRSH_TOT) (Insert value if ≥ 1.0)	Number of Crashes Reviewed	Number of Remaining Crashes	Summarize the contributing factors for ALL REMAINING crashes in the flagged segment.	Which geometric features contribute to the type and severity of the crashes?	Possible countermeasures for the Safety Evaluation and Economic Appraisal Procedure
10075	045N256 000	STH 64 EB	045N256 026	0.26									
10076	045N256 026	AMRON AVE	045N256 044	0.18									
10077	045N256 044		045N256 097	0.53									
10078	045N256 097		045N258 000	0.57									
10079	045N258 000	CTH N	045N260H000	1.42									
10080	045N260H000	CTH I	045N260M000	0.56									
10081	045N260M000	CTH A	045N261 000	0.48									
10082	045N261 000	CTH B	045N261 020	0.2	3.12				11	4	Eight crashes were intersection-related and are evaluated within the USH 45 and CTH B intersection (IX_34_01894). One crash was a run-off-road crash relating to snow/ice conditions. Three crashes were northbound run-off-road crashes where the vehicle left the roadway, overcorrected and overturned.	Narrow paved shoulder width, pavement edge drop-off	Shoulder widening and shoulder rumble strips
10083	045N261 020		045N262 000	0.82	1.42				7	6	Four crashes were run-off-road crashes. Two of these crashes occurred during snow/ice conditions and the remaining crashes occurred during dry conditions. One crash occurred when a southbound vehicle slowed to turn into a driveway and was rear-ended. One crash occurred when a vehicle leaving a driveway failed to yield to a southbound vehicle.	Narrow paved shoulder width	Shoulder widening and shoulder rumble strips
10084	045N262 000	CTH C	045N264 000	1.48		1.03			11	0	11 crashes were intersection-related and are evaluated within the USH 45 and CTH C intersection (IX_34_01953)		
10085	045N264 000	BRANCH RD	045N265 000	0.97	1.07				7	5	Two crashes were northbound run-off-road crashes. One crash was a southbound run-off-road crash where the vehicle left the roadway, overcorrected and overturned. One crash was a northbound vehicle that crossed the centerline and hit a southbound vehicle head-on. One crash was a rear-end at Branch Rd where a vehicle was waiting to perform a left turn and was struck.	Narrow paved shoulder width, pavement edge drop-off	Shoulder widening and shoulder rumble strips
10086	045N265 000	CTH V	045N266 000	0.94	1.85	1.11			15	10	Two crashes were a northbound vehicles that crossed the centerline and hit a southbound vehicle head-on. One crash occurred when a southbound vehicle was turning left into a driveway and was rear-ended. Two crashes were southbound run-off-road crashes. Three crashes were northbound run-off-road crashes. Two crashes occurred during snow/ice conditions. Two crashes occurred at the intersection of CTH V: -One crash occurred when a westbound vehicle failed to stop for the stop sign and struck a northbound vehicle. -One crash occurred when a northbound vehicle was slowing to	Narrow paved shoulder width, pavement edge drop-off	Shoulder widening and shoulder rumble strips
10087	045N266 000	CTH J	045N266 158	1.58									
10088	045N266 158		045N266 265	1.07									
10089	045N266 265		045N270 000	1.06		1.36			3	3	One crash was a northbound run-off-road crash where the vehicle left the roadway, overcorrected and overturned. Two crashes were northbound run-off-road crashes	Narrow paved shoulder width, pavement edge drop-off	Shoulder widening and shoulder rumble strips
10090	045N270 000	CTH J	045N271G009	1.05	1.15	1.32			8	5	Three crashes occurred at the intersection of CTH J: -One crash occurred when an eastbound vehicle failed to yield to a northbound vehicle. -One crash occurred when a westbound vehicle failed to yield to a northbound vehicle. -One crash occurred when an ATV was crossing the intersection and was struck by a southbound vehicle. Two crashes involved a southbound vehicle crossing the centerline and striking a northbound vehicle head-or	Two of the crashes involved vehicles crossing the centerline. These crashes could be mitigated with centerline rumble strips. It is standard to install these on this facility type and it will be included within the scope of work. Sight distance, visibility at the intersection of CTH J.	Recommended to maintenance to perform brushing at the intersection of CTH J to improve the visibility.
10091	045N271G009		045N272 000	1.46									
10092	045N272 000	CTH T	045N273 000	0.32									
10093	045N273 000	CTH B	045N273 066	0.66									
10094	045N273 066		045N275 000	0.73									
10095	045N275 000		045N276 000	1.06		1.77			5	5	Five crashes were run-off-the-road crashes and occurred within the horizontal curve between CTH T and CTH B intersection. Four of the five crashes occurred during snow/ice/wet conditions.	Speed limit, horizontal curvature, narrow paved shoulder width	Shoulder widening and shoulder rumble strips, High Friction Surface Treatment
10173	045S261 000	CTH B	045S260T009	0.49									
10174	045S260T009		045S260H000	0.56									
10175	045S260H000	CTH I	045S258 000	1.41									
10176	045S258 000	CTH N	045S258 056	0.56									
10177	045S258 056		045S258 110	0.54									
10178	045S258 110		045S258 128	0.18									
10179	045S258 128		045S256 000	0.26									

FDM 11-38 Attachment 10.4 - Safety Certification Worksheet

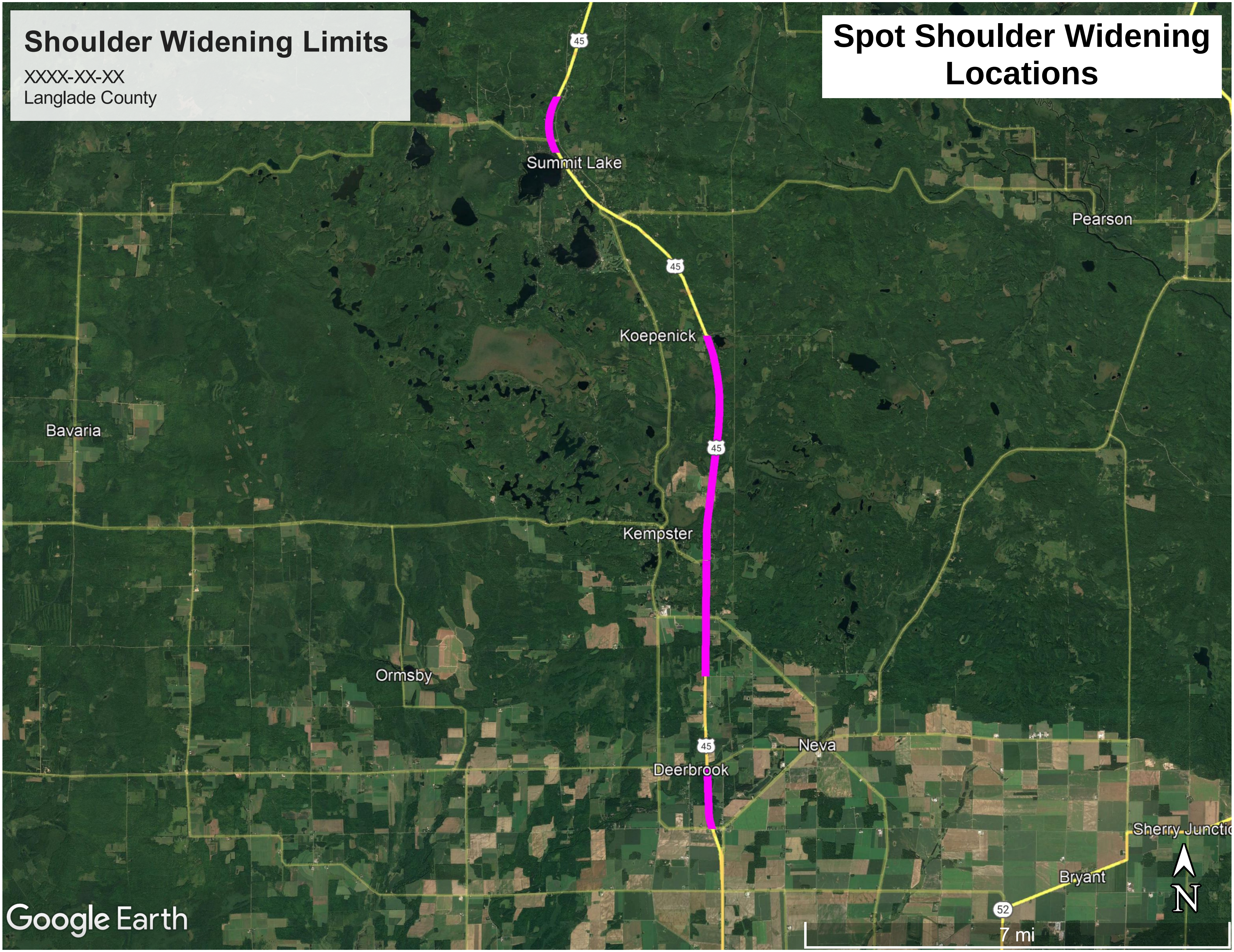
Last updated: November 15, 2021

Intersections: Intersection Network Screening											
INT_ID	**Intersection Name** (IX_NAME)	**LOSS** (TOTAL)	**PSI** (TOTAL)	**LOSS** (KABC)	**PSI** (KABC)	**Number of Crashes Reviewed**	**Number of Remaining Crashes**	**Summarize the contributing factors for ALL REMAINING crashes in the flagged intersection.**	**Which geometric features contribute to the type and severity of the crashes?**	**Possible countermeasures for the Safety Evaluation and Economic Appraisal Procedure**
IX_34_01623	USH 45 & STH 52 & STH 64	LOSS 3	6.54	LOSS 3	0.89					
IX_34_01653	USH 45 & Prosser Pl	LOSS 2	-0.25	LOSS 3	0.06					
IX_34_01665	USH 45 & Amron Ave	LOSS 3	0.35	LOSS 4	0.81	5	0			
IX_34_01680	USH 45 & Memory Ln & Rusch Rd	LOSS 2	-2.35	LOSS 2	-0.58					
IX_34_01715	USH 45 & Industrial Park Rd	LOSS 2	-0.49	LOSS 3	0.13					
IX_34_01770	USH 45 & CTH N & Cherry Rd	LOSS 2	-1.61	LOSS 2	-0.29					
IX_34_01843	USH 45 & CTH I	LOSS 4	2.97	LOSS 4	0.49	8	7	Three crashes were eastbound vehicles that failed to yield and struck northbound vehicles. One crash was a westbound vehicle that failed to yield and struck a northbound vehicle. One crash was a westbound vehicle that failed to stop, avoided striking a northbound vehicle and struck a power pole. Two crashes were northbound vehicles that were turning left and struck a southbound vehicle.	Cross section, poor gap selection, speed limit	Roundabout, RCUT
IX_34_01876	USH 45 & CTH A	LOSS 2	-1.71	LOSS 2	-0.33					
IX_34_01894	USH 45 & CTH B	LOSS 4	2.33	LOSS 3	0.28	8	2	One crash was a northbound run-off-road crash where a vehicle struck a sign post. One crash was a westbound rear-end		
IX_34_01953	USH 45 & CTH C	LOSS 4	4.58	LOSS 4	0.91	11	8	One crash was a westbound vehicle that failed to yield and struck a northbound vehicle. Four crashes were rear-ends due to vehicles slowing to perform a left turn. Three occurred in the northbound direction and one occurred in the southbound direction. Two crashes were southbound vehicles that ran-off-the-road and struck guardrail. One crash was an eastbound vehicle that lost control during snow/ice conditions and struck a sign post.	Lack of left turn lanes	Mainline left turn lanes
IX_34_01984	USH 45 & Bagly Ln	LOSS 2	-0.12	LOSS 2	-0.04					
IX_34_02006	USH 45 & Branch Rd	LOSS 2	-0.12	LOSS 3	0.12					
IX_34_02036	USH 45 & CTH V	LOSS 2	-0.24	LOSS 2	-0.10					
IX_34_02051	USH 45 & CTH J & Forman Rd	LOSS 3	0.06	LOSS 3	0.15					
IX_34_02062	USH 45 & Mark Ln	LOSS 2	-0.53	LOSS 2	-0.04					
IX_34_02094	USH 45 & Knight Rd	LOSS 3	0.16	LOSS 2	-0.11					
IX_34_02160	USH 45 & Noboken Ln	LOSS 2	-0.11	LOSS 2	-0.04					
IX_34_02171	USH 45 & CTH J & Koepenick Rd	LOSS 2	-0.68	LOSS 3	0.12					
IX_34_02219	USH 45 & CTH T	LOSS 3	0.19	LOSS 2	-0.09					
IX_34_02236	USH 45 & CTH B	LOSS 2	-1.04	LOSS 2	-0.36					
IX_34_02261	USH 45 & Forest Rd	LOSS 2	-0.18	LOSS 2	-0.24					
IX_34_02270	USH 45 & TN RD 96	LOSS 2	-0.54	LOSS 2	-0.04					
IX_34_02272	USH 45 & Merlin St	LOSS 2	-0.11	LOSS 2	-0.04					
IX_34_02275	USH 45 & TN RD 97	LOSS 2	-0.54	LOSS 2	-0.04					
IX_34_02278	USH 45 & Summit Lake Rd	LOSS 2	-0.28	LOSS 2	-0.11					
IX_34_02282	USH 45 & TN RD 98	LOSS 2	-0.54	LOSS 2	-0.04					
IX_34_02287	USH 45 & Rasmussen St	LOSS 2	-0.54	LOSS 2	-0.04					
IX_34_02304	USH 45 & CTH T	LOSS 2	-1.22	LOSS 2	-0.25					
IX_34_02326	USH 45 & CTH B	LOSS 3	0.36	LOSS 3	0.10					

Shoulder Widening Limits

XXXX-XX-XX
Langlade County

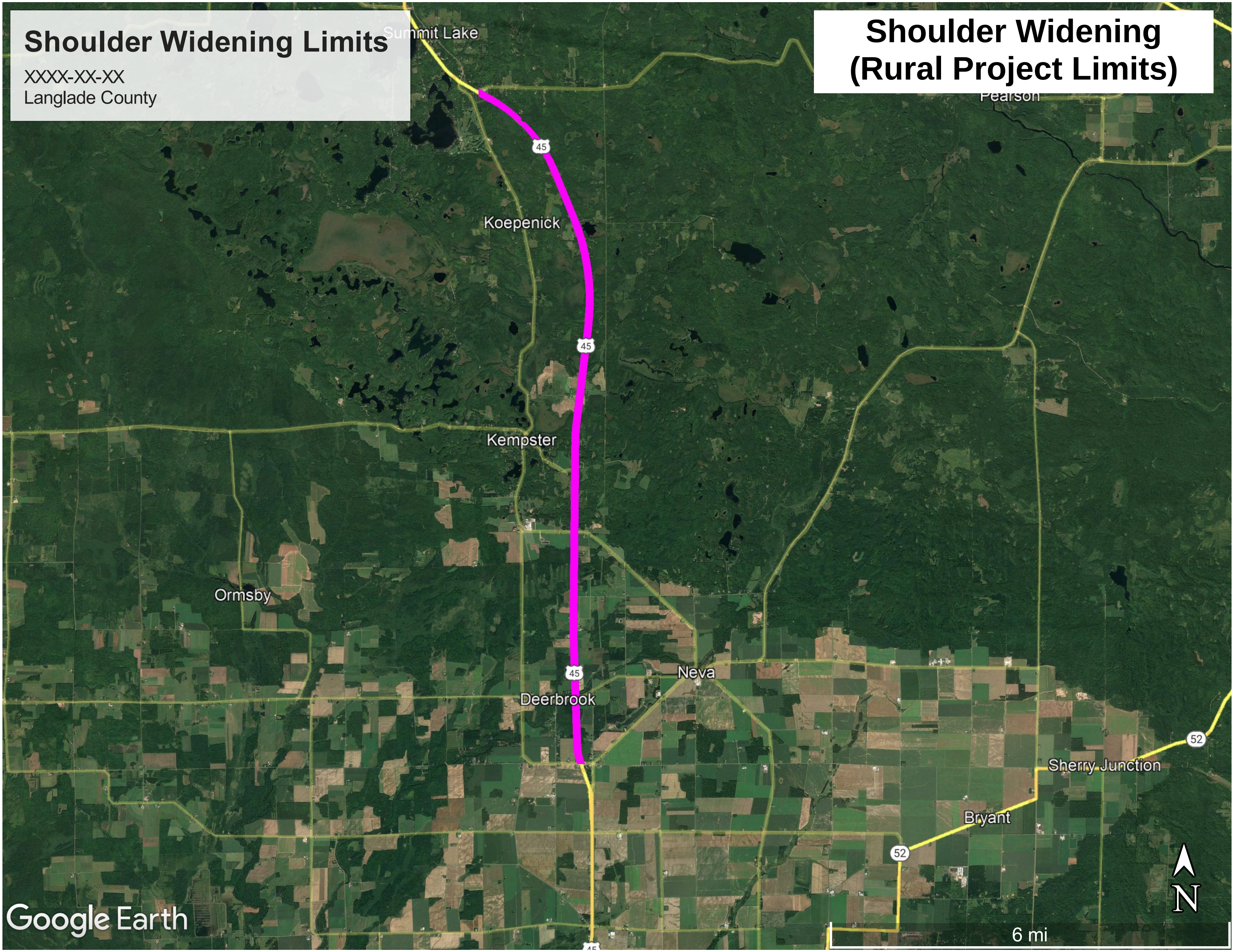
Spot Shoulder Widening Locations



Shoulder Widening Limits

XXXX-XX-XX
Langlade County

Shoulder Widening (Rural Project Limits)



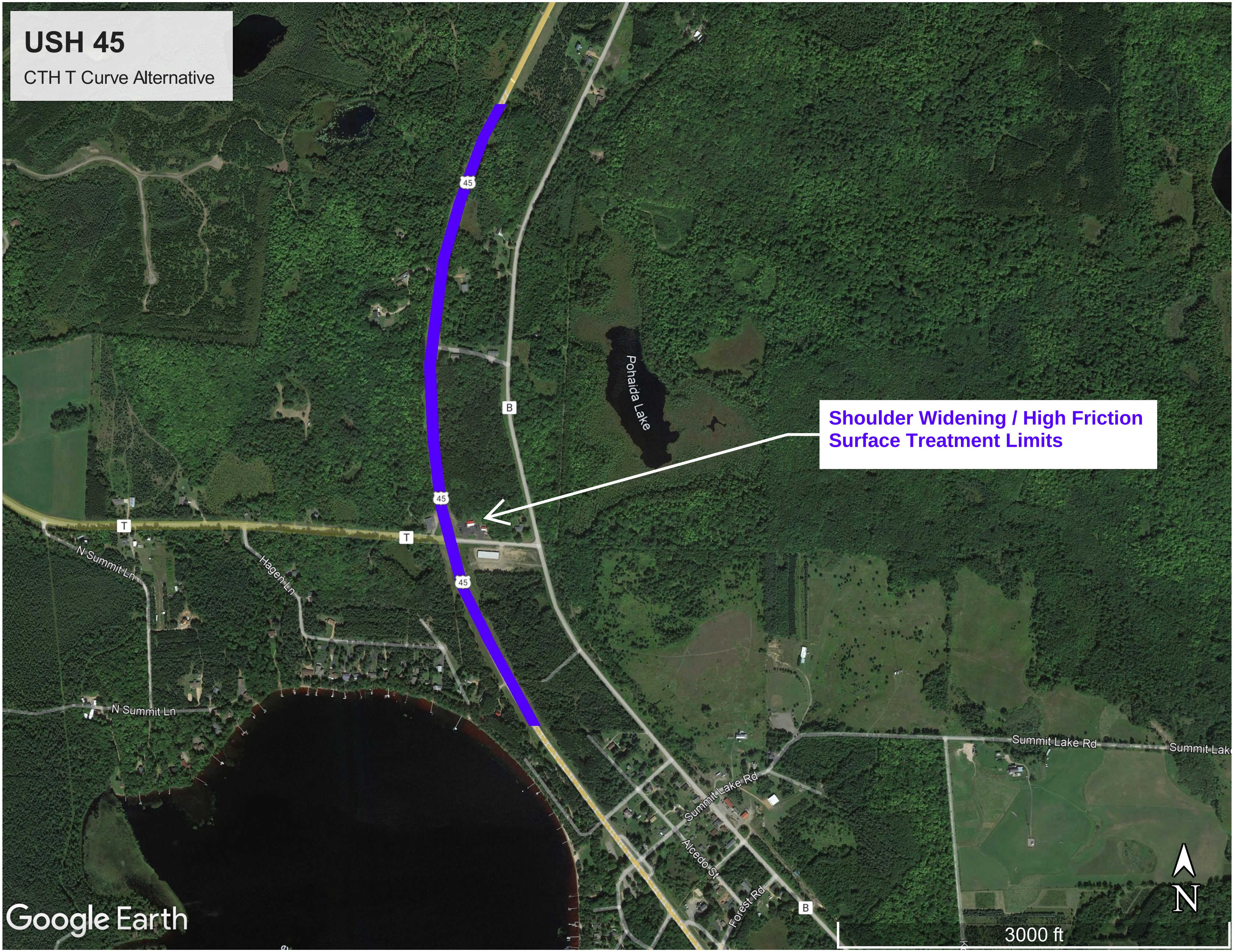
Shoulder Widening and Shoulder Rumble Strips Estimates

Spot Widening Analysis					
Major Bid Item Estimate					
Description	Unit	Quantity	Unit Price	Total Price	Total Price (Rounded)
CTH B to CTH C	Miles	1.02	$49,000	$49,980	**$50,000.00**
Branch Rd to CTH J/Forman Rd	Miles	1.91	$49,000	$93,590	**$94,000.00**
CTH J/Forman Rd to CTH J/Koepenick Rd	Miles	3.71	$49,000	$181,790	**$182,000.00**

Assume:
$49,000 per mile based on historical prices

Corridor Analysis					
Major Bid Item Estimate					
Description	Unit	Quantity	Unit Price	Total Price	Total Price (Rounded)
CTH B to CTH T (Rural Project Limits)	Miles	10.96	$49,000	$537,040	**$538,000.00**

Assume:
$49,000 per mile based on historical prices


USH 45
CTH T Curve Alternative
Shoulder Widening / High Friction Surface Treatment Limits
Pohaida Lake
45
B
T
N Summit Ln
Hagen Ln
Summit Lake Rd
Alcedo St
Forest Rd
3000 ft
N
Google Earth

CTH T Curve Estimate

Alternative 1 - Shoulder Widening and Shoulder Rumble Strips				
Major Bid Item Estimate				
Description	**Unit**	**Quantity**	**Unit Price**	**Total Price**
Shoulder Widening and Shoulder Rumbles (CTH T Curve)	Miles	0.962	$49,000	$47,133.10
Total				$47,133.10
Total (Rounded)				**$48,000.00**

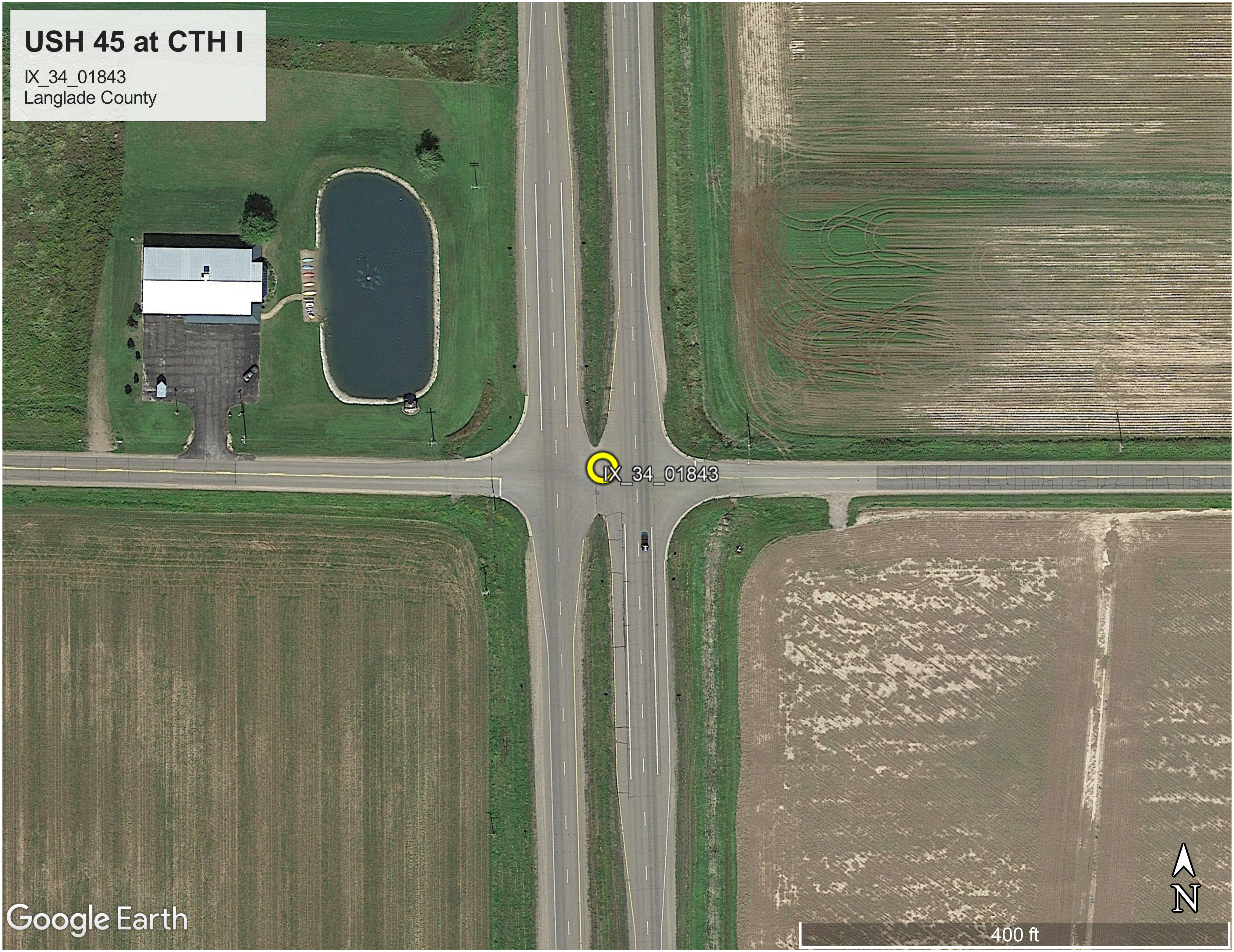
Assume:

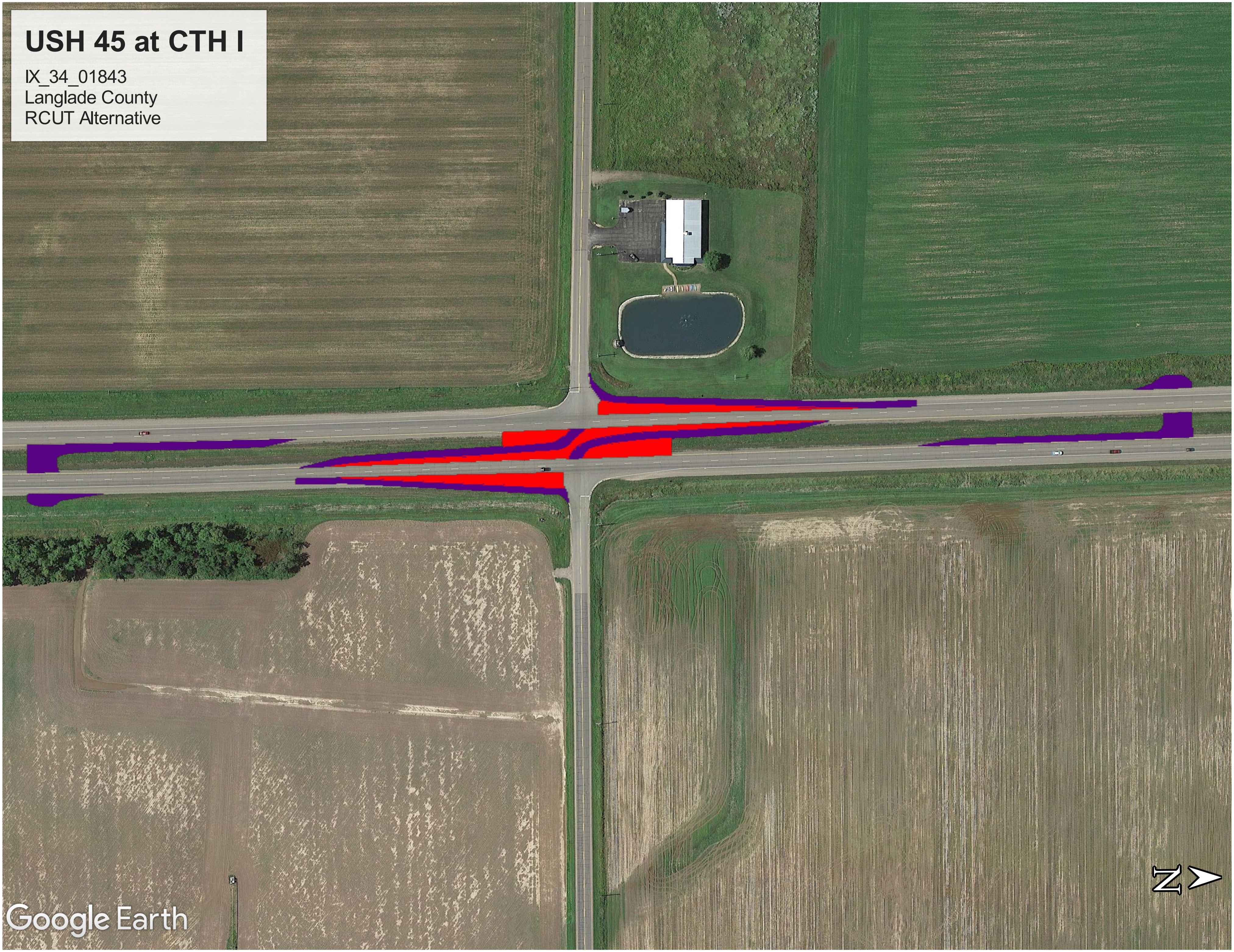
$49,000 per mile based on historical prices

Alternative 2 - High Friction Surface Treatment				
Major Bid Item Estimate				
Description	**Unit**	**Quantity**	**Unit Price**	**Total Price**
Resin Binder High Friction Surface Treatment (CTH T Curve)	SY	13,544	$25.00	$338,588.80
Incidentals		3.0%	$338,588.80	$10,157.66
Total				$348,746.46
Total (Rounded)				**$349,000.00**

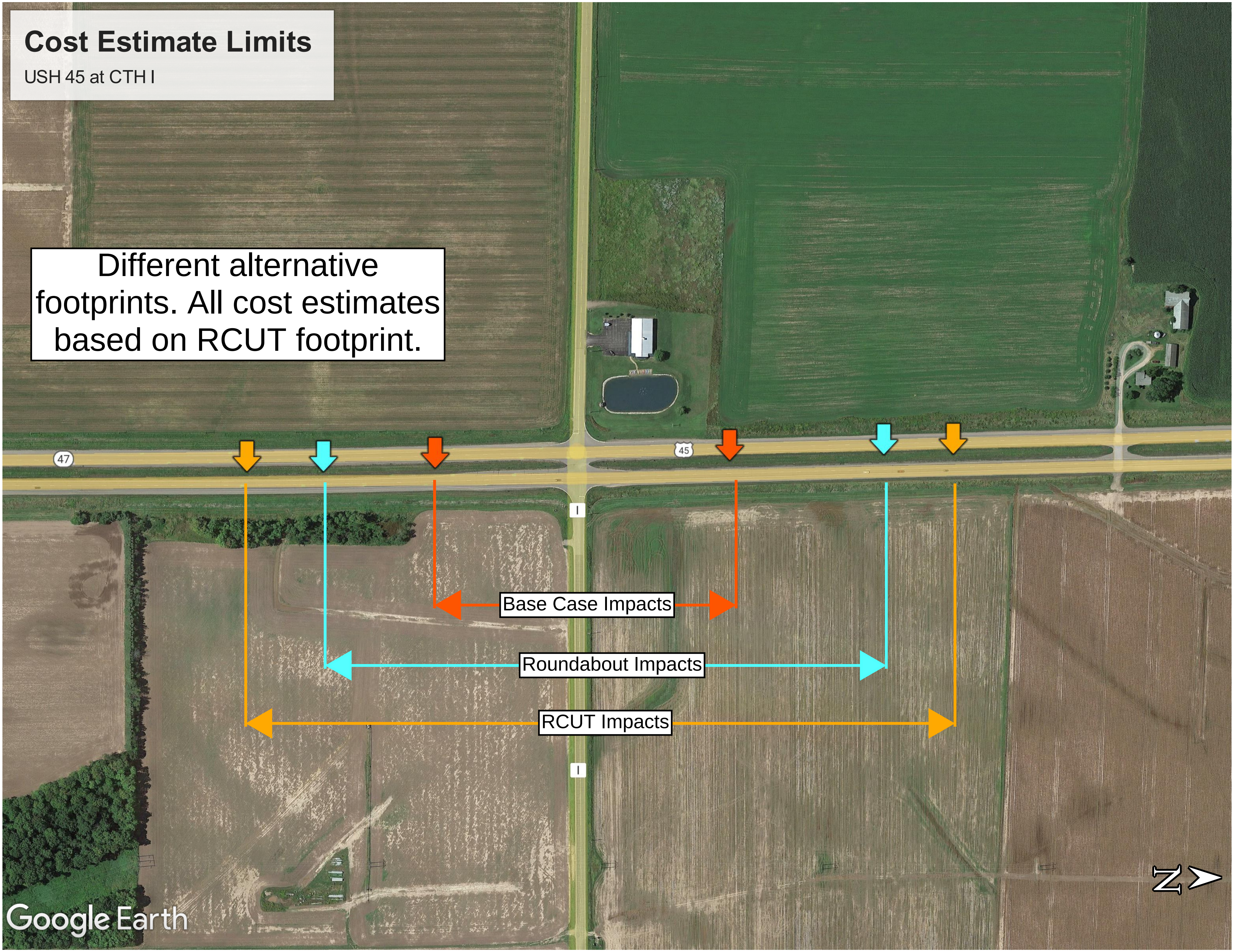
USH 45 at CTH I

IX_34_01843
Langlade County




USH 45 at CTH I
IX_34_01843
Langlade County
RCUT Alternative
N
Google Earth


USH 45 at CTH I
IX_34_01843
Langlade County
Roundabout Alternative
N


Cost Estimate Limits
USH 45 at CTH I
Different alternative footprints. All cost estimates based on RCUT footprint.
47
45
I
Base Case Impacts
Roundabout Impacts
RCUT Impacts
I
Google Earth
N

CTH I Base Cost

Major Bid Item Estimate					
Item #	Description	Unit	Quantity	Unit Price	Total Price
	Removing Asphaltic Surface, Milling	SY	16,500	$1.50	$24,750.00
	HMA Pavement	Ton	3,795	$70.00	$265,650.00
	Tack Coat	Gal	2,310	$2.50	$5,775.00
	Base Aggregate Dense 3/4-Inch	Ton	600	$18.00	$10,800.00
	Removing curb and gutter	LF	30	$6.00	$180.00
	Curb and gutter	LF	30	$18.00	$540.00
	Incidentals		15.0%	$307,695.00	$46,154.25
	Total				$353,849.25
	Total (Rounded)				**$354,000.00**

Assume:
4-in mill and overlay
Minor curb replacement
Estimate is based on matching the footprint of other alternatives

CTH I RCUT Estimate

Major Bid Item Estimate					
Item #	Description	Unit	Quantity	Unit Price	Total Price
	Prepare Foundation for Asphaltic Paving (project)	LS	1	$8,500.00	$8,500.00
	Common Excavation	CY	5,417	$15.00	$81,255.00
	Borrow	CY	1,760	$17.00	$29,920.00
	HMA Pavement	Ton	1,150	$70.00	$80,500.00
	Select Crushed Material	Ton	5,177	$22.00	$113,894.00
	Tack Coat	Gal	850	$2.50	$2,125.00
	Base Aggregate Dense 3/4-Inch	Ton	500	$18.00	$9,000.00
	Base Aggregate Dense 1 1/4-Inch	Ton	1,655	$15.00	$24,825.00
	Pavement Marking	LS	1	$10,000.00	$10,000.00
	Landscaping	LS	1	$25,000.00	$25,000.00
	Real Estate	Acre	0	$2,500.00	$0.00
	Traffic Control	LS	1	$15,000.00	$15,000.00
	Mainline Paving	LS	1	$285,000.00	$285,000.00
	Incidentals		15.0%	$685,019.00	$102,752.85
	Total				$787,771.85
	Total (Rounded)				**$788,000.00**

Assume:

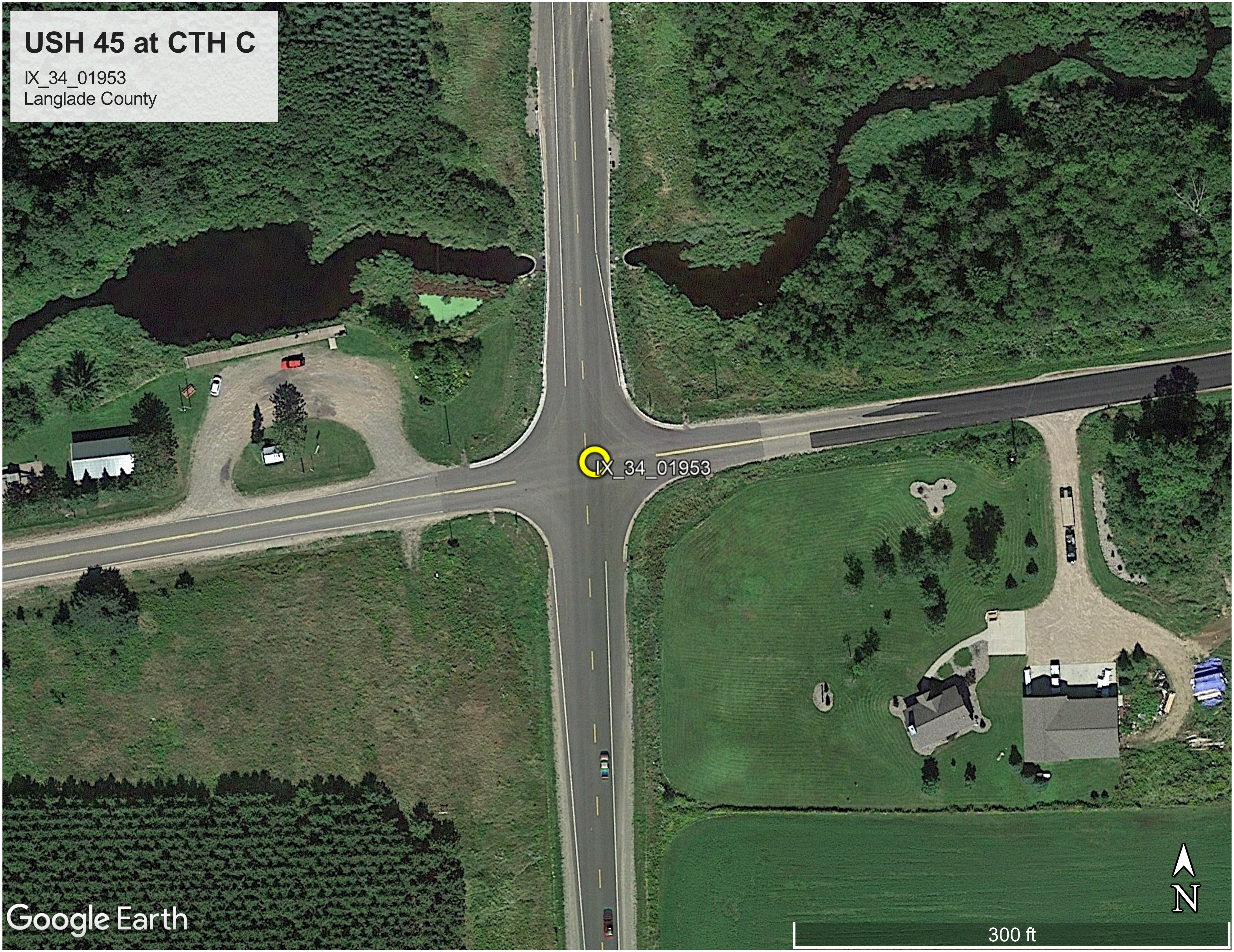
Estimate is based on matching the footprint of other alternatives

Includes cost of mainline paving from base case

CTH I Roundabout Estimate

Major Bid Item Estimate					
Item #	Description	Unit	Quantity	Unit Price	Total Price
	Multi-lane Roundabout	LS	1	$2,000,000	$2,000,000.00
	Total				$2,000,000.00
	Total (Rounded)				**$2,000,000.00**

Assume:
Preliminary estimate based on historical prices
Estimate is based on matching the footprint of other alternatives



USH 45 at CTH C
IX_34_01953
Langlade County
IX_34_01953
Google Earth
N
300 ft

USH 45 at CTH C

IX_34_01953
Langlade County
Left-Turn Lane Alternative


Cost Estimate Limits
USH 45 at CTH C
Same alternative footprint. All estimates based on these limits.
C
45
47
C
Base Case Impacts
and
Left Turn Lane Impacts
C
N
Google Earth

CTH C Base Cost

Major Bid Item Estimate					
Item #	**Description**	**Unit**	**Quantity**	**Unit Price**	**Total Price**
	Removing Asphaltic Surface, Milling	SY	2,000	$1.50	$3,000.00
	HMA Pavement	Ton	460	$70.00	$32,200.00
	Tack Coat	Gal	280	$2.50	$700.00
	Base Aggregate Dense 3/4-Inch	Ton	100	$18.00	$1,800.00
	Removing curb and gutter	LF	30	$6.00	$180.00
	Curb and gutter	LF	30	$18.00	$540.00
	Incidentals		15.0%	$38,420.00	$5,763.00
	Total				$44,183.00
	Total (Rounded)				**$45,000.00**

Assume:
4-in mill and overlay
Minor curb replacement

CTH C Left Turn Lane Estimate

Major Bid Item Estimate					
Item #	Description	Unit	Quantity	Unit Price	Total Price
	Common Excavation	CY	1,584	$15.00	$23,760.00
	Borrow	CY	940	$17.00	$15,980.00
	HMA Pavement	Ton	1,280	$70.00	$89,600.00
	Tack Coat	Gal	280	$2.50	$700.00
	Removing Pavement	SY	1,783	$4.00	$7,132.00
	Base Aggregate Dense 3/4-Inch	Ton	350	$18.00	$6,300.00
	Base Aggregate Dense 1 1/4-Inch	Ton	2,131	$15.00	$31,965.00
	Removing curb and gutter	LF	30	$5.00	$150.00
	Curb and gutter	LF	30	$18.00	$540.00
	Pavement Marking	LS	1	$10,000.00	$10,000.00
	Landscaping	LS	1	$15,000.00	$15,000.00
	Real Estate	Acre	0.10	$2,500.00	$250.00
	Traffic Control	LS	1	$5,000.00	$5,000.00
	Incidentals		15.0%	$206,377.00	$30,956.55
	Total				$237,333.55
	Total (Rounded)				**$238,000.00**

Assume:
4-in mill and overlay
Minor curb replacement
Includes base case intersection paving

SAFETY EVALUATION AND ECONOMIC APPRAISAL DOCUMENTATION

IHSDM
CTH B to CTH C
Base Case

CTH B to CTH C - Base Case Crash Prediction

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 29, 2021

CTH B to CTH C - Base Case Crash Prediction

Disclaimer

Limited Warranty and Limitations of Remedies

Notice

Table of Contents

List of Tables

Report Overview

Report Generated: Nov 29, 2021 10:26 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Wed Nov 24 10:58:53 CST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Segments
Project Comment: Created Fri Nov 19 10:26:02 CST 2021
Project Unit System: U.S. Customary

Site Set: CTH B to CTH C (10082-10083) - Base Case
Site Set Comment: Created Fri Nov 19 10:36:10 CST 2021
Site Set Version: v1

Evaluation Title: CTH B to CTH C - Base Case
Evaluation Comment: Created Wed Nov 24 10:58:20 CST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: CTH B to CTH C (10082-10083) - Base Case
Crash History Siteset Comment: Created Fri Nov 19 10:36:10 CST 2021
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 2U
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (2U)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	3	3	0	1	2
2017	2	2	1	0	1
2018	1	1	0	0	1
2019	2	2	0	0	2
2020	2	2	1	1	0
All Years	10 [1]	10	2	2	6

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

CTH B to CTH C - Base Case Crash Prediction

Table 2. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
1	2U	CSD:USH 45	CTH B to CTH C	0.0625	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
1	2U	USH 45	CTH B to CTH C	0.0625	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
2	2U	CSD:USH 45	CTH B to CTH C	0.2090	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	3,819.72	0.2090	0	0.00	no
2	2U	USH 45	CTH B to CTH C	0.2090	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	3,819.72	0.2090	0	0.00	no
4	2U	CSD:USH 45	CTH B to CTH C	0.7485	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
4	2U	USH 45	CTH B to CTH C	0.7485	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no

CTH B to CTH C - Base Case Crash Prediction

Table 3. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Crash Rate (crashes/mi /yr)	Expected Travel Crash Rate (crashes/million veh-mi)
1	2U	USH 45	CTH B to CTH C	0.0625	3.667	0.594	0.3667	0.1900	0.1767	0.0594	0.0191	0.0403	0.3073	0.1709	0.1364	5.8670	3.94
2	2U	USH 45	CTH B to CTH C	0.2090	3.343	2.114	0.3343	0.1262	0.2081	0.2114	0.0679	0.1435	0.1229	0.0584	0.0645	1.5995	1.07
4	2U	USH 45	CTH B to CTH C	0.7485	9.178	7.110	0.9178	0.2376	0.6802	0.7110	0.2282	0.4828	0.2068	0.0094	0.1974	1.2262	0.82
		Total	Total	1.0200	16.188	9.818	1.6188	0.5538	1.0650	0.9818	0.3151	0.6666	0.6370	0.2387	0.3983	1.5870	1.07

Table 4. Predicted Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	0.94	0.30	32.100	0.64	67.900
2026	0.95	0.30	32.100	0.64	67.900
2027	0.96	0.31	32.100	0.65	67.900
2028	0.97	0.31	32.100	0.66	67.900
2029	0.98	0.31	32.100	0.66	67.900
2030	0.99	0.32	32.100	0.67	67.900
2031	1.00	0.32	32.100	0.68	67.900
2032	1.01	0.32	32.100	0.68	67.900
2033	1.01	0.33	32.100	0.69	67.900
2034	1.02	0.33	32.100	0.70	67.900
Total	9.82	3.15	32.100	6.67	67.900
Average	0.98	0.32	32.100	0.67	67.900

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 5. Expected Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	1.55	0.53	34.212	1.02	65.788
2026	1.56	0.54	34.212	1.03	65.788
2027	1.58	0.54	34.212	1.04	65.788
2028	1.59	0.55	34.212	1.05	65.788
2029	1.61	0.55	34.212	1.06	65.788
2030	1.63	0.56	34.212	1.07	65.788
2031	1.64	0.56	34.212	1.08	65.788
2032	1.66	0.57	34.212	1.09	65.788
2033	1.67	0.57	34.212	1.10	65.788
2034	1.69	0.58	34.212	1.11	65.788
Total	16.19	5.54	34.212	10.65	65.788
Average	1.62	0.55	34.212	1.06	65.788

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Comparing Predicted and Expected Crashes for the Evaluation Period (2U)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	9.82	3.15	32.100	6.67	67.900
Expected	16.19	5.54	34.212	10.65	65.788
Expected - Predicted	6.37	2.39		3.98	
Percent Difference	39.35	43.09		37.40	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Expected 2U Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.21	1.3	1.96	12.1	1.96	12.1
Highway Segment	Collision with Bicycle	0.02	0.1	0.01	0.1	0.03	0.2
Highway Segment	Other Single-vehicle Collision	0.04	0.2	0.31	1.9	0.34	2.1
Highway Segment	Overturned	0.20	1.3	0.16	1.0	0.41	2.5
Highway Segment	Collision with Pedestrian	0.04	0.2	0.01	0.1	0.05	0.3
Highway Segment	Run Off Road	3.02	18.6	5.38	33.2	8.43	52.1
Highway Segment	Total Single Vehicle Crashes	3.53	21.8	7.83	48.4	11.22	69.3
Highway Segment	Angle Collision	0.56	3.5	0.77	4.7	1.38	8.5
Highway Segment	Head-on Collision	0.19	1.2	0.03	0.2	0.26	1.6
Highway Segment	Other Multiple-vehicle Collision	0.14	0.9	0.32	2.0	0.44	2.7
Highway Segment	Rear-end Collision	0.91	5.6	1.30	8.0	2.30	14.2
Highway Segment	Sideswipe	0.21	1.3	0.41	2.5	0.60	3.7
Highway Segment	Total Multiple Vehicle Crashes	2.02	12.5	2.82	17.4	4.97	30.7
Highway Segment	Total Highway Segment Crashes	5.55	34.3	10.65	65.8	16.19	100.0
	Total Crashes	5.55	34.3	10.65	65.8	16.19	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
CTH B to CTH C
Alternative 1

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 29, 2021

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Notice

Table of Contents

List of Tables

Report Overview

Report Generated: Nov 29, 2021 10:26 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Mon Nov 29 09:15:33 CST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Segments
Project Comment: Created Fri Nov 19 10:26:02 CST 2021
Project Unit System: U.S. Customary

Site Set: CTH B to CTH C (10082-10083) - Alternative 1
Site Set Comment: Copied from CTH B to CTH C (10082-10083) - Base Case (v1)
Site Set Version: v1

Evaluation Title: CTH B to CTH C - Alternative 1
Evaluation Comment: Created Mon Nov 29 09:15:23 CST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: CTH B to CTH C (10082-10083) - Base Case
Crash History Siteset Comment: Created Fri Nov 19 10:36:10 CST 2021
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 2U
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (2U)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	3	3	0	1	2
2017	2	2	1	0	1
2018	1	1	0	0	1
2019	2	2	0	0	2
2020	2	2	1	1	0
All Years	10 [1]	10	2	2	6

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. User Defined CMF Used in the Intersection CPM Evaluation (SSCPMRuralTwoLane)

Site No.	Name	Description	Start CMF Year	End CMF Year	Severity	CMF Value
1	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
2	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
4	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200

Table 3. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
1	2U	CSD:USH 45	CTH B to CTH C	0.0625	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
1	2U	USH 45	CTH B to CTH C	0.0625	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
2	2U	CSD:USH 45	CTH B to CTH C	0.2090	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	3,819.72	0.2090	0	0.00	no
2	2U	USH 45	CTH B to CTH C	0.2090	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	3,819.72	0.2090	0	0.00	no
4	2U	CSD:USH 45	CTH B to CTH C	0.7485	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
4	2U	USH 45	CTH B to CTH C	0.7485	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no

CTH B to CTH C - Alternative 1 Crash Prediction

Table 4. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Crash Rate (crashes/mi /yr)	Expected Travel Crash Rate (crashes/mi llion veh-mi)
1	2U	USH 45	CTH B to CTH C	0.0625	3.349	0.542	0.3349	0.1735	0.1614	0.0542	0.0164	0.0378	0.2807	0.1571	0.1236	5.3589	3.60
2	2U	USH 45	CTH B to CTH C	0.2090	3.053	1.931	0.3053	0.1153	0.1900	0.1931	0.0585	0.1346	0.1122	0.0568	0.0555	1.4610	0.98
4	2U	USH 45	CTH B to CTH C	0.7485	8.383	6.494	0.8383	0.2170	0.6213	0.6494	0.1968	0.4526	0.1889	0.0202	0.1687	1.1200	0.75
		Total	Total	1.0200	14.786	8.968	1.4786	0.5058	0.9727	0.8968	0.2718	0.6249	0.5818	0.2340	0.3478	1.4496	0.97

Table 5. Predicted Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	0.86	0.26	30.310	0.60	69.690
2026	0.87	0.26	30.310	0.60	69.690
2027	0.88	0.27	30.310	0.61	69.690
2028	0.88	0.27	30.310	0.62	69.690
2029	0.89	0.27	30.310	0.62	69.690
2030	0.90	0.27	30.310	0.63	69.690
2031	0.91	0.28	30.310	0.63	69.690
2032	0.92	0.28	30.310	0.64	69.690
2033	0.93	0.28	30.310	0.65	69.690
2034	0.94	0.28	30.310	0.65	69.690
Total	8.97	2.72	30.310	6.25	69.690
Average	0.90	0.27	30.310	0.62	69.690

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Expected Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	1.41	0.48	34.212	0.93	65.788
2026	1.43	0.49	34.212	0.94	65.788
2027	1.44	0.49	34.212	0.95	65.788
2028	1.46	0.50	34.212	0.96	65.788
2029	1.47	0.50	34.212	0.97	65.788
2030	1.49	0.51	34.212	0.98	65.788
2031	1.50	0.51	34.212	0.99	65.788
2032	1.51	0.52	34.212	1.00	65.788
2033	1.53	0.52	34.212	1.01	65.788
2034	1.54	0.53	34.212	1.02	65.788
Total	14.79	5.06	34.212	9.73	65.788
Average	1.48	0.51	34.212	0.97	65.788

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Comparing Predicted and Expected Crashes for the Evaluation Period (2U)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	8.97	2.72	30.310	6.25	69.690
Expected	14.79	5.06	34.212	9.73	65.788
Expected - Predicted	5.82	2.34		3.48	
Percent Difference	39.35	46.27		35.75	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Expected 2U Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.19	1.3	1.79	12.1	1.79	12.1
Highway Segment	Collision with Bicycle	0.02	0.1	0.01	0.1	0.03	0.2
Highway Segment	Other Single-vehicle Collision	0.04	0.2	0.28	1.9	0.31	2.1
Highway Segment	Overturned	0.19	1.3	0.15	1.0	0.37	2.5
Highway Segment	Collision with Pedestrian	0.04	0.2	0.01	0.1	0.04	0.3
Highway Segment	Run Off Road	2.76	18.6	4.91	33.2	7.70	52.1
Highway Segment	Total Single Vehicle Crashes	3.23	21.8	7.15	48.4	10.25	69.3
Highway Segment	Angle Collision	0.51	3.5	0.70	4.7	1.26	8.5
Highway Segment	Head-on Collision	0.17	1.2	0.03	0.2	0.24	1.6
Highway Segment	Other Multiple-vehicle Collision	0.13	0.9	0.29	2.0	0.40	2.7
Highway Segment	Rear-end Collision	0.83	5.6	1.19	8.0	2.10	14.2
Highway Segment	Sideswipe	0.19	1.3	0.37	2.5	0.55	3.7
Highway Segment	Total Multiple Vehicle Crashes	1.84	12.5	2.58	17.4	4.54	30.7
Highway Segment	Total Highway Segment Crashes	5.07	34.3	9.73	65.8	14.79	100.0
	Total Crashes	5.07	34.3	9.73	65.8	14.79	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
CTH B to CTH C
Economic Analysis

Interactive Highway Safety Design Model

Economic Analysis Report

November 29, 2021

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Table of Contents

List of Tables

Economic Analysis Report

Economic Analysis Report Overview

Report Generated: Nov 29, 2021 1:43 PM
Report Template: System: Single Page [System] (eam3, Feb 10, 2021 8:56 AM)

Evaluation Title: EA_BTO_SCP_Example_CTH B-CTH C Widening
Evaluation Comment: Created Mon Nov 29 11:20:39 CST 2021
Evaluation Date: Mon Nov 29 11:20:51 CST 2021

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_CTH B-CTH C Widening
Project Comment: Created Wed Nov 24 12:31:39 CST 2021

Configuration Summary

Crash Cost Configuration: WisDOTEconomics_v16-1
Configuration Comment: Updated with 2020 Crash Cost Values

Table 1. Economic Analysis Configuration

Configuration Data	
Crash Unit Cost Zero Year	2020
Crash Cost Index	0.00
Discount Rate	0.05
KABCO Unit Costs	
K Cost ($/Crash)	12,694,788.00
A Cost ($/Crash)	684,064.00
B Cost ($/Crash)	217,328.00
C Cost ($/Crash)	123,679.00
O Cost ($/Crash)	10,824.00

Table 2. RTL Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL 2U Two-Lane Undivided	3.502	12.638	43.370	40.490

Table 3. RTL Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL Three-Legged w/STOP control	3.072	15.068	42.383	39.477
RTL Four-Legged w/STOP control	3.975	15.278	42.862	37.885
RTL Four-Legged Signalized	2.957	11.751	35.292	50.000

Table 4. RML Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Four-Lane Undivided	3.502	12.638	43.370	40.490
RML Four-Lane Divided	3.502	12.638	43.370	40.490

Table 5. RML Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Three-Legged w/STOP control	4.095	14.091	40.626	41.188
RML Four-Legged w/STOP control	4.711	15.912	41.988	37.389
RML Four-Legged Signalized	0.598	10.012	37.176	52.214

Table 6. USA Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Two-Lane Undivided	1.012	5.785	33.011	60.192
USA Three-Lane w/Center TWLTL	1.012	5.785	33.011	60.192
USA Four-Lane Undivided	1.012	5.785	33.011	60.192
USA Four-Lane Divided	1.012	5.785	33.011	60.192
USA Five-Lane w/Center TWLTL	1.012	5.785	33.011	60.192

Table 7. USA Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Three-Legged w/STOP control	0.744	6.558	36.725	55.973
USA Three-Legged Signalized	0.451	4.957	32.024	62.568
USA Four-Legged w/STOP control	0.864	6.637	38.161	54.338
USA Four-Legged Signalized	0.715	5.263	32.359	61.663

Analysis Output Summary

Analysis Type: Benefit/Cost

Table 8. Case Cost Summary

Is Base Case	Title	Present Value of Crash Cost ($)	Present Value of Other Cost ($)	Net Present Value of Benefits (B) ($)	Net Present Value of Costs (C) ($)	Present Value of Net Benefit (B-C) ($)	Benefit Cost Ratio (B/C)
Yes	Existing	3,113,607.27	0.00				
	Alternative 1 - Shoulder Widening/Shoulder Rumble Strips	2,843,988.01	50,000.00	269,619.26	50,000.00	219,619.26	5.3924

Table 9. Case Crash Summary

Is Base Case	Title	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Yes	Existing	0.1939	0.6999	2.4018	2.2423	10.6496	16.1876
	Alternative 1 - Shoulder Widening/Shoulder Rumble Strips	0.1771	0.6393	2.1939	2.0482	9.7274	14.7858

Crash Cost Data

Existing Data

Case Title: Existing

Is Base Case: true

Present Value of Crash Cost: 3,113,607.27

Present Value of Other Cost: 0.00

Table 10. Existing Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_Segments	CTH B to CTH C (10082-10083) - Base Case	CTH B to CTH C - Base Case	3,113,607.27
Total			3,113,607.27

Table 11. Existing Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_Segments	CTH B to CTH C (10082-10083) - Base Case	CTH B to CTH C - Base Case	0.1939	0.6999	2.4018	2.2423	10.6496	16.1876
Total			0.1939	0.6999	2.4018	2.2423	10.6496	16.1876

Table 12. CTH B to CTH C (10082-10083) - Base Case Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Segment	0.1939	0.6999	2.4018	2.2423	10.6496	16.1876
Total	0.1939	0.6999	2.4018	2.2423	10.6496	16.1876

Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Data

Case Title: Alternative 1 - Shoulder Widening/Shoulder Rumble Strips

Is Base Case: false

Present Value of Crash Cost: 2,843,988.01

Present Value of Other Cost: 50,000.00

Table 13. Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_Segments	CTH B to CTH C (10082-10083) - Alternative 1	CTH B to CTH C - Alternative 1	2,843,988.01
Total			2,843,988.01

Table 14. Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_Segments	CTH B to CTH C (10082-10083) - Alternative 1	CTH B to CTH C - Alternative 1	0.1771	0.6393	2.1939	2.0482	9.7274	14.7858
Total			0.1771	0.6393	2.1939	2.0482	9.7274	14.7858

Table 15. CTH B to CTH C (10082-10083) - Alternative 1 Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Segment	0.1771	0.6393	2.1939	2.0482	9.7274	14.7858
Total	0.1771	0.6393	2.1939	2.0482	9.7274	14.7858

Evaluation Message

IHSDM
Branch Rd to CTH J/Forman Rd
Base Case

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

March 4, 2022

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Notice

Table of Contents

List of Tables

Report Overview

Report Generated: Mar 4, 2022 9:33 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Fri Mar 04 09:33:58 CST 2022
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Segments
Project Comment: Created Fri Nov 19 10:26:02 CST 2021
Project Unit System: U.S. Customary

Site Set: Branch Rd to CTH CTH J/Forman Rd (10085-10086) - Base Case
Site Set Comment: Created Fri Nov 19 10:50:09 CST 2021
Site Set Version: v1

Evaluation Title: Branch Rd to CTH CTH J/Forman Rd - Base Case
Evaluation Comment: Created Fri Mar 04 09:33:50 CST 2022
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: Branch Rd to CTH CTH J/Forman Rd (10085-10086) - Base Case
Crash History Siteset Comment: Created Fri Nov 19 10:50:09 CST 2021
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 2U
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (2U)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	5	5	1	2	2
2017	5	5	2	1	2
2018	4	4	1	0	3
2019	3	3	0	1	2
2020	3	3	2	0	1
All Years	20 [1]	20	6	4	10

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Branch Rd to CTH J/Forman Rd - Base Case Crash Prediction

Table 2. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
1	2U	CSD:USH 45	Branch Rd to CTH J/Forman Rd	1.9100	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
1	2U	USH 45	Branch Rd to CTH J/Forman Rd	1.9100	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no

Table 3. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Crash Rate (crashes/mi/yr)	Expected Travel Crash Rate (crashes/million veh-mi)
1	2U	USH 45	Branch Rd to CTH J/Forman Rd	1.9100	31.553	18.143	3.1553	1.1838	1.9714	1.8143	0.5824	1.2319	1.3409	0.6014	0.7395	1.6520	1.11
		Total	Total	1.9100	31.553	18.143	3.1553	1.1838	1.9714	1.8143	0.5824	1.2319	1.3409	0.6014	0.7395	1.6520	1.11

Table 4. Predicted Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	1.73	0.56	32.100	1.18	67.900
2026	1.75	0.56	32.100	1.19	67.900
2027	1.77	0.57	32.100	1.20	67.900
2028	1.79	0.57	32.100	1.21	67.900
2029	1.80	0.58	32.100	1.23	67.900
2030	1.82	0.58	32.100	1.24	67.900
2031	1.84	0.59	32.100	1.25	67.900
2032	1.86	0.60	32.100	1.26	67.900
2033	1.88	0.60	32.100	1.27	67.900
2034	1.89	0.61	32.100	1.29	67.900
Total	18.14	5.82	32.100	12.32	67.900
Average	1.81	0.58	32.100	1.23	67.900

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 5. Expected Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	3.02	1.13	37.519	1.88	62.481
2026	3.05	1.14	37.519	1.90	62.481
2027	3.08	1.16	37.519	1.92	62.481
2028	3.11	1.17	37.519	1.94	62.481
2029	3.14	1.18	37.519	1.96	62.481
2030	3.17	1.19	37.519	1.98	62.481
2031	3.20	1.20	37.519	2.00	62.481
2032	3.23	1.21	37.519	2.02	62.481
2033	3.26	1.22	37.519	2.04	62.481
2034	3.29	1.24	37.519	2.06	62.481
Total	31.55	11.84	37.519	19.71	62.481
Average	3.15	1.18	37.519	1.97	62.481

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Comparing Predicted and Expected Crashes for the Evaluation Period (2U)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	18.14	5.82	32.100	12.32	67.900
Expected	31.55	11.84	37.519	19.71	62.481
Expected - Predicted	13.41	6.01		7.39	
Percent Difference	42.50	50.80		37.51	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Expected 2U Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.45	1.4	3.63	11.5	3.82	12.1
Highway Segment	Collision with Bicycle	0.05	0.1	0.02	0.1	0.06	0.2
Highway Segment	Other Single-vehicle Collision	0.08	0.3	0.57	1.8	0.66	2.1
Highway Segment	Overturned	0.44	1.4	0.30	0.9	0.79	2.5
Highway Segment	Collision with Pedestrian	0.08	0.3	0.02	0.1	0.10	0.3
Highway Segment	Run Off Road	6.45	20.4	9.96	31.6	16.44	52.1
Highway Segment	Total Single Vehicle Crashes	7.55	23.9	14.49	45.9	21.87	69.3
Highway Segment	Angle Collision	1.20	3.8	1.42	4.5	2.68	8.5
Highway Segment	Head-on Collision	0.40	1.3	0.06	0.2	0.51	1.6
Highway Segment	Other Multiple-vehicle Collision	0.31	1.0	0.59	1.9	0.85	2.7
Highway Segment	Rear-end Collision	1.95	6.2	2.40	7.6	4.48	14.2
Highway Segment	Sideswipe	0.45	1.4	0.75	2.4	1.17	3.7
Highway Segment	Total Multiple Vehicle Crashes	4.31	13.7	5.22	16.6	9.69	30.7
Highway Segment	Total Highway Segment Crashes	11.86	37.6	19.71	62.5	31.55	100.0
	Total Crashes	11.86	37.6	19.71	62.5	31.55	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
Branch Rd to CTH J/Forman Rd
Alternative 1

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

March 4, 2022

Branch Rd to CTH J/Forman Rd - Alternative 1 Crash Prediction

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Table of Contents

List of Tables

Report Overview

Report Generated: Mar 4, 2022 9:49 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Fri Mar 04 09:34:54 CST 2022
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Segments
Project Comment: Created Fri Nov 19 10:26:02 CST 2021
Project Unit System: U.S. Customary

Site Set: Branch Rd to CTH CTH J/Forman Rd (10085-10086) - Alternative 1
Site Set Comment: Copied from Branch Rd to CTH V (10085-10086) - Base Case (v1)
Site Set Version: v1

Evaluation Title: Branch Rd to CTH CTH J/Forman Rd - Alternative 1
Evaluation Comment: Created Fri Mar 04 09:34:48 CST 2022
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: Branch Rd to CTH CTH J/Forman Rd (10085-10086) - Base Case
Crash History Siteset Comment: Created Fri Nov 19 10:50:09 CST 2021
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

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- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

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Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 2U
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (2U)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	5	5	1	2	2
2017	5	5	2	1	2
2018	4	4	1	0	3
2019	3	3	0	1	2
2020	3	3	2	0	1
All Years	20 [1]	20	6	4	10

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. User Defined CMF Used in the Intersection CPM Evaluation (SSCPMRuralTwoLane)

Site No.	Name	Description	Start CMF Year	End CMF Year	Severity	CMF Value
1	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200

Table 3. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
1	2U	CSD:USH 45	Branch Rd to CTH J/Forman Rd	1.9100	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
1	2U	USH 45	Branch Rd to CTH J/Forman Rd	1.9100	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no

Table 4. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Crash Rate (crashes/mi/yr)	Expected Travel Crash Rate (crashes/million veh-mi)
1	2U	USH 45	Branch Rd to CTH J/Forman Rd	1.9100	28.820	16.572	2.8820	1.0813	1.8007	1.6572	0.5023	1.1549	1.2248	0.5790	0.6458	1.5089	1.01
		Total	Total	1.9100	28.820	16.572	2.8820	1.0813	1.8007	1.6572	0.5023	1.1549	1.2248	0.5790	0.6458	1.5089	1.01

Table 5. Predicted Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	1.58	0.48	30.310	1.10	69.690
2026	1.60	0.48	30.310	1.11	69.690
2027	1.62	0.49	30.310	1.13	69.690
2028	1.63	0.49	30.310	1.14	69.690
2029	1.65	0.50	30.310	1.15	69.690
2030	1.67	0.51	30.310	1.16	69.690
2031	1.68	0.51	30.310	1.17	69.690
2032	1.70	0.52	30.310	1.18	69.690
2033	1.71	0.52	30.310	1.20	69.690
2034	1.73	0.52	30.310	1.21	69.690
Total	16.57	5.02	30.310	11.55	69.690
Average	1.66	0.50	30.310	1.16	69.690

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Expected Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	2.75	1.03	37.519	1.72	62.481
2026	2.78	1.04	37.519	1.74	62.481
2027	2.81	1.05	37.519	1.76	62.481
2028	2.84	1.06	37.519	1.77	62.481
2029	2.87	1.08	37.519	1.79	62.481
2030	2.90	1.09	37.519	1.81	62.481
2031	2.92	1.10	37.519	1.83	62.481
2032	2.95	1.11	37.519	1.84	62.481
2033	2.98	1.12	37.519	1.86	62.481
2034	3.01	1.13	37.519	1.88	62.481
Total	28.82	10.81	37.519	18.01	62.481
Average	2.88	1.08	37.519	1.80	62.481

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Comparing Predicted and Expected Crashes for the Evaluation Period (2U)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	16.57	5.02	30.310	11.55	69.690
Expected	28.82	10.81	37.519	18.01	62.481
Expected - Predicted	12.25	5.79		6.46	
Percent Difference	42.50	53.55		35.86	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Expected 2U Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.41	1.4	3.31	11.5	3.49	12.1
Highway Segment	Collision with Bicycle	0.04	0.1	0.02	0.1	0.06	0.2
Highway Segment	Other Single-vehicle Collision	0.08	0.3	0.52	1.8	0.60	2.1
Highway Segment	Overturned	0.40	1.4	0.27	0.9	0.72	2.5
Highway Segment	Collision with Pedestrian	0.08	0.3	0.02	0.1	0.09	0.3
Highway Segment	Run Off Road	5.89	20.4	9.09	31.6	15.02	52.1
Highway Segment	Total Single Vehicle Crashes	6.90	23.9	13.23	45.9	19.97	69.3
Highway Segment	Angle Collision	1.09	3.8	1.30	4.5	2.45	8.5
Highway Segment	Head-on Collision	0.37	1.3	0.05	0.2	0.46	1.6
Highway Segment	Other Multiple-vehicle Collision	0.28	1.0	0.54	1.9	0.78	2.7
Highway Segment	Rear-end Collision	1.78	6.2	2.20	7.6	4.09	14.2
Highway Segment	Sideswipe	0.41	1.4	0.68	2.4	1.07	3.7
Highway Segment	Total Multiple Vehicle Crashes	3.94	13.7	4.77	16.6	8.85	30.7
Highway Segment	Total Highway Segment Crashes	10.84	37.6	18.01	62.5	28.82	100.0
	Total Crashes	10.84	37.6	18.01	62.5	28.82	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
Branch Rd to CTH J/Forman Rd
Economic Analysis

Interactive Highway Safety Design Model

Economic Analysis Report

March 4, 2022

Disclaimer

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Table of Contents

List of Tables

Economic Analysis Report

Economic Analysis Report Overview

Report Generated: Mar 4, 2022 9:37 AM
Report Template: System: Single Page [System] (eam3, Feb 10, 2021 8:56 AM)

Evaluation Title: EA_BTO_SCP_Example_Branch Rd to CTH J/Forman Rd Widening
Evaluation Comment: Created Fri Mar 04 09:37:46 CST 2022
Evaluation Date: Fri Mar 04 09:37:49 CST 2022

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Branch Rd-CTH J/Forman Rd Widening
Project Comment: Created Wed Nov 24 12:51:13 CST 2021

Configuration Summary

Crash Cost Configuration: WisDOTEconomics_v16-1
Configuration Comment: Updated with 2020 Crash Cost Values

Table 1. Economic Analysis Configuration

Configuration Data	
Crash Unit Cost Zero Year	2020
Crash Cost Index	0.00
Discount Rate	0.05
KABCO Unit Costs	
K Cost ($/Crash)	12,694,788.00
A Cost ($/Crash)	684,064.00
B Cost ($/Crash)	217,328.00
C Cost ($/Crash)	123,679.00
O Cost ($/Crash)	10,824.00

Table 2. RTL Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL 2U Two-Lane Undivided	3.502	12.638	43.370	40.490

Table 3. RTL Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL Three-Legged w/STOP control	3.072	15.068	42.383	39.477
RTL Four-Legged w/STOP control	3.975	15.278	42.862	37.885
RTL Four-Legged Signalized	2.957	11.751	35.292	50.000

Table 4. RML Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Four-Lane Undivided	3.502	12.638	43.370	40.490
RML Four-Lane Divided	3.502	12.638	43.370	40.490

Table 5. RML Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Three-Legged w/STOP control	4.095	14.091	40.626	41.188
RML Four-Legged w/STOP control	4.711	15.912	41.988	37.389
RML Four-Legged Signalized	0.598	10.012	37.176	52.214

Table 6. USA Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Two-Lane Undivided	1.012	5.785	33.011	60.192
USA Three-Lane w/Center TWLTL	1.012	5.785	33.011	60.192
USA Four-Lane Undivided	1.012	5.785	33.011	60.192
USA Four-Lane Divided	1.012	5.785	33.011	60.192
USA Five-Lane w/Center TWLTL	1.012	5.785	33.011	60.192

Table 7. USA Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Three-Legged w/STOP control	0.744	6.558	36.725	55.973
USA Three-Legged Signalized	0.451	4.957	32.024	62.568
USA Four-Legged w/STOP control	0.864	6.637	38.161	54.338
USA Four-Legged Signalized	0.715	5.263	32.359	61.663

Analysis Output Summary

Analysis Type: Benefit/Cost

Table 8. Case Cost Summary

Is Base Case	Title	Present Value of Crash Cost ($)	Present Value of Other Cost ($)	Net Present Value of Benefits (B) ($)	Net Present Value of Costs (C) ($)	Present Value of Net Benefit (B-C) ($)	Benefit Cost Ratio (B/C)
Yes	Existing	6,629,057.12	0.00				
	Alternative 1 - Shoulder Widening/Shoulder Rumble Strips	6,055,021.49	94,000.00	574,035.63	94,000.00	480,035.63	6.1068

Table 9. Case Crash Summary

Is Base Case	Title	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Yes	Existing	0.4146	1.4961	5.1342	4.7933	19.7144	31.5526
	Alternative 1 - Shoulder Widening/Shoulder Rumble Strips	0.3787	1.3666	4.6896	4.3782	18.0072	28.8203

Crash Cost Data

Existing Data

Case Title: Existing

Is Base Case: true

Present Value of Crash Cost: 6,629,057.12

Present Value of Other Cost: 0.00

Table 10. Existing Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_Segments	Branch Rd to CTH CTH J/Forman Rd (10085-10086) - Base Case	Branch Rd to CTH CTH J/Forman Rd - Base Case	6,629,057.12
Total			6,629,057.12

Table 11. Existing Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_Segments	Branch Rd to CTH CTH J/Forman Rd (10085-10086) - Base Case	Branch Rd to CTH CTH J/Forman Rd - Base Case	0.4146	1.4961	5.1342	4.7933	19.7144	31.5526
Total			0.4146	1.4961	5.1342	4.7933	19.7144	31.5526

Table 12. Branch Rd to CTH CTH J/Forman Rd (10085-10086) - Base Case Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Segment	0.4146	1.4961	5.1342	4.7933	19.7144	31.5526
Total	0.4146	1.4961	5.1342	4.7933	19.7144	31.5526

Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Data

Case Title: Alternative 1 - Shoulder Widening/Shoulder Rumble Strips

Is Base Case: false

Present Value of Crash Cost: 6,055,021.49

Present Value of Other Cost: 94,000.00

Table 13. Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_Segments	Branch Rd to CTH CTH J/Forman Rd (10085-10086) - Alternative 1	Branch Rd to CTH CTH J/Forman Rd - Alternative 1	6,055,021.49
Total			6,055,021.49

Table 14. Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_Segments	Branch Rd to CTH CTH J/Forman Rd (10085-10086) - Alternative 1	Branch Rd to CTH CTH J/Forman Rd - Alternative 1	0.3787	1.3666	4.6896	4.3782	18.0072	28.8203
Total			0.3787	1.3666	4.6896	4.3782	18.0072	28.8203

Table 15. Branch Rd to CTH CTH J/Forman Rd (10085-10086) - Alternative 1 Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Segment	0.3787	1.3666	4.6896	4.3782	18.0072	28.8203
Total	0.3787	1.3666	4.6896	4.3782	18.0072	28.8203

Evaluation Message

IHSDM
CTH J/Forman Rd to CTH J/Koepenick Rd
Base Case

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

March 4, 2022

CTH J/Forman Rd to CTH J/Koepenick Rd - Base Case Crash Prediction

Table of Contents

List of Tables

Report Overview

Report Generated: Mar 4, 2022 9:27 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Fri Mar 04 09:27:51 CST 2022
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Segments
Project Comment: Created Fri Nov 19 10:26:02 CST 2021
Project Unit System: U.S. Customary

Site Set: CTH J/Forman Rd to CTH J/Koepenick Rd (10089) - Base Case
Site Set Comment: Copied from Project Limits (10082-10092) - Base Case (v1)
Site Set Version: v1

Evaluation Title: CTH J/Forman Rd to CTH J/Koepenick Rd - Base Case
Evaluation Comment: Created Fri Mar 04 09:27:39 CST 2022
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: CTH J/Forman Rd to CTH J/Koepenick Rd (10089) - Base Case
Crash History Siteset Comment: Copied from Project Limits (10082-10092) - Base Case (v1)
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 2U
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (2U)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	5	5	1	0	4
2017	4	4	1	0	3
2018	3	3	1	1	1
2019	7	7	3	1	3
2020	6	6	1	0	5
All Years	25 [1]	25	7	2	16

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
10	2U	CSD: USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.4421	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
10	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.4421	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
11	2U	CSD: USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.2348	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	0.2348	0	0.00	no
11	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.2348	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	0.2348	0	0.00	no
12	2U	CSD: USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.9031	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
12	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.9031	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
13	2U	CSD: USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.5871	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
13	2U	USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.5871	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
14	2U	CSD: USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.4829	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	0.4829	0	0.00	no
14	2U	USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.4829	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	0.4829	0	0.00	no
15	2U	CSD: USH 45	2.65 miles north of CTH J W/Forman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	1.0600	0	0.00	no
15	2U	USH 45	2.65 miles north of CTH J W/Forman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	1.0600	0	0.00	no

Table 3. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Crash Rate (crashes/ mi/yr)	Expected Travel Crash Rate (crashes/ million veh-mi)
10	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.4421	6.596	4.199	0.6597	0.2475	0.4122	0.4200	0.1348	0.2851	0.2397	0.1127	0.1270	1.4921	1.00
11	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.2348	4.530	2.273	0.4530	0.3205	0.1325	0.2273	0.0730	0.1544	0.2256	0.2475	-0.0219	1.9292	1.29
12	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.9031	9.914	8.579	0.9914	0.2679	0.7235	0.8579	0.2754	0.5825	0.1335	-0.0075	0.1410	1.0977	0.74
13	2U	USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.5871	8.410	5.577	0.8410	0.2052	0.6357	0.5577	0.1790	0.3787	0.2833	0.0262	0.2571	1.4324	0.96
14	2U	USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.4829	7.939	4.616	0.7938	0.1845	0.6093	0.4616	0.1482	0.3134	0.3323	0.0364	0.2959	1.6439	1.10
15	2U	USH 45	2.65 miles north of CTH J W/Forman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	8.426	10.098	0.8426	0.2839	0.5587	1.0098	0.3241	0.6856	-0.1672	-0.0402	-0.1270	0.7949	0.53
		Total	Total	3.7100	45.814	35.342	4.5814	1.5095	3.0719	3.5342	1.1345	2.3997	1.0472	0.3751	0.6721	1.2349	0.83

Table 4. Predicted Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	3.38	1.08	32.100	2.29	67.900
2026	3.41	1.10	32.100	2.32	67.900
2027	3.45	1.11	32.100	2.34	67.900
2028	3.48	1.12	32.100	2.36	67.900
2029	3.52	1.13	32.100	2.39	67.900
2030	3.55	1.14	32.100	2.41	67.900
2031	3.59	1.15	32.100	2.44	67.900
2032	3.62	1.16	32.100	2.46	67.900
2033	3.65	1.17	32.100	2.48	67.900
2034	3.69	1.19	32.100	2.51	67.900
Total	35.34	11.35	32.100	24.00	67.900
Average	3.53	1.13	32.100	2.40	67.900

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 5. Expected Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	4.38	1.44	32.950	2.94	67.050
2026	4.42	1.46	32.950	2.97	67.050
2027	4.47	1.47	32.950	3.00	67.050
2028	4.51	1.49	32.950	3.03	67.050
2029	4.56	1.50	32.950	3.06	67.050
2030	4.60	1.52	32.950	3.09	67.050
2031	4.65	1.53	32.950	3.12	67.050
2032	4.69	1.55	32.950	3.15	67.050
2033	4.74	1.56	32.950	3.18	67.050
2034	4.78	1.58	32.950	3.21	67.050
Total	45.81	15.10	32.950	30.72	67.050
Average	4.58	1.51	32.950	3.07	67.050

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Comparing Predicted and Expected Crashes for the Evaluation Period (2U)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	35.34	11.35	32.100	24.00	67.900
Expected	45.81	15.10	32.950	30.72	67.050
Expected - Predicted	10.47	3.75		6.72	
Percent Difference	22.86	24.85		21.88	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Expected 2U Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.57	1.3	5.65	12.3	5.54	12.1
Highway Segment	Collision with Bicycle	0.06	0.1	0.03	0.1	0.09	0.2
Highway Segment	Other Single-vehicle Collision	0.11	0.2	0.89	1.9	0.96	2.1
Highway Segment	Overturned	0.56	1.2	0.46	1.0	1.15	2.5
Highway Segment	Collision with Pedestrian	0.11	0.2	0.03	0.1	0.14	0.3
Highway Segment	Run Off Road	8.23	18.0	15.51	33.9	23.87	52.1
Highway Segment	Total Single Vehicle Crashes	9.63	21.0	22.58	49.3	31.75	69.3
Highway Segment	Angle Collision	1.52	3.3	2.21	4.8	3.89	8.5
Highway Segment	Head-on Collision	0.51	1.1	0.09	0.2	0.73	1.6
Highway Segment	Other Multiple-vehicle Collision	0.39	0.9	0.92	2.0	1.24	2.7
Highway Segment	Rear-end Collision	2.49	5.4	3.75	8.2	6.51	14.2
Highway Segment	Sideswipe	0.57	1.3	1.17	2.5	1.70	3.7
Highway Segment	Total Multiple Vehicle Crashes	5.50	12.0	8.14	17.8	14.06	30.7
Highway Segment	Total Highway Segment Crashes	15.13	33.0	30.72	67.1	45.81	100.0
	Total Crashes	15.13	33.0	30.72	67.1	45.81	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
CTH J/Forman Rd to CTH J/Koepenick Rd
Alternative 1

CTH J/Forman Rd to CTH J/Koepenick Rd - Alternative 1 Crash Prediction

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

March 4, 2022

CTH J/Forman Rd to CTH J/Koepenick Rd - Alternative 1 Crash Prediction

Table of Contents

List of Tables

Report Overview

Report Generated: Mar 4, 2022 9:30 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Fri Mar 04 09:30:40 CST 2022
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Segments
Project Comment: Created Fri Nov 19 10:26:02 CST 2021
Project Unit System: U.S. Customary

Site Set: CTH J/Forman Rd to CTH J/Koepenick Rd (10089) - Alternative 1
Site Set Comment: Copied from CTH J/Forman Rd to CTH J/Koepenick Rd (10089) - Base Case (v1)
Site Set Version: v1

Evaluation Title: CTH J/Forman Rd to CTH J/Koepenick Rd - Alternative 1
Evaluation Comment: Created Fri Mar 04 09:30:35 CST 2022
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: CTH J/Forman Rd to CTH J/Koepenick Rd (10089) - Base Case
Crash History Siteset Comment: Copied from Project Limits (10082-10092) - Base Case (v1)
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 2U
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (2U)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	5	5	1	0	4
2017	4	4	1	0	3
2018	3	3	1	1	1
2019	7	7	3	1	3
2020	6	6	1	0	5
All Years	25 [1]	25	7	2	16

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. User Defined CMF Used in the Intersection CPM Evaluation (SSCPMRuralTwoLane)

Site No.	Name	Description	Start CMF Year	End CMF Year	Severity	CMF Value
10	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
11	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
12	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
13	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
14	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
15	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200

Table 3. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
10	2U	CSD: USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.4421	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
10	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.4421	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
11	2U	CSD: USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.2348	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	0.2348	0	0.00	no
11	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.2348	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	11,459.16	0.2348	0	0.00	no
12	2U	CSD: USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.9031	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
12	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.9031	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
13	2U	CSD: USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.5871	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
13	2U	USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.5871	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
14	2U	CSD: USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.4829	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	0.4829	0	0.00	no
14	2U	USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.4829	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	17,188.73	0.4829	0	0.00	no
15	2U	CSD: USH 45	2.65 miles north of CTH J W/Forman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	1.0600	0	0.00	no
15	2U	USH 45	2.65 miles north of CTH J W/Forman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	17,188.73	1.0600	0	0.00	no

CTH J/Forman Rd to CTH J/Koepenick Rd - Alternative 1 Crash Prediction

Table 4. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Crash Rate (crashes/ mi/yr)	Expected Travel Crash Rate (crashes/ million veh-mi)
10	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.4421	6.025	3.836	0.6025	0.2261	0.3765	0.3836	0.1163	0.2673	0.2189	0.1098	0.1091	1.3629	0.92
11	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.2348	4.137	2.076	0.4137	0.2927	0.1210	0.2076	0.0629	0.1447	0.2061	0.2298	-0.0237	1.7621	1.18
12	2U	USH 45	CTH J W/Forman Rd to 1.58 miles north of CTH J W/Forman Rd (PDP_10087)	0.9031	9.055	7.836	0.9055	0.2447	0.6608	0.7836	0.2375	0.5461	0.1219	0.0072	0.1147	1.0027	0.67
13	2U	USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.5871	7.681	5.094	0.7682	0.1875	0.5807	0.5094	0.1544	0.3550	0.2588	0.0331	0.2257	1.3084	0.88
14	2U	USH 45	1.58 miles north of CTH J W/Forman Rd to 2.65 miles north of CTH J W/Forman Rd (PDP_10088)	0.4829	7.251	4.216	0.7251	0.1685	0.5566	0.4216	0.1278	0.2938	0.3035	0.0408	0.2627	1.5016	1.01
15	2U	USH 45	2.65 miles north of CTH J W/Forman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	7.696	9.223	0.7696	0.2593	0.5103	0.9223	0.2796	0.6428	-0.1527	-0.0202	-0.1325	0.7261	0.49
		Total	Total	3.7100	41.847	32.281	4.1847	1.3788	2.8058	3.2281	0.9785	2.2497	0.9565	0.4004	0.5562	1.1279	0.76

Table 5. Predicted Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	3.09	0.94	30.310	2.15	69.690
2026	3.12	0.94	30.310	2.17	69.690
2027	3.15	0.95	30.310	2.19	69.690
2028	3.18	0.96	30.310	2.22	69.690
2029	3.21	0.97	30.310	2.24	69.690
2030	3.24	0.98	30.310	2.26	69.690
2031	3.28	0.99	30.310	2.28	69.690
2032	3.31	1.00	30.310	2.31	69.690
2033	3.34	1.01	30.310	2.33	69.690
2034	3.37	1.02	30.310	2.35	69.690
Total	32.28	9.79	30.310	22.50	69.690
Average	3.23	0.98	30.310	2.25	69.690

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Expected Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	4.00	1.32	32.950	2.68	67.050
2026	4.04	1.33	32.950	2.71	67.050
2027	4.08	1.34	32.950	2.74	67.050
2028	4.12	1.36	32.950	2.77	67.050
2029	4.16	1.37	32.950	2.79	67.050
2030	4.21	1.39	32.950	2.82	67.050
2031	4.25	1.40	32.950	2.85	67.050
2032	4.29	1.41	32.950	2.88	67.050
2033	4.33	1.43	32.950	2.90	67.050
2034	4.37	1.44	32.950	2.93	67.050
Total	41.85	13.79	32.950	28.06	67.050
Average	4.18	1.38	32.950	2.81	67.050

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Comparing Predicted and Expected Crashes for the Evaluation Period (2U)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	32.28	9.79	30.310	22.50	69.690
Expected	41.85	13.79	32.950	28.06	67.050
Expected - Predicted	9.56	4.00		5.56	
Percent Difference	22.86	29.04		19.82	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Expected 2U Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.52	1.3	5.16	12.3	5.06	12.1
Highway Segment	Collision with Bicycle	0.06	0.1	0.03	0.1	0.08	0.2
Highway Segment	Other Single-vehicle Collision	0.10	0.2	0.81	1.9	0.88	2.1
Highway Segment	Overturned	0.51	1.2	0.42	1.0	1.05	2.5
Highway Segment	Collision with Pedestrian	0.10	0.2	0.03	0.1	0.13	0.3
Highway Segment	Run Off Road	7.51	18.0	14.17	33.9	21.80	52.1
Highway Segment	Total Single Vehicle Crashes	8.80	21.0	20.62	49.3	29.00	69.3
Highway Segment	Angle Collision	1.39	3.3	2.02	4.8	3.56	8.5
Highway Segment	Head-on Collision	0.47	1.1	0.08	0.2	0.67	1.6
Highway Segment	Other Multiple-vehicle Collision	0.36	0.9	0.84	2.0	1.13	2.7
Highway Segment	Rear-end Collision	2.27	5.4	3.42	8.2	5.94	14.2
Highway Segment	Sideswipe	0.52	1.3	1.07	2.5	1.55	3.7
Highway Segment	Total Multiple Vehicle Crashes	5.02	12.0	7.43	17.8	12.85	30.7
Highway Segment	Total Highway Segment Crashes	13.82	33.0	28.06	67.1	41.85	100.0
	Total Crashes	13.82	33.0	28.06	67.1	41.85	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
CTH J/Forman Rd to CTH J/Koepenick Rd
Economic Analysis

Interactive Highway Safety Design Model

Economic Analysis Report

March 15, 2022

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Table of Contents

List of Tables

Economic Analysis Report

Economic Analysis Report Overview

Report Generated: Mar 15, 2022 9:10 AM
Report Template: System: Single Page [System] (eam3, Feb 10, 2021 8:56 AM)

Evaluation Title: EA_BTO_SCP_Example_South of CTH J/Koepenick Rd to CTH J/Koepenick Rd Widening
Evaluation Comment: Created Tue Mar 15 09:10:10 CDT 2022
Evaluation Date: Tue Mar 15 09:10:15 CDT 2022

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_CTH J/Forman Rd to CTH J/Koepenick Rd Widening
Project Comment: Created Wed Nov 24 12:53:16 CST 2021

Configuration Summary

Crash Cost Configuration: WisDOTEconomics_v16-1
Configuration Comment: Updated with 2020 Crash Cost Values

Table 1. Economic Analysis Configuration

Configuration Data	
Crash Unit Cost Zero Year	2020
Crash Cost Index	0.00
Discount Rate	0.05
KABCO Unit Costs	
K Cost ($/Crash)	12,694,788.00
A Cost ($/Crash)	684,064.00
B Cost ($/Crash)	217,328.00
C Cost ($/Crash)	123,679.00
O Cost ($/Crash)	10,824.00

Table 2. RTL Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL 2U Two-Lane Undivided	3.502	12.638	43.370	40.490

Table 3. RTL Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL Three-Legged w/STOP control	3.072	15.068	42.383	39.477
RTL Four-Legged w/STOP control	3.975	15.278	42.862	37.885
RTL Four-Legged Signalized	2.957	11.751	35.292	50.000

Table 4. RML Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Four-Lane Undivided	3.502	12.638	43.370	40.490
RML Four-Lane Divided	3.502	12.638	43.370	40.490

Table 5. RML Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Three-Legged w/STOP control	4.095	14.091	40.626	41.188
RML Four-Legged w/STOP control	4.711	15.912	41.988	37.389
RML Four-Legged Signalized	0.598	10.012	37.176	52.214

Table 6. USA Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Two-Lane Undivided	1.012	5.785	33.011	60.192
USA Three-Lane w/Center TWLTL	1.012	5.785	33.011	60.192
USA Four-Lane Undivided	1.012	5.785	33.011	60.192
USA Four-Lane Divided	1.012	5.785	33.011	60.192
USA Five-Lane w/Center TWLTL	1.012	5.785	33.011	60.192

Table 7. USA Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Three-Legged w/STOP control	0.744	6.558	36.725	55.973
USA Three-Legged Signalized	0.451	4.957	32.024	62.568
USA Four-Legged w/STOP control	0.864	6.637	38.161	54.338
USA Four-Legged Signalized	0.715	5.263	32.359	61.663

Analysis Output Summary

Analysis Type: Benefit/Cost

CTH J/Forman Rd to CTH J/Koepenick Rd - Economic Analysis

Table 8. Case Cost Summary

Is Base Case	Title	Present Value of Crash Cost ($)	Present Value of Other Cost ($)	Net Present Value of Benefits (B) ($)	Net Present Value of Costs (C) ($)	Present Value of Net Benefit (B-C) ($)	Benefit Cost Ratio (B/C)
Yes	Existing	8,501,812.36	0.00				
	Alternative 1 - Shoulder Widening/Shoulder Rumble Strips	7,765,607.64	182,000.00	736,204.72	182,000.00	554,204.72	4.0451

Table 9. Case Crash Summary

Is Base Case	Title	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Yes	Existing	0.5286	1.9078	6.5469	6.1122	30.7185	45.8140
	Alternative 1 - Shoulder Widening/Shoulder Rumble Strips	0.4829	1.7426	5.9800	5.5829	28.0585	41.8468

Crash Cost Data

Existing Data

Case Title: Existing
Is Base Case: true
Present Value of Crash Cost: 8,501,812.36
Present Value of Other Cost: 0.00

Table 10. Existing Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_Segments	CTH J/Forman Rd to CTH J/Koepenick Rd (10089) - Base Case	CTH J/Forman Rd to CTH J/Koepenick Rd - Base Case	8,501,812.36
Total			8,501,812.36

CTH J/Forman Rd to CTH J/Koepenick Rd - Economic Analysis

Table 11. Existing Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_Segments	CTH J/Forman Rd to CTH J/Koepenick Rd (10089) - Base Case	CTH J/Forman Rd to CTH J/Koepenick Rd - Base Case	0.5286	1.9078	6.5469	6.1122	30.7185	45.8140
Total			0.5286	1.9078	6.5469	6.1122	30.7185	45.8140

Table 12. CTH J/Forman Rd to CTH J/Koepenick Rd (10089) - Base Case Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Segment	0.5286	1.9078	6.5469	6.1122	30.7185	45.8140
Total	0.5286	1.9078	6.5469	6.1122	30.7185	45.8140

Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Data

Case Title: Alternative 1 - Shoulder Widening/Shoulder Rumble Strips
Is Base Case: false
Present Value of Crash Cost: 7,765,607.64
Present Value of Other Cost: 182,000.00

Table 13. Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_Segments	CTH J/Forman Rd to CTH J/Koepenick Rd (10089) - Alternative 1	CTH J/Forman Rd to CTH J/Koepenick Rd - Alternative 1	7,765,607.64
Total			7,765,607.64

CTH J/Forman Rd to CTH J/Koepenick Rd - Economic Analysis

Table 14. Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_Segments	CTH J/Forman Rd to CTH J/Koepenick Rd (10089) - Alternative 1	CTH J/Forman Rd to CTH J/Koepenick Rd - Alternative 1	0.4829	1.7426	5.9800	5.5829	28.0585	41.8468
Total			0.4829	1.7426	5.9800	5.5829	28.0585	41.8468

Table 15. CTH J/Forman Rd to CTH J/Koepenick Rd (10089) - Alternative 1 Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Segment	0.4829	1.7426	5.9800	5.5829	28.0585	41.8468
Total	0.4829	1.7426	5.9800	5.5829	28.0585	41.8468

Evaluation Message

IHSDM
CTH B to CTH T
(Rural Project Limits)
Base Case

CTH B to CTH T (Rural Project Limits) - Base Case Crash Prediction

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 29, 2021

CTH B to CTH T (Rural Project Limits) - Base Case Crash Prediction

Table of Contents

List of Tables

Report Overview

Report Generated: Nov 29, 2021 10:48 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Wed Nov 24 11:03:26 CST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Segments
Project Comment: Created Fri Nov 19 10:26:02 CST 2021
Project Unit System: U.S. Customary

Site Set: Project Limits (10082-10092) - Base Case
Site Set Comment: Copied from PDP_10082-10083 (v1)
Site Set Version: v1

Evaluation Title: Project Limits (CTH B to CTH T) - Base Case
Evaluation Comment: Created Wed Nov 24 11:02:48 CST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: Project Limits (10082-10092) - Base Case
Crash History Siteset Comment: Copied from PDP_10082-10083 (v1)
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 2U
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (2U)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	16	16	2	5	9
2017	14	14	4	1	9
2018	9	9	2	1	6
2019	13	13	3	2	8
2020	11	11	4	1	6
All Years	63 [1]	63	15	10	38

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
1	2U	CSD: USH 45	CTH B to CTH C (PDP_10082)	0.0625	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
1	2U	USH 45	CTH B to CTH C (PDP_10082)	0.0625	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
2	2U	CSD: USH 45	CTH B to CTH C (PDP_10083)	0.2090	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	3,819.72	0.2090	0	0.00	no
2	2U	USH 45	CTH B to CTH C (PDP_10083)	0.2090	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	3,819.72	0.2090	0	0.00	no
4	2U	CSD: USH 45	CTH B to CTH C (PDP_10083)	0.7485	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
4	2U	USH 45	CTH B to CTH C (PDP_10083)	0.7485	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
5	2U	CSD: USH 45	CTH C to Branch Rd (PDP_10084)	0.9316	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
5	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.9316	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
6	2U	CSD: USH 45	CTH C to Branch Rd (PDP_10084)	0.0972	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	0.0972	0	0.00	no
6	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.0972	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	0.0972	0	0.00	no
7	2U	CSD: USH 45	CTH C to Branch Rd (PDP_10084)	0.4512	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
7	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.4512	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
8	2U	CSD: USH 45	Branch Rd to CTH V (PDP_10085)	0.9700	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
8	2U	USH 45	Branch Rd to CTH V (PDP_10085)	0.9700	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
9	2U	CSD: USH 45	CTH V to CTH J W/Foreman Rd (PDP_10086)	0.9400	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
9	2U	USH 45	CTH V to CTH J W/Foreman Rd (PDP_10086)	0.9400	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
10	2U	CSD: USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.4421	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
10	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.4421	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
11	2U	CSD: USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.2348	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	0.2348	0	0.00	no

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
11	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.2348	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	0.2348	0	0.00	no
12	2U	CSD: USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.9031	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
12	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.9031	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
13	2U	CSD: USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.5871	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
13	2U	USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.5871	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
14	2U	CSD: USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.4829	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	0.4829	0	0.00	no
14	2U	USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.4829	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	0.4829	0	0.00	no
15	2U	CSD: USH 45	2.65 miles north of CTH J W/Foreman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	1.0600	0	0.00	no
15	2U	USH 45	2.65 miles north of CTH J W/Foreman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	1.0600	0	0.00	no
16	2U	CSD: USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.1086	2016-2018: 3800; 2019: 3857; 2020: 3914	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	0.1086	0	0.00	no
16	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.1086	2025: 4200; 2026: 4230; 2027: 4260; 2028: 4290; 2029: 4320; 2030: 4350; 2031: 4380; 2032: 4410; 2033: 4440; 2034: 4470	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	0.1086	0	0.00	no
17	2U	CSD: USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.7396	2016-2018: 3800; 2019: 3857; 2020: 3914	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
17	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.7396	2025: 4200; 2026: 4230; 2027: 4260; 2028: 4290; 2029: 4320; 2030: 4350; 2031: 4380; 2032: 4410; 2033: 4440; 2034: 4470	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
18	2U	CSD: USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.2018	2016-2018: 3800; 2019: 3857; 2020: 3914	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	0.2018	0	0.00	no
18	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.2018	2025: 4200; 2026: 4230; 2027: 4260; 2028: 4290; 2029: 4320; 2030: 4350; 2031: 4380; 2032: 4410; 2033: 4440; 2034: 4470	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	0.2018	0	0.00	no
19	2U	CSD: USH 45	Wayside Driveway to CTH T (PDP_10091)	1.2669	2016-2018: 3800; 2019: 3857; 2020: 3914	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	1.2669	0	0.00	no
19	2U	USH 45	Wayside Driveway to CTH T (PDP_10091)	1.2669	2025: 4200; 2026: 4230; 2027: 4260; 2028: 4290; 2029: 4320; 2030: 4350; 2031: 4380; 2032: 4410; 2033: 4440; 2034: 4470	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	1.2669	0	0.00	no
20	2U	CSD: USH 45	Wayside Driveway to CTH T (PDP_10091)	0.1931	2016-2018: 3800; 2019: 3857; 2020: 3914	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no			0	0.00	no
20	2U	USH 45	Wayside Driveway to CTH T (PDP_10091)	0.1931	2025: 4200; 2026: 4230; 2027: 4260; 2028: 4290; 2029: 4320; 2030: 4350; 2031: 4380; 2032: 4410; 2033: 4440; 2034: 4470	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no			0	0.00	no

CTH B to CTH T (Rural Project Limits) - Base Case Crash Prediction

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
21	2U	CSD: USH 45	CTH T to CTH B (PDP_10092)	0.2176	2016-2018: 3700; 2019: 3742; 2020: 3785	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no			0	0.00	no
21	2U	USH 45	CTH T to CTH B (PDP_10092)	0.2176	2025: 4000; 2026: 4030; 2027: 4060; 2028: 4090; 2029: 4120; 2030: 4150; 2031: 4180; 2032: 4210; 2033: 4240; 2034: 4270	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no			0	0.00	no
22	2U	CSD: USH 45	CTH T to CTH B (PDP_10092)	0.1100	2016-2018: 3700; 2019: 3742; 2020: 3785	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	5,729.58	0.1100	0	0.00	no
22	2U	USH 45	CTH T to CTH B (PDP_10092)	0.1100	2025: 4000; 2026: 4030; 2027: 4060; 2028: 4090; 2029: 4120; 2030: 4150; 2031: 4180; 2032: 4210; 2033: 4240; 2034: 4270	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	5,729.58	0.1100	0	0.00	no

Table 3. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Crash Rate (crashes/ mi/yr)	Expected Travel Crash Rate (crashes/ million veh-mi)
1	2U	USH 45	CTH B to CTH C (PDP_10082)	0.0625	3.667	0.594	0.3667	0.1900	0.1767	0.0594	0.0191	0.0403	0.3073	0.1709	0.1364	5.8670	3.94
2	2U	USH 45	CTH B to CTH C (PDP_10083)	0.2090	3.343	2.114	0.3343	0.1262	0.2081	0.2114	0.0679	0.1435	0.1229	0.0584	0.0645	1.5995	1.07
4	2U	USH 45	CTH B to CTH C (PDP_10083)	0.7485	9.178	7.110	0.9178	0.2376	0.6802	0.7110	0.2282	0.4828	0.2068	0.0094	0.1974	1.2262	0.82
5	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.9316	4.434	8.849	0.4434	0.1663	0.2770	0.8849	0.2841	0.6009	-0.4416	-0.1177	-0.3239	0.4759	0.32
6	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.0972	0.473	0.966	0.0473	0.0178	0.0295	0.0966	0.0310	0.0656	-0.0493	-0.0132	-0.0361	0.4867	0.33
7	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.4512	2.147	4.286	0.2147	0.0806	0.1342	0.4286	0.1376	0.2910	-0.2139	-0.0570	-0.1569	0.4759	0.32
8	2U	USH 45	Branch Rd to CTH V (PDP_10085)	0.9700	12.478	9.214	1.2478	0.4304	0.8175	0.9214	0.2958	0.6256	0.3264	0.1346	0.1918	1.2864	0.86
9	2U	USH 45	CTH V to CTH J W/Foreman Rd (PDP_10086)	0.9400	19.074	8.929	1.9074	0.7588	1.1486	0.8929	0.2866	0.6063	1.0145	0.4722	0.5423	2.0292	1.36
10	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.4421	6.596	4.199	0.6597	0.2475	0.4122	0.4200	0.1348	0.2851	0.2397	0.1127	0.1270	1.4921	1.00
11	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.2348	4.530	2.273	0.4530	0.3205	0.1325	0.2273	0.0730	0.1544	0.2256	0.2475	-0.0219	1.9292	1.29
12	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.9031	9.914	8.579	0.9914	0.2679	0.7235	0.8579	0.2754	0.5825	0.1335	-0.0075	0.1410	1.0977	0.74
13	2U	USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.5871	8.410	5.577	0.8410	0.2052	0.6357	0.5577	0.1790	0.3787	0.2833	0.0262	0.2571	1.4324	0.96
14	2U	USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.4829	7.939	4.616	0.7938	0.1845	0.6093	0.4616	0.1482	0.3134	0.3323	0.0364	0.2959	1.6439	1.10
15	2U	USH 45	2.65 miles north of CTH J W/Foreman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	8.426	10.098	0.8426	0.2839	0.5587	1.0098	0.3241	0.6856	-0.1672	-0.0402	-0.1270	0.7949	0.53
16	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.1086	1.716	1.127	0.1716	0.1131	0.0585	0.1126	0.0362	0.0765	0.0590	0.0769	-0.0179	1.5804	1.00
17	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.7396	7.115	7.465	0.7115	0.2333	0.4782	0.7465	0.2396	0.5068	-0.0349	-0.0063	-0.0287	0.9620	0.61
18	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.2018	2.175	2.082	0.2175	0.0476	0.1699	0.2082	0.0668	0.1414	0.0093	-0.0192	0.0285	1.0778	0.68
19	2U	USH 45	Wayside Driveway to CTH T (PDP_10091)	1.2669	8.562	12.832	0.8562	0.2623	0.5939	1.2832	0.4119	0.8713	-0.4270	-0.1496	-0.2774	0.6758	0.43
20	2U	USH 45	Wayside Driveway to CTH T (PDP_10091)	0.1931	2.109	1.949	0.2109	0.0452	0.1657	0.1949	0.0626	0.1323	0.0160	-0.0174	0.0334	1.0922	0.69
21	2U	USH 45	CTH T to CTH B (PDP_10092)	0.2176	1.035	2.095	0.1035	0.0389	0.0646	0.2095	0.0672	0.1422	-0.1060	-0.0283	-0.0777	0.4758	0.32
22	2U	USH 45	CTH T to CTH B (PDP_10092)	0.1100	0.544	1.146	0.0544	0.0206	0.0338	0.1146	0.0368	0.0778	-0.0602	-0.0162	-0.0441	0.4943	0.33
		Total	Total	10.9576	123.865	106.100	12.3865	4.2784	8.1081	10.6099	3.4058	7.2042	1.7765	0.8726	0.9039	1.1304	0.75

Table 4. Predicted Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	10.18	3.27	32.100	6.91	67.900
2026	10.27	3.30	32.100	6.98	67.900
2027	10.37	3.33	32.100	7.04	67.900
2028	10.47	3.36	32.100	7.11	67.900
2029	10.56	3.39	32.100	7.17	67.900
2030	10.66	3.42	32.100	7.24	67.900
2031	10.75	3.45	32.100	7.30	67.900
2032	10.85	3.48	32.100	7.37	67.900
2033	10.95	3.51	32.100	7.43	67.900
2034	11.04	3.54	32.100	7.50	67.900
Total	106.10	34.06	32.100	72.04	67.900
Average	10.61	3.41	32.100	7.20	67.900

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 5. Expected Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	11.88	4.10	34.541	7.78	65.459
2026	11.99	4.14	34.541	7.85	65.459
2027	12.11	4.18	34.541	7.92	65.459
2028	12.22	4.22	34.541	8.00	65.459
2029	12.33	4.26	34.541	8.07	65.459
2030	12.44	4.30	34.541	8.14	65.459
2031	12.55	4.34	34.541	8.22	65.459
2032	12.67	4.38	34.541	8.29	65.459
2033	12.78	4.41	34.541	8.36	65.459
2034	12.89	4.45	34.541	8.44	65.459
Total	123.86	42.78	34.541	81.08	65.459
Average	12.39	4.28	34.541	8.11	65.459

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Comparing Predicted and Expected Crashes for the Evaluation Period (2U)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	106.10	34.06	32.100	72.04	67.900
Expected	123.86	42.78	34.541	81.08	65.459
Expected - Predicted	17.77	8.73		9.04	
Percent Difference	14.34	20.40		11.15	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Expected 2U Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	1.63	1.3	14.92	12.0	14.99	12.1
Highway Segment	Collision with Bicycle	0.17	0.1	0.08	0.1	0.25	0.2
Highway Segment	Other Single-vehicle Collision	0.30	0.2	2.35	1.9	2.60	2.1
Highway Segment	Overturned	1.58	1.3	1.22	1.0	3.10	2.5
Highway Segment	Collision with Pedestrian	0.30	0.2	0.08	0.1	0.37	0.3
Highway Segment	Run Off Road	23.32	18.8	40.95	33.1	64.53	52.1
Highway Segment	Total Single Vehicle Crashes	27.30	22.0	59.59	48.1	85.84	69.3
Highway Segment	Angle Collision	4.32	3.5	5.84	4.7	10.53	8.5
Highway Segment	Head-on Collision	1.46	1.2	0.24	0.2	1.98	1.6
Highway Segment	Other Multiple-vehicle Collision	1.11	0.9	2.43	2.0	3.34	2.7
Highway Segment	Rear-end Collision	7.06	5.7	9.89	8.0	17.59	14.2
Highway Segment	Sideswipe	1.63	1.3	3.08	2.5	4.58	3.7
Highway Segment	Total Multiple Vehicle Crashes	15.57	12.6	21.49	17.3	38.03	30.7
Highway Segment	Total Highway Segment Crashes	42.87	34.6	81.08	65.5	123.86	100.0
	Total Crashes	42.87	34.6	81.08	65.5	123.86	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
CTH B to CTH T
(Rural Project Limits)
Alternative 1

CTH B to CTH T (Rural Project Limits) - Alternative 1 Crash Prediction

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 29, 2021

CTH B to CTH T (Rural Project Limits) - Alternative 1 Crash Prediction

Table of Contents

List of Tables

Report Overview

Report Generated: Nov 29, 2021 10:49 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Mon Nov 29 09:18:55 CST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Segments
Project Comment: Created Fri Nov 19 10:26:02 CST 2021
Project Unit System: U.S. Customary

Site Set: Project Limits (10082-10092) - Alternative 1
Site Set Comment: Copied from Project Limits (10082-10092) - Base Case (v1)
Site Set Version: v1

Evaluation Title: Project Limits (CTH B to CTH T) - Alternative 1
Evaluation Comment: Created Mon Nov 29 09:18:48 CST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: Project Limits (10082-10092) - Base Case
Crash History Siteset Comment: Copied from PDP_10082-10083 (v1)
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 2U
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (2U)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	16	16	2	5	9
2017	14	14	4	1	9
2018	9	9	2	1	6
2019	13	13	3	2	8
2020	11	11	4	1	6
All Years	63 [1]	63	15	10	38

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. User Defined CMF Used in the Intersection CPM Evaluation (SSCPMRuralTwoLane)

Site No.	Name	Description	Start CMF Year	End CMF Year	Severity	CMF Value
1	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
2	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
4	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
5	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
6	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
7	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
8	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
9	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
10	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
11	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
12	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
13	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
14	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
15	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
16	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
17	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
18	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
19	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
20	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
21	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200
22	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200

Table 3. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
1	2U	CSD: USH 45	CTH B to CTH C (PDP_10082)	0.0625	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.0	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
1	2U	USH 45	CTH B to CTH C (PDP_10082)	0.0625	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.0	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
2	2U	CSD: USH 45	CTH B to CTH C (PDP_10083)	0.2090	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.0	0.0	2	no	None (0)	no	no	3,819.72	0.2090	0	0.00	no
2	2U	USH 45	CTH B to CTH C (PDP_10083)	0.2090	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.0	0.0	2	yes	None (0)	no	no	3,819.72	0.2090	0	0.00	no
4	2U	CSD: USH 45	CTH B to CTH C (PDP_10083)	0.7485	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.0	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
4	2U	USH 45	CTH B to CTH C (PDP_10083)	0.7485	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.0	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
5	2U	CSD: USH 45	CTH C to Branch Rd (PDP_10084)	0.9316	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.0	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
5	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.9316	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.0	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
6	2U	CSD: USH 45	CTH C to Branch Rd (PDP_10084)	0.0972	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.0	0.0	2	no	None (0)	no	no	11,459.16	0.0972	0	0.00	no
6	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.0972	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.0	0.0	2	yes	None (0)	no	no	11,459.16	0.0972	0	0.00	no
7	2U	CSD: USH 45	CTH C to Branch Rd (PDP_10084)	0.4512	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.0	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
7	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.4512	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.0	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
8	2U	CSD: USH 45	Branch Rd to CTH V (PDP_10085)	0.9700	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.0	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
8	2U	USH 45	Branch Rd to CTH V (PDP_10085)	0.9700	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.0	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
9	2U	CSD: USH 45	CTH V to CTH J W/Foreman Rd (PDP_10086)	0.9400	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.0	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
9	2U	USH 45	CTH V to CTH J W/Foreman Rd (PDP_10086)	0.9400	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.0	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
10	2U	CSD: USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.4421	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.0	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
10	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.4421	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.0	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
11	2U	CSD: USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.2348	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.0	0.0	2	no	None (0)	no	no	11,459.16	0.2348	0	0.00	no

CTH B to CTH T (Rural Project Limits) - Alternative 1 Crash Prediction

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLTLane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
11	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.2348	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	11,459.16	0.2348	0	0.00	no
12	2U	CSD: USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.9031	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
12	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.9031	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
13	2U	CSD: USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.5871	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
13	2U	USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.5871	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
14	2U	CSD: USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.4829	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	0.4829	0	0.00	no
14	2U	USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.4829	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	17,188.73	0.4829	0	0.00	no
15	2U	CSD: USH 45	2.65 miles north of CTH J W/Foreman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	2016-2018: 3600; 2019: 3642; 2020: 3685	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	1.0600	0	0.00	no
15	2U	USH 45	2.65 miles north of CTH J W/Foreman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	2025: 3900; 2026: 3940; 2027: 3980; 2028: 4020; 2029: 4060; 2030: 4100; 2031: 4140; 2032: 4180; 2033: 4220; 2034: 4260	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	17,188.73	1.0600	0	0.00	no
16	2U	CSD: USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.1086	2016-2018: 3800; 2019: 3857; 2020: 3914	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	17,188.73	0.1086	0	0.00	no
16	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.1086	2025: 4200; 2026: 4230; 2027: 4260; 2028: 4290; 2029: 4320; 2030: 4350; 2031: 4380; 2032: 4410; 2033: 4440; 2034: 4470	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	17,188.73	0.1086	0	0.00	no
17	2U	CSD: USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.7396	2016-2018: 3800; 2019: 3857; 2020: 3914	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	0.00	0.0000	0	0.00	no
17	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.7396	2025: 4200; 2026: 4230; 2027: 4260; 2028: 4290; 2029: 4320; 2030: 4350; 2031: 4380; 2032: 4410; 2033: 4440; 2034: 4470	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	0.00	0.0000	0	0.00	no
18	2U	CSD: USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.2018	2016-2018: 3800; 2019: 3857; 2020: 3914	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	0.2018	0	0.00	no
18	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.2018	2025: 4200; 2026: 4230; 2027: 4260; 2028: 4290; 2029: 4320; 2030: 4350; 2031: 4380; 2032: 4410; 2033: 4440; 2034: 4470	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	11,459.16	0.2018	0	0.00	no
19	2U	CSD: USH 45	Wayside Driveway to CTH T (PDP_10091)	1.2669	2016-2018: 3800; 2019: 3857; 2020: 3914	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	11,459.16	1.2669	0	0.00	no
19	2U	USH 45	Wayside Driveway to CTH T (PDP_10091)	1.2669	2025: 4200; 2026: 4230; 2027: 4260; 2028: 4290; 2029: 4320; 2030: 4350; 2031: 4380; 2032: 4410; 2033: 4440; 2034: 4470	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	11,459.16	1.2669	0	0.00	no
20	2U	CSD: USH 45	Wayside Driveway to CTH T (PDP_10091)	0.1931	2016-2018: 3800; 2019: 3857; 2020: 3914	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no			0	0.00	no
20	2U	USH 45	Wayside Driveway to CTH T (PDP_10091)	0.1931	2025: 4200; 2026: 4230; 2027: 4260; 2028: 4290; 2029: 4320; 2030: 4350; 2031: 4380; 2032: 4410; 2033: 4440; 2034: 4470	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no			0	0.00	no

CTH B to CTH T (Rural Project Limits) - Alternative 1 Crash Prediction

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
21	2U	CSD: USH 45	CTH T to CTH B (PDP_10092)	0.2176	2016-2018: 3700; 2019: 3742; 2020: 3785	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no			0	0.00	no
21	2U	USH 45	CTH T to CTH B (PDP_10092)	0.2176	2025: 4000; 2026: 4030; 2027: 4060; 2028: 4090; 2029: 4120; 2030: 4150; 2031: 4180; 2032: 4210; 2033: 4240; 2034: 4270	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no			0	0.00	no
22	2U	CSD: USH 45	CTH T to CTH B (PDP_10092)	0.1100	2016-2018: 3700; 2019: 3742; 2020: 3785	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	5,729.58	0.1100	0	0.00	no
22	2U	USH 45	CTH T to CTH B (PDP_10092)	0.1100	2025: 4000; 2026: 4030; 2027: 4060; 2028: 4090; 2029: 4120; 2030: 4150; 2031: 4180; 2032: 4210; 2033: 4240; 2034: 4270	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	5,729.58	0.1100	0	0.00	no

Table 4. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Crash Rate (crashes/ mi/yr)	Expected Travel Crash Rate (crashes/ million veh-mi)
1	2U	USH 45	CTH B to CTH C (PDP_10082)	0.0625	3.349	0.542	0.3349	0.1735	0.1614	0.0542	0.0164	0.0378	0.2807	0.1571	0.1236	5.3589	3.60
2	2U	USH 45	CTH B to CTH C (PDP_10083)	0.2090	3.053	1.931	0.3053	0.1153	0.1900	0.1931	0.0585	0.1346	0.1122	0.0568	0.0555	1.4610	0.98
4	2U	USH 45	CTH B to CTH C (PDP_10083)	0.7485	8.383	6.494	0.8383	0.2170	0.6213	0.6494	0.1968	0.4526	0.1889	0.0202	0.1687	1.1200	0.75
5	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.9316	4.050	8.083	0.4050	0.1519	0.2530	0.8083	0.2450	0.5633	-0.4033	-0.0931	-0.3103	0.4347	0.29
6	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.0972	0.432	0.882	0.0432	0.0163	0.0269	0.0883	0.0267	0.0615	-0.0450	-0.0105	-0.0346	0.4446	0.30
7	2U	USH 45	CTH C to Branch Rd (PDP_10084)	0.4512	1.961	3.915	0.1961	0.0736	0.1225	0.3915	0.1187	0.2728	-0.1954	-0.0451	-0.1503	0.4347	0.29
8	2U	USH 45	Branch Rd to CTH V (PDP_10085)	0.9700	11.398	8.416	1.1398	0.3931	0.7467	0.8416	0.2551	0.5865	0.2981	0.1380	0.1602	1.1750	0.79
9	2U	USH 45	CTH V to CTH J W/Foreman Rd (PDP_10086)	0.9400	17.423	8.156	1.7423	0.6931	1.0492	0.8156	0.2472	0.5684	0.9267	0.4459	0.4808	1.8535	1.25
10	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.4421	6.025	3.836	0.6025	0.2261	0.3765	0.3836	0.1163	0.2673	0.2189	0.1098	0.1091	1.3629	0.92
11	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.2348	4.137	2.076	0.4137	0.2927	0.1210	0.2076	0.0629	0.1447	0.2061	0.2298	-0.0237	1.7621	1.18
12	2U	USH 45	CTH J W/Foreman Rd to 1.58 miles north of CTH J W/Foreman Rd (PDP_10087)	0.9031	9.055	7.836	0.9055	0.2447	0.6608	0.7836	0.2375	0.5461	0.1219	0.0072	0.1147	1.0027	0.67
13	2U	USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.5871	7.681	5.094	0.7682	0.1875	0.5807	0.5094	0.1544	0.3550	0.2588	0.0331	0.2257	1.3084	0.88
14	2U	USH 45	1.58 miles north of CTH J W/Foreman Rd to 2.65 miles north of CTH J W/Foreman Rd (PDP_10088)	0.4829	7.251	4.216	0.7251	0.1685	0.5566	0.4216	0.1278	0.2938	0.3035	0.0408	0.2627	1.5016	1.01
15	2U	USH 45	2.65 miles north of CTH J W/Foreman Rd to CTH J E/Koepenick Rd (PDP_10089)	1.0600	7.696	9.223	0.7696	0.2593	0.5103	0.9223	0.2796	0.6428	-0.1527	-0.0202	-0.1325	0.7261	0.49
16	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.1086	1.568	1.029	0.1568	0.1033	0.0535	0.1029	0.0312	0.0717	0.0539	0.0721	-0.0182	1.4436	0.91
17	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.7396	6.499	6.818	0.6499	0.2131	0.4368	0.6818	0.2067	0.4752	-0.0319	0.0065	-0.0384	0.8787	0.56
18	2U	USH 45	CTH J E/Koepenick Rd to Wayside Driveway (PDP_10090)	0.2018	1.987	1.902	0.1987	0.0435	0.1552	0.1902	0.0576	0.1325	0.0085	-0.0141	0.0226	0.9845	0.62
19	2U	USH 45	Wayside Driveway to CTH T (PDP_10091)	1.2669	7.821	11.721	0.7821	0.2396	0.5424	1.1721	0.3553	0.8168	-0.3900	-0.1156	-0.2744	0.6173	0.39
20	2U	USH 45	Wayside Driveway to CTH T (PDP_10091)	0.1931	1.927	1.780	0.1926	0.0413	0.1514	0.1780	0.0540	0.1241	0.0146	-0.0127	0.0273	0.9977	0.63
21	2U	USH 45	CTH T to CTH B (PDP_10092)	0.2176	0.946	1.913	0.0946	0.0356	0.0590	0.1913	0.0580	0.1333	-0.0968	-0.0224	-0.0744	0.4346	0.29
22	2U	USH 45	CTH T to CTH B (PDP_10092)	0.1100	0.497	1.047	0.0497	0.0188	0.0308	0.1047	0.0317	0.0729	-0.0550	-0.0129	-0.0421	0.4515	0.30
		Total	Total	10.9576	113.139	96.912	11.3139	3.9079	7.4060	9.6912	2.9374	6.7538	1.6227	0.9705	0.6522	1.0325	0.68

Table 5. Predicted Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	9.30	2.82	30.310	6.48	69.690
2026	9.38	2.85	30.310	6.54	69.690
2027	9.47	2.87	30.310	6.60	69.690
2028	9.56	2.90	30.310	6.66	69.690
2029	9.65	2.92	30.310	6.72	69.690
2030	9.73	2.95	30.310	6.78	69.690
2031	9.82	2.98	30.310	6.84	69.690
2032	9.91	3.00	30.310	6.91	69.690
2033	10.00	3.03	30.310	6.97	69.690
2034	10.09	3.06	30.310	7.03	69.690
Total	96.91	29.37	30.310	67.54	69.690
Average	9.69	2.94	30.310	6.75	69.690

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Expected Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	10.85	3.75	34.541	7.11	65.459
2026	10.96	3.78	34.541	7.17	65.459
2027	11.06	3.82	34.541	7.24	65.459
2028	11.16	3.85	34.541	7.31	65.459
2029	11.26	3.89	34.541	7.37	65.459
2030	11.37	3.93	34.541	7.44	65.459
2031	11.47	3.96	34.541	7.51	65.459
2032	11.57	4.00	34.541	7.57	65.459
2033	11.67	4.03	34.541	7.64	65.459
2034	11.77	4.07	34.541	7.71	65.459
Total	113.14	39.08	34.541	74.06	65.459
Average	11.31	3.91	34.541	7.41	65.459

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Comparing Predicted and Expected Crashes for the Evaluation Period (2U)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	96.91	29.37	30.310	67.54	69.690
Expected	113.14	39.08	34.541	74.06	65.459
Expected - Predicted	16.23	9.71		6.52	
Percent Difference	14.34	24.83		8.81	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Expected 2U Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	1.49	1.3	13.63	12.0	13.69	12.1
Highway Segment	Collision with Bicycle	0.16	0.1	0.07	0.1	0.23	0.2
Highway Segment	Other Single-vehicle Collision	0.27	0.2	2.15	1.9	2.38	2.1
Highway Segment	Overturned	1.45	1.3	1.11	1.0	2.83	2.5
Highway Segment	Collision with Pedestrian	0.27	0.2	0.07	0.1	0.34	0.3
Highway Segment	Run Off Road	21.30	18.8	37.40	33.1	58.95	52.1
Highway Segment	Total Single Vehicle Crashes	24.93	22.0	54.43	48.1	78.41	69.3
Highway Segment	Angle Collision	3.95	3.5	5.33	4.7	9.62	8.5
Highway Segment	Head-on Collision	1.33	1.2	0.22	0.2	1.81	1.6
Highway Segment	Other Multiple-vehicle Collision	1.02	0.9	2.22	2.0	3.06	2.7
Highway Segment	Rear-end Collision	6.45	5.7	9.04	8.0	16.07	14.2
Highway Segment	Sideswipe	1.49	1.3	2.81	2.5	4.19	3.7
Highway Segment	Total Multiple Vehicle Crashes	14.22	12.6	19.63	17.3	34.73	30.7
Highway Segment	Total Highway Segment Crashes	39.16	34.6	74.06	65.5	113.14	100.0
	Total Crashes	39.16	34.6	74.06	65.5	113.14	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

<u>IHSDM</u>
<u>CTH B to CTH T</u>
<u>(Rural Project Limits)</u>
Economic Analysis

CTH B to CTH T (Rural Project Limits) - Economic Analysis

Interactive Highway Safety Design Model

Economic Analysis Report

November 29, 2021

CTH B to CTH T (Rural Project Limits) - Economic Analysis

Disclaimer

Limited Warranty and Limitations of Remedies

Notice

Table of Contents

List of Tables

Economic Analysis Report

Economic Analysis Report Overview

Report Generated: Nov 29, 2021 1:47 PM
Report Template: System: Single Page [System] (eam3, Feb 10, 2021 8:56 AM)

Evaluation Title: EA_BTO_SCP_Example_CTH B to CTH T Widening
Evaluation Comment: Created Mon Nov 29 11:15:30 CST 2021
Evaluation Date: Mon Nov 29 11:16:00 CST 2021

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_CTH B-CTH T Widening
Project Comment: Created Wed Nov 24 11:12:12 CST 2021

Configuration Summary

Crash Cost Configuration: WisDOTEconomics_v16-1
Configuration Comment: Updated with 2020 Crash Cost Values

Table 1. Economic Analysis Configuration

Configuration Data	
Crash Unit Cost Zero Year	2020
Crash Cost Index	0.00
Discount Rate	0.05
KABCO Unit Costs	
K Cost ($/Crash)	12,694,788.00
A Cost ($/Crash)	684,064.00
B Cost ($/Crash)	217,328.00
C Cost ($/Crash)	123,679.00
O Cost ($/Crash)	10,824.00

Table 2. RTL Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL 2U Two-Lane Undivided	3.502	12.638	43.370	40.490

Table 3. RTL Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL Three-Legged w/STOP control	3.072	15.068	42.383	39.477
RTL Four-Legged w/STOP control	3.975	15.278	42.862	37.885
RTL Four-Legged Signalized	2.957	11.751	35.292	50.000

Table 4. RML Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Four-Lane Undivided	3.502	12.638	43.370	40.490
RML Four-Lane Divided	3.502	12.638	43.370	40.490

Table 5. RML Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Three-Legged w/STOP control	4.095	14.091	40.626	41.188
RML Four-Legged w/STOP control	4.711	15.912	41.988	37.389
RML Four-Legged Signalized	0.598	10.012	37.176	52.214

Table 6. USA Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Two-Lane Undivided	1.012	5.785	33.011	60.192
USA Three-Lane w/Center TWLTL	1.012	5.785	33.011	60.192
USA Four-Lane Undivided	1.012	5.785	33.011	60.192
USA Four-Lane Divided	1.012	5.785	33.011	60.192
USA Five-Lane w/Center TWLTL	1.012	5.785	33.011	60.192

Table 7. USA Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Three-Legged w/STOP control	0.744	6.558	36.725	55.973
USA Three-Legged Signalized	0.451	4.957	32.024	62.568
USA Four-Legged w/STOP control	0.864	6.637	38.161	54.338
USA Four-Legged Signalized	0.715	5.263	32.359	61.663

Analysis Output Summary

Analysis Type: Benefit/Cost

Table 8. Case Cost Summary

Is Base Case	Title	Present Value of Crash Cost ($)	Present Value of Other Cost ($)	Net Present Value of Benefits (B) ($)	Net Present Value of Costs (C) ($)	Present Value of Net Benefit (B-C) ($)	Benefit Cost Ratio (B/C)
Yes	Existing	24,048,745.17	0.00				
	Alternative 1 - Shoulder Widening/Shoulder Rumble Strips	21,966,271.59	538,000.00	2,082,473.59	538,000.00	1,544,473.59	3.8708

Table 9. Case Crash Summary

Is Base Case	Title	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Yes	Existing	1.4983	5.4071	18.5554	17.3233	81.0808	123.8649
	Alternative 1 - Shoulder Widening/Shoulder Rumble Strips	1.3686	4.9388	16.9487	15.8232	74.0597	113.1389

Crash Cost Data

Existing Data

Case Title: Existing
Is Base Case: true
Present Value of Crash Cost: 24,048,745.17
Present Value of Other Cost: 0.00

Table 10. Existing Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_Segments	Project Limits (10082-10092) - Base Case	Project Limits (CTH B to CTH T) - Base Case	24,048,745.17
Total			24,048,745.17

Table 11. Existing Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_Segments	Project Limits (10082-10092) - Base Case	Project Limits (CTH B to CTH T) - Base Case	1.4983	5.4071	18.5554	17.3233	81.0808	123.8649
Total			1.4983	5.4071	18.5554	17.3233	81.0808	123.8649

Table 12. Project Limits (10082-10092) - Base Case Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Segment	1.4983	5.4071	18.5554	17.3233	81.0808	123.8649
Total	1.4983	5.4071	18.5554	17.3233	81.0808	123.8649

Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Data

Case Title: Alternative 1 - Shoulder Widening/Shoulder Rumble Strips

Is Base Case: false

Present Value of Crash Cost: 21,966,271.59

Present Value of Other Cost: 538,000.00

Table 13. Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_Segments	Project Limits (10082-10092) - Alternative 1	Project Limits (CTH B to CTH T) - Alternative 1	21,966,271.59
Total			21,966,271.59

Table 14. Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_Segments	Project Limits (10082-10092) - Alternative 1	Project Limits (CTH B to CTH T) - Alternative 1	1.3686	4.9388	16.9487	15.8232	74.0597	113.1389
Total			1.3686	4.9388	16.9487	15.8232	74.0597	113.1389

Table 15. Project Limits (10082-10092) - Alternative 1 Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Segment	1.3686	4.9388	16.9487	15.8232	74.0597	113.1389
Total	1.3686	4.9388	16.9487	15.8232	74.0597	113.1389

Evaluation Message

<u>IHSDM</u>
<u>CTH T Curve</u>
Base Case

CTH T Curve - Base Case Crash Prediction

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 29, 2021

CTH T Curve - Base Case Crash Prediction

Disclaimer

Limited Warranty and Limitations of Remedies

Notice

Table of Contents

List of Tables

CTH T Curve - Base Case Crash Prediction

Report Overview

Report Generated: Nov 29, 2021 10:44 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Wed Nov 24 11:02:30 CST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Segments
Project Comment: Created Fri Nov 19 10:26:02 CST 2021
Project Unit System: U.S. Customary

Site Set: CTH T Curve (10095) - Base Case
Site Set Comment: Created Fri Nov 19 11:13:02 CST 2021
Site Set Version: v1

Evaluation Title: CTH T Curve - Base Case
Evaluation Comment: Created Wed Nov 24 11:02:09 CST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: CTH T Curve (10095) - Base Case
Crash History Siteset Comment: Created Fri Nov 19 11:13:02 CST 2021
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 2U
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (2U)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	0	0	0	0	0
2017	1	1	0	0	1
2018	3	3	2	0	1
2019	1	1	0	1	0
2020	0	0	0	0	0
All Years	5 [1]	5	2	1	2

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
1	2U	CSD:USH 45	CTH T Curve	0.9619	2016-2018: 3400; 2019: 3421; 2020: 3442	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	4,583.67	0.9619	0	0.00	no
1	2U	USH 45	CTH T Curve	0.9619	2025: 3550; 2026: 3575; 2027: 3600; 2028: 3625; 2029: 3650; 2030: 3675; 2031: 3700; 2032: 3725; 2033: 3750; 2034: 3775	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	4,583.67	0.9619	0	0.00	no

Table 3. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Crash Rate (crashes/mi /yr)	Expected Travel Crash Rate (crashes/mi llion veh-mi)
1	2U	USH 45	CTH T Curve	0.9619	9.483	8.298	0.9483	0.3885	0.5599	0.8298	0.2664	0.5635	0.1185	0.1221	-0.0036	0.9859	0.74
		Total	Total	0.9619	9.483	8.298	0.9483	0.3885	0.5599	0.8298	0.2664	0.5635	0.1185	0.1221	-0.0036	0.9859	0.74

Table 4. Predicted Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	0.80	0.26	32.100	0.55	67.900
2026	0.81	0.26	32.100	0.55	67.900
2027	0.82	0.26	32.100	0.55	67.900
2028	0.82	0.26	32.100	0.56	67.900
2029	0.83	0.27	32.100	0.56	67.900
2030	0.83	0.27	32.100	0.56	67.900
2031	0.84	0.27	32.100	0.57	67.900
2032	0.84	0.27	32.100	0.57	67.900
2033	0.85	0.27	32.100	0.58	67.900
2034	0.85	0.28	32.100	0.58	67.900
Total	8.30	2.66	32.100	5.63	67.900
Average	0.83	0.27	32.100	0.56	67.900

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 5. Expected Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	0.92	0.38	40.964	0.54	59.036
2026	0.93	0.38	40.964	0.55	59.036
2027	0.93	0.38	40.964	0.55	59.036
2028	0.94	0.38	40.964	0.55	59.036
2029	0.94	0.39	40.964	0.56	59.036
2030	0.95	0.39	40.964	0.56	59.036
2031	0.96	0.39	40.964	0.57	59.036
2032	0.96	0.40	40.964	0.57	59.036
2033	0.97	0.40	40.964	0.57	59.036
2034	0.98	0.40	40.964	0.58	59.036
Total	9.48	3.88	40.964	5.60	59.036
Average	0.95	0.39	40.964	0.56	59.036

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Comparing Predicted and Expected Crashes for the Evaluation Period (2U)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	8.30	2.66	32.100	5.63	67.900
Expected	9.48	3.88	40.964	5.60	59.036
Expected - Predicted	1.19	1.22		-0.04	
Percent Difference	12.49	31.43		-0.65	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Expected 2U Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.15	1.6	1.03	10.9	1.15	12.1
Highway Segment	Collision with Bicycle	0.02	0.2	0.01	0.1	0.02	0.2
Highway Segment	Other Single-vehicle Collision	0.03	0.3	0.16	1.7	0.20	2.1
Highway Segment	Overturned	0.14	1.5	0.08	0.9	0.24	2.5
Highway Segment	Collision with Pedestrian	0.03	0.3	0.01	0.1	0.03	0.3
Highway Segment	Run Off Road	2.12	22.3	2.83	29.8	4.94	52.1
Highway Segment	Total Single Vehicle Crashes	2.48	26.1	4.12	43.4	6.57	69.3
Highway Segment	Angle Collision	0.39	4.1	0.40	4.3	0.81	8.5
Highway Segment	Head-on Collision	0.13	1.4	0.02	0.2	0.15	1.6
Highway Segment	Other Multiple-vehicle Collision	0.10	1.1	0.17	1.8	0.26	2.7
Highway Segment	Rear-end Collision	0.64	6.8	0.68	7.2	1.35	14.2
Highway Segment	Sideswipe	0.15	1.6	0.21	2.2	0.35	3.7
Highway Segment	Total Multiple Vehicle Crashes	1.41	14.9	1.48	15.6	2.91	30.7
Highway Segment	Total Highway Segment Crashes	3.89	41.0	5.60	59.0	9.48	100.0
	Total Crashes	3.89	41.0	5.60	59.0	9.48	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
CTH T Curve
Alternative 1

CTH T Curve - Alternative 1 (Shoulder Widening/Rumbles) Crash Prediction

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 29, 2021

CTH T Curve - Alternative 1 (Shoulder Widening/Rumbles) Crash Prediction

Table of Contents

List of Tables

Report Overview

Report Generated: Nov 29, 2021 10:45 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Mon Nov 29 09:20:27 CST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Segments
Project Comment: Created Fri Nov 19 10:26:02 CST 2021
Project Unit System: U.S. Customary

Site Set: CTH T Curve (10095) - Alternative 1
Site Set Comment: Copied from CTH T Curve (10095) - Base Case (v1)
Site Set Version: v1

Evaluation Title: CTH T Curve - Alternative 1
Evaluation Comment: Created Mon Nov 29 09:20:21 CST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: CTH T Curve (10095) - Base Case
Crash History Siteset Comment: Created Fri Nov 19 11:13:02 CST 2021
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 2U
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (2U)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	0	0	0	0	0
2017	1	1	0	0	1
2018	3	3	2	0	1
2019	1	1	0	1	0
2020	0	0	0	0	0
All Years	5 [1]	5	2	1	2

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. User Defined CMF Used in the Intersection CPM Evaluation (SSCPMRuralTwoLane)

Site No.	Name	Description	Start CMF Year	End CMF Year	Severity	CMF Value
1	Install Shoulder Rumble Strips	WisDOT CMF Table (S-6.01.3.5.AS)	2025	2034	Fatal and Injury	0.9200

Table 3. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
1	2U	CSD:USH 45	CTH T Curve	0.9619	2016-2018: 3400; 2019: 3421; 2020: 3442	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	4,583.67	0.9619	0	0.00	no
1	2U	USH 45	CTH T Curve	0.9619	2025: 3550; 2026: 3575; 2027: 3600; 2028: 3625; 2029: 3650; 2030: 3675; 2031: 3700; 2032: 3725; 2033: 3750; 2034: 3775	12.00	12.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	4,583.67	0.9619	0	0.00	no

Table 4. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Crash Rate (crashes/mi /yr)	Expected Travel Crash Rate (crashes/mi llion veh-mi)
1	2U	USH 45	CTH T Curve	0.9619	8.662	7.580	0.8662	0.3548	0.5114	0.7580	0.2297	0.5282	0.1082	0.1251	-0.0169	0.9005	0.67
		Total	Total	0.9619	8.662	7.580	0.8662	0.3548	0.5114	0.7580	0.2297	0.5282	0.1082	0.1251	-0.0169	0.9005	0.67

Table 5. Predicted Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	0.73	0.22	30.310	0.51	69.690
2026	0.74	0.22	30.310	0.52	69.690
2027	0.74	0.23	30.310	0.52	69.690
2028	0.75	0.23	30.310	0.52	69.690
2029	0.76	0.23	30.310	0.53	69.690
2030	0.76	0.23	30.310	0.53	69.690
2031	0.77	0.23	30.310	0.53	69.690
2032	0.77	0.23	30.310	0.54	69.690
2033	0.78	0.23	30.310	0.54	69.690
2034	0.78	0.24	30.310	0.54	69.690
Total	7.58	2.30	30.310	5.28	69.690
Average	0.76	0.23	30.310	0.53	69.690

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Expected Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	0.84	0.34	40.964	0.50	59.036
2026	0.85	0.35	40.964	0.50	59.036
2027	0.85	0.35	40.964	0.50	59.036
2028	0.86	0.35	40.964	0.51	59.036
2029	0.86	0.35	40.964	0.51	59.036
2030	0.87	0.36	40.964	0.51	59.036
2031	0.88	0.36	40.964	0.52	59.036
2032	0.88	0.36	40.964	0.52	59.036
2033	0.89	0.36	40.964	0.52	59.036
2034	0.89	0.37	40.964	0.53	59.036
Total	8.66	3.55	40.964	5.11	59.036
Average	0.87	0.35	40.964	0.51	59.036

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Comparing Predicted and Expected Crashes for the Evaluation Period (2U)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	7.58	2.30	30.310	5.28	69.690
Expected	8.66	3.55	40.964	5.11	59.036
Expected - Predicted	1.08	1.25		-0.17	
Percent Difference	12.49	35.25		-3.30	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Expected 2U Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.14	1.6	0.94	10.9	1.05	12.1
Highway Segment	Collision with Bicycle	0.01	0.2	0.01	0.1	0.02	0.2
Highway Segment	Other Single-vehicle Collision	0.03	0.3	0.15	1.7	0.18	2.1
Highway Segment	Overturned	0.13	1.5	0.08	0.9	0.22	2.5
Highway Segment	Collision with Pedestrian	0.03	0.3	0.01	0.1	0.03	0.3
Highway Segment	Run Off Road	1.93	22.3	2.58	29.8	4.51	52.1
Highway Segment	Total Single Vehicle Crashes	2.26	26.1	3.76	43.4	6.00	69.3
Highway Segment	Angle Collision	0.36	4.1	0.37	4.3	0.74	8.5
Highway Segment	Head-on Collision	0.12	1.4	0.01	0.2	0.14	1.6
Highway Segment	Other Multiple-vehicle Collision	0.09	1.1	0.15	1.8	0.23	2.7
Highway Segment	Rear-end Collision	0.58	6.8	0.62	7.2	1.23	14.2
Highway Segment	Sideswipe	0.14	1.6	0.19	2.2	0.32	3.7
Highway Segment	Total Multiple Vehicle Crashes	1.29	14.9	1.35	15.6	2.66	30.7
Highway Segment	Total Highway Segment Crashes	3.56	41.0	5.11	59.0	8.66	100.0
	Total Crashes	3.56	41.0	5.11	59.0	8.66	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
CTH T Curve
Alternative 2

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

March 21, 2022

CTH T Curve - Alternative 2 (High Friction Surface Treatment) Crash Prediction

CTH T Curve - Alternative 2 (High Friction Surface Treatment) Crash Prediction

Table of Contents

List of Tables

CTH T Curve - Alternative 2 (High Friction Surface Treatment) Crash Prediction

Report Overview

Report Generated: Mar 21, 2022 3:13 PM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Mon Mar 21 15:10:12 CDT 2022
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_Segments
Project Comment: Created Fri Nov 19 10:26:02 CST 2021
Project Unit System: U.S. Customary

Site Set: CTH T Curve (10095) - Alternative 2
Site Set Comment: Copied from CTH T Curve (10095) - Base Case (v1)
Site Set Version: v1

Evaluation Title: CTH T Curve - Alternative 2
Evaluation Comment: Created Mon Mar 21 15:10:00 CDT 2022
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: CTH T Curve (10095) - Base Case
Crash History Siteset Comment: Created Fri Nov 19 11:13:02 CST 2021
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 2U
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (2U)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	0	0	0	0	0
2017	1	1	0	0	1
2018	3	3	2	0	1
2019	1	1	0	1	0
2020	0	0	0	0	0
All Years	5 [1]	5	2	1	2

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. User Defined CMF Used in the Intersection CPM Evaluation (SSCPMRuralTwoLane)

Site No.	Name	Description	Start CMF Year	End CMF Year	Severity	CMF Value
1	Install High Friction Surface Treatment	WisDOT CMF Table (S-4.03.1.0.AA)	2025	2034	Total	0.4300

CTH T Curve - Alternative 2 (High Friction Surface Treatment) Crash Prediction

Table 3. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Paved Shoulder Width (ft)	Right Side Paved Shoulder Width (ft)	Left Side Gravel Shoulder Width (ft)	Right Side Gravel Shoulder Width (ft)	Left Side Turf Shoulder Width (ft)	Right Side Turf Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Roadside Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLTLane	Lighting	Curve Radius (ft)	Curve Length (mi)	Presence of Spirals	Superelevation Variance (%)	Automated Speed Enforcement
1	2U	CSD:USH 45	CTH T Curve	0.9619	2016-2018: 3400; 2019: 3421; 2020: 3442	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	no	None (0)	no	no	4,583.67	0.9619	0	0.00	no
1	2U	USH 45	CTH T Curve	0.9619	2025: 3550; 2026: 3575; 2027: 3600; 2028: 3625; 2029: 3650; 2030: 3675; 2031: 3700; 2032: 3725; 2033: 3750; 2034: 3775	12.00	12.00	3.00	3.00	7.00	7.00	0.00	0.00	0.00	0.0	2	yes	None (0)	no	no	4,583.67	0.9619	0	0.00	no

CTH T Curve - Alternative 2 (High Friction Surface Treatment) Crash Prediction

Table 4. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Crash Rate (crashes/mi /yr)	Expected Travel Crash Rate (crashes/mi llion veh-mi)
1	2U	USH 45	CTH T Curve	0.9619	3.833	3.354	0.3833	0.1570	0.2263	0.3354	0.1077	0.2278	0.0479	0.0493	-0.0015	0.3985	0.30
		Total	Total	0.9619	3.833	3.354	0.3833	0.1570	0.2263	0.3354	0.1077	0.2278	0.0479	0.0493	-0.0015	0.3985	0.30

Table 5. Predicted Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	0.33	0.10	32.100	0.22	67.900
2026	0.33	0.10	32.100	0.22	67.900
2027	0.33	0.11	32.100	0.22	67.900
2028	0.33	0.11	32.100	0.23	67.900
2029	0.33	0.11	32.100	0.23	67.900
2030	0.34	0.11	32.100	0.23	67.900
2031	0.34	0.11	32.100	0.23	67.900
2032	0.34	0.11	32.100	0.23	67.900
2033	0.34	0.11	32.100	0.23	67.900
2034	0.35	0.11	32.100	0.23	67.900
Total	3.35	1.08	32.100	2.28	67.900
Average	0.34	0.11	32.100	0.23	67.900

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Expected Crash Frequencies by Year (2U)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	0.37	0.15	40.964	0.22	59.036
2026	0.37	0.15	40.964	0.22	59.036
2027	0.38	0.15	40.964	0.22	59.036
2028	0.38	0.15	40.964	0.22	59.036
2029	0.38	0.16	40.964	0.23	59.036
2030	0.39	0.16	40.964	0.23	59.036
2031	0.39	0.16	40.964	0.23	59.036
2032	0.39	0.16	40.964	0.23	59.036
2033	0.39	0.16	40.964	0.23	59.036
2034	0.40	0.16	40.964	0.23	59.036
Total	3.83	1.57	40.964	2.26	59.036
Average	0.38	0.16	40.964	0.23	59.036

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Comparing Predicted and Expected Crashes for the Evaluation Period (2U)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	3.35	1.08	32.100	2.28	67.900
Expected	3.83	1.57	40.964	2.26	59.036
Expected - Predicted	0.48	0.49		-0.01	
Percent Difference	12.49	31.43		-0.65	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Expected 2U Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.06	1.6	0.42	10.9	0.46	12.1
Highway Segment	Collision with Bicycle	0.01	0.2	0.00	0.1	0.01	0.2
Highway Segment	Other Single-vehicle Collision	0.01	0.3	0.07	1.7	0.08	2.1
Highway Segment	Overturned	0.06	1.5	0.03	0.9	0.10	2.5
Highway Segment	Collision with Pedestrian	0.01	0.3	0.00	0.1	0.01	0.3
Highway Segment	Run Off Road	0.86	22.3	1.14	29.8	2.00	52.1
Highway Segment	Total Single Vehicle Crashes	1.00	26.1	1.66	43.4	2.66	69.3
Highway Segment	Angle Collision	0.16	4.1	0.16	4.3	0.33	8.5
Highway Segment	Head-on Collision	0.05	1.4	0.01	0.2	0.06	1.6
Highway Segment	Other Multiple-vehicle Collision	0.04	1.1	0.07	1.8	0.10	2.7
Highway Segment	Rear-end Collision	0.26	6.8	0.28	7.2	0.54	14.2
Highway Segment	Sideswipe	0.06	1.6	0.09	2.2	0.14	3.7
Highway Segment	Total Multiple Vehicle Crashes	0.57	14.9	0.60	15.6	1.18	30.7
Highway Segment	Total Highway Segment Crashes	1.57	41.0	2.26	59.0	3.83	100.0
	Total Crashes	1.57	41.0	2.26	59.0	3.83	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
CTH T Curve
Economic Analysis

Interactive Highway Safety Design Model

Economic Analysis Report

March 21, 2022

Table of Contents

List of Tables

Economic Analysis Report

Economic Analysis Report Overview

Report Generated: Mar 21, 2022 3:28 PM
Report Template: System: Single Page [System] (eam3, Feb 10, 2021 8:56 AM)

Evaluation Title: EA_BTO_SCP_Example_CTH T Curve
Evaluation Comment: Created Mon Mar 21 15:11:45 CDT 2022
Evaluation Date: Mon Mar 21 15:11:49 CDT 2022

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_CTH T Curve
Project Comment: Created Wed Nov 24 12:23:50 CST 2021

Configuration Summary

Crash Cost Configuration: WisDOTEconomics_v16-1
Configuration Comment: Updated with 2020 Crash Cost Values

Table 1. Economic Analysis Configuration

Configuration Data	
Crash Unit Cost Zero Year	2020
Crash Cost Index	0.00
Discount Rate	0.05
KABCO Unit Costs	
K Cost ($/Crash)	12,694,788.00
A Cost ($/Crash)	684,064.00
B Cost ($/Crash)	217,328.00
C Cost ($/Crash)	123,679.00
O Cost ($/Crash)	10,824.00

Table 2. RTL Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL 2U Two-Lane Undivided	3.502	12.638	43.370	40.490

Table 3. RTL Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL Three-Legged w/STOP control	3.072	15.068	42.383	39.477
RTL Four-Legged w/STOP control	3.975	15.278	42.862	37.885
RTL Four-Legged Signalized	2.957	11.751	35.292	50.000

Table 4. RML Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Four-Lane Undivided	3.502	12.638	43.370	40.490
RML Four-Lane Divided	3.502	12.638	43.370	40.490

Table 5. RML Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Three-Legged w/STOP control	4.095	14.091	40.626	41.188
RML Four-Legged w/STOP control	4.711	15.912	41.988	37.389
RML Four-Legged Signalized	0.598	10.012	37.176	52.214

Table 6. USA Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Two-Lane Undivided	1.012	5.785	33.011	60.192
USA Three-Lane w/Center TWLTL	1.012	5.785	33.011	60.192
USA Four-Lane Undivided	1.012	5.785	33.011	60.192
USA Four-Lane Divided	1.012	5.785	33.011	60.192
USA Five-Lane w/Center TWLTL	1.012	5.785	33.011	60.192

Table 7. USA Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Three-Legged w/STOP control	0.744	6.558	36.725	55.973
USA Three-Legged Signalized	0.451	4.957	32.024	62.568
USA Four-Legged w/STOP control	0.864	6.637	38.161	54.338
USA Four-Legged Signalized	0.715	5.263	32.359	61.663

Analysis Output Summary

Analysis Type: Benefit/Cost

Table 8. Case Cost Summary

Is Base Case	Title	Present Value of Crash Cost ($)	Present Value of Other Cost ($)	Net Present Value of Benefits (B) ($)	Net Present Value of Costs (C) ($)	Present Value of Net Benefit (B-C) ($)	Benefit Cost Ratio (B/C)
Yes	Existing	2,170,316.76	0.00				
	Alternative 1 - Shoulder Widening/Shoulder Rumble Strips	1,982,380.67	48,000.00	187,936.09	48,000.00	139,936.09	3.9153
	Alternative 2 - High Friction Surface Treatment	877,242.05	349,000.00	1,293,074.72	349,000.00	944,074.71	3.7051

Table 9. Case Crash Summary

Is Base Case	Title	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Yes	Existing	0.1360	0.4910	1.6848	1.5729	5.5985	9.4832
	Alternative 1 - Shoulder Widening/Shoulder Rumble Strips	0.1243	0.4484	1.5389	1.4367	5.1137	8.6620
	Alternative 2 - High Friction Surface Treatment	0.0550	0.1984	0.6810	0.6358	2.2629	3.8331

Crash Cost Data

Existing Data

Case Title: Existing
Is Base Case: true
Present Value of Crash Cost: 2,170,316.76
Present Value of Other Cost: 0.00

Table 10. Existing Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_Segments	CTH T Curve (10095) - Base Case	CTH T Curve - Base Case	2,170,316.76
Total			2,170,316.76

Table 11. Existing Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_Segments	CTH T Curve (10095) - Base Case	CTH T Curve - Base Case	0.1360	0.4910	1.6848	1.5729	5.5985	9.4832
Total			0.1360	0.4910	1.6848	1.5729	5.5985	9.4832

Table 12. CTH T Curve (10095) - Base Case Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Segment	0.1360	0.4910	1.6848	1.5729	5.5985	9.4832
Total	0.1360	0.4910	1.6848	1.5729	5.5985	9.4832

Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Data

Case Title: Alternative 1 - Shoulder Widening/Shoulder Rumble Strips

Is Base Case: false

Present Value of Crash Cost: 1,982,380.67

Present Value of Other Cost: 48,000.00

Table 13. Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_Segments	CTH T Curve (10095) - Alternative 1	CTH T Curve - Alternative 1	1,982,380.67
Total			1,982,380.67

Table 14. Alternative 1 - Shoulder Widening/Shoulder Rumble Strips Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_Segments	CTH T Curve (10095) - Alternative 1	CTH T Curve - Alternative 1	0.1243	0.4484	1.5389	1.4367	5.1137	8.6620
Total			0.1243	0.4484	1.5389	1.4367	5.1137	8.6620

Table 15. CTH T Curve (10095) - Alternative 1 Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Segment	0.1243	0.4484	1.5389	1.4367	5.1137	8.6620
Total	0.1243	0.4484	1.5389	1.4367	5.1137	8.6620

Alternative 2 - High Friction Surface Treatment Data

Case Title: Alternative 2 - High Friction Surface Treatment

Is Base Case: false

Present Value of Crash Cost: 877,242.05

Present Value of Other Cost: 349,000.00

Table 16. Alternative 2 - High Friction Surface Treatment Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_Segments	CTH T Curve (10095) - Alternative 2	CTH T Curve - Alternative 2	877,242.05
Total			877,242.05

Table 17. Alternative 2 - High Friction Surface Treatment Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_Segments	CTH T Curve (10095) - Alternative 2	CTH T Curve - Alternative 2	0.0550	0.1984	0.6810	0.6358	2.2629	3.8331
Total			0.0550	0.1984	0.6810	0.6358	2.2629	3.8331

Table 18. CTH T Curve (10095) - Alternative 2 Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Segment	0.0550	0.1984	0.6810	0.6358	2.2629	3.8331
Total	0.0550	0.1984	0.6810	0.6358	2.2629	3.8331

Evaluation Message

<u>IHSDM</u>
<u>USH 45 at CTH I</u>
Base Case

USH 45 and CTH I - Base Case Crash Prediction

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 19, 2021

USH 45 and CTH I - Base Case Crash Prediction

Disclaimer

Limited Warranty and Limitations of Remedies

Notice

Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Nov 19, 2021 9:02 AM
Report Template: System: Single Page [System] (mlcpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Fri Nov 19 08:58:45 CST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example
Project Comment: Created Thu Nov 18 16:41:31 CST 2021
Project Unit System: U.S. Customary

Highway Title: USH 45
Highway Comment: Created Thu Nov 18 16:55:45 CST 2021
Highway Version: 1

Evaluation Title: USH 45 at CTH I - Base Case
Evaluation Comment: Created Fri Nov 19 08:58:30 CST 2021

Minimum Location: 0.000
Maximum Location: 10+00.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 10+00.000
Area Type: Rural

Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Rural, Multilane
Calibration Factor: 4D=1.0; 4ST=1.0;

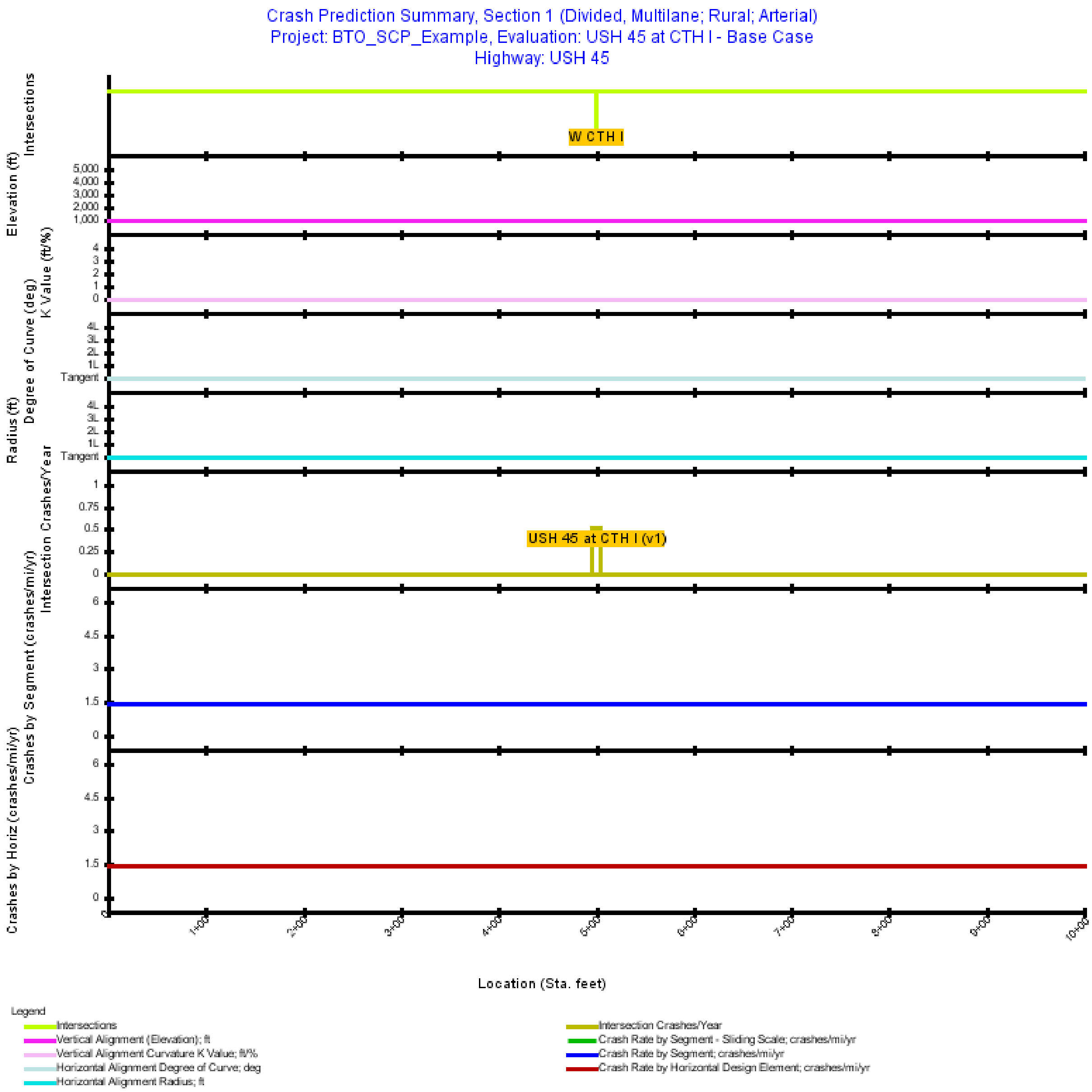

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Median Width (ft)	Median Type	Effective Median Width (ft)	Lighting	Automated Speed Enforcement	Left Side Slope	Right Side Slope
1	Rural Multi-Lane Segment Four-lane Divided	0.000	2+50.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	42.00	false	false		
2	Rural Multi-Lane Segment Four-lane Divided	2+50.000	5+00.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	54.00	false	false		
3	Rural Multi-Lane Segment Four-lane Divided	5+00.000	7+50.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	54.00	false	false		
4	Rural Multi-Lane Segment Four-lane Divided	7+50.000	10+00.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	42.00	false	false		

USH 45 and CTH I - Base Case Crash Prediction

Table 2. Evaluation Intersection (Section 1)

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	USH 45 at CTH I (v1)	Rural Multi-Lane Intersection Four-Legged w/STOP control	5+00.000	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	2025: 445; 2026: 452; 2027: 460; 2028: 467; 2029-2034: 475	4	Stop-Controlled	2	2	1.50	1.50	false

Table 3. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2025**
Last Year of Analysis	**2034**
Evaluated Length (mi)	**0.1894**
Average Future Road AADT (vpd)	**6,843**
Predicted Crashes	
Total Crashes	**7.79**
Fatal and Injury Crashes	**2.51**
Fatal and Serious Injury Crashes	**2.07**
Property-Damage-Only Crashes	**5.28**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**32**
Percent Fatal and Serious Injury Crashes (%)	**27**
Percent Property-Damage-Only Crashes (%)	**68**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**4.1139**
FI Crash Rate (crashes/mi/yr)	**1.3243**
FI no/C Crash Rate (crashes/mi/yr)	**1.0920**
PDO Crash Rate (crashes/mi/yr)	**2.7897**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**4.73**
Travel Crash Rate (crashes/million veh-mi)	**1.65**
Travel FI Crash Rate (crashes/million veh-mi)	**0.53**
Travel FI no/C Crash Rate (crashes/million veh-mi)	**0.44**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.12**

Table 4. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	0.000	2+50.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
2	2+50.000	5+00.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
USH 45 at CTH I (v1)	5+00.000			5.122	0.5122	0.1066	0.1111	0.4056			0.19
3	5+00.000	7+50.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
4	7+50.000	10+00.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
All Segments			0.1894	2.669	0.2669	0.1442	0.0957	0.1227	1.4094	0.56	
All Intersections				5.122	0.5122	0.1066	0.1111	0.4056			0.19
Total			0.1894	7.792	0.7792	0.2508	0.2068	0.5283	4.1139		

Table 5. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	10+00.000	0.1894	2.669	0.2669	0.1442	0.0957	0.1227	1.4094	0.56

Table 6. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	FI/no C Crashes	Percent FI/no C (%)	PDO Crashes	Percent PDO (%)
2025	0.75	0.24	32.293	0.20	26.693	0.51	67.707
2026	0.76	0.24	32.259	0.20	26.651	0.51	67.741
2027	0.76	0.25	32.221	0.20	26.605	0.52	67.779
2028	0.77	0.25	32.188	0.20	26.564	0.52	67.812
2029	0.78	0.25	32.151	0.21	26.520	0.53	67.849
2030	0.79	0.25	32.154	0.21	26.509	0.53	67.846
2031	0.79	0.25	32.156	0.21	26.498	0.54	67.844
2032	0.79	0.26	32.158	0.21	26.486	0.54	67.842
2033	0.80	0.26	32.161	0.21	26.476	0.54	67.839
2034	0.80	0.26	32.163	0.21	26.465	0.55	67.837
Total	7.79	2.51	32.190	2.07	26.545	5.28	67.811
Average	0.78	0.25	32.190	0.21	26.545	0.53	67.811

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

USH 45 and CTH I - Base Case Crash Prediction

Table 7. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Fatal and Serious Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Single	1.05	13.5	0.74	9.6	0.97	12.5	2.05	26.3
Highway Segment	Total Single Vehicle Crashes	1.05	13.5	0.74	9.6	0.97	12.5	2.05	26.3
Highway Segment	Angle Collision	0.07	0.9	0.04	0.6	0.05	0.6	0.12	1.5
Highway Segment	Head-on Collision	0.02	0.2	0.02	0.2	0.00	0.0	0.02	0.2
Highway Segment	Rear-end Collision	0.23	3.0	0.11	1.4	0.11	1.4	0.31	4.0
Highway Segment	Sideswipe	0.04	0.5	0.02	0.3	0.07	0.8	0.12	1.5
Highway Segment	Total Multiple Vehicle Crashes	0.36	4.6	0.19	2.4	0.23	2.9	0.56	7.1
Highway Segment	Total Highway Segment Crashes	1.44	18.5	0.96	12.3	1.23	15.8	2.67	34.3
Highway Segment	Other Collision	0.03	0.4	0.02	0.3	0.03	0.4	0.06	0.8
Intersection	Single	0.20	2.5	0.00	0.0	2.19	28.1	2.23	28.6
Intersection	Total Single Vehicle Crashes	0.20	2.5	0.00	0.0	2.19	28.1	2.23	28.6
Intersection	Angle Collision	0.64	8.2	0.00	0.0	0.83	10.7	1.64	21.1
Intersection	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Rear-end Collision	0.14	1.8	0.00	0.0	0.48	6.2	0.63	8.1
Intersection	Sideswipe	0.07	0.9	0.00	0.0	0.52	6.7	0.57	7.3
Intersection	Total Multiple Vehicle Crashes	0.85	11.0	0.00	0.0	1.83	23.5	2.84	36.4
Intersection	Total Intersection Crashes	1.07	13.7	0.00	0.0	4.06	52.1	5.12	65.7
Intersection	Other Collision	0.01	0.2	0.00	0.0	0.04	0.5	0.05	0.7
	Total Crashes	2.51	32.2	0.96	12.3	5.28	67.8	7.79	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
USH 45 at CTH I
Alternative 1

USH 45 and CTH I - Alternative 1 (RCUT) Crash Prediction

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 19, 2021

USH 45 and CTH I - Alternative 1 (RCUT) Crash Prediction

Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Nov 19, 2021 9:03 AM
Report Template: System: Single Page [System] (mlcpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Fri Nov 19 09:01:27 CST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example
Project Comment: Created Thu Nov 18 16:41:31 CST 2021
Project Unit System: U.S. Customary

Highway Title: USH 45
Highway Comment: Created Thu Nov 18 16:55:45 CST 2021
Highway Version: 1

Evaluation Title: USH 45 at CTH I - Alternative 1
Evaluation Comment: Created Fri Nov 19 09:01:09 CST 2021

Minimum Location: 0.000
Maximum Location: 10+00.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 10+00.000
Area Type: Rural

Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Rural, Multilane
Calibration Factor: 4D=1.0; 4ST=1.0;

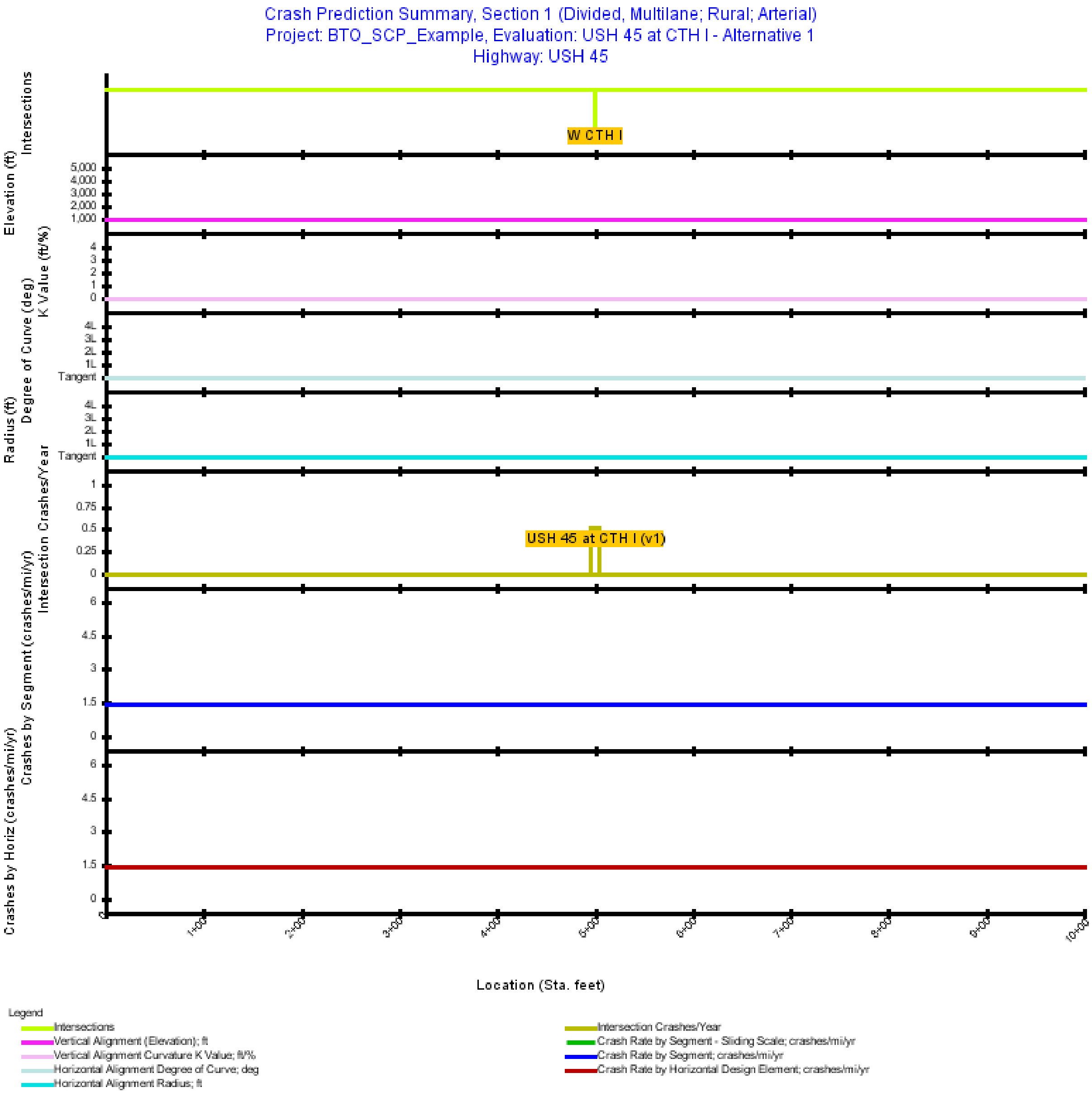

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Median Width (ft)	Median Type	Effective Median Width (ft)	Lighting	Automated Speed Enforcement	Left Side Slope	Right Side Slope
1	Rural Multi-Lane Segment Four-lane Divided	0.000	2+50.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	42.00	false	false		
2	Rural Multi-Lane Segment Four-lane Divided	2+50.000	5+00.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	54.00	false	false		
3	Rural Multi-Lane Segment Four-lane Divided	5+00.000	7+50.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	54.00	false	false		
4	Rural Multi-Lane Segment Four-lane Divided	7+50.000	10+00.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	42.00	false	false		

USH 45 and CTH I - Alternative 1 (RCUT) Crash Prediction

Table 2. Evaluation Intersection (Section 1)

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	USH 45 at CTH I (v1)	Rural Multi-Lane Intersection Four-Legged w/STOP control	5+00.000	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	2025: 445; 2026: 452; 2027: 460; 2028: 467; 2029-2034: 475	4	Stop-Controlled	2	2	1.50	1.50	false

Table 3. User Defined CMF Used in the Eval Intersection CPM Evaluation (Section 1)

Site No.	Name	Description	Start CMF Year	End CMF Year	Severity	CMF Value
1	Install Restricted Crossing U-Turn (RCUT) a.k.a. J-Turn	WisDOT CMF Table (I- 7.01.3.7.AS)	2025	2034	Fatal and Injury	0.3700

Table 4. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2025**
Last Year of Analysis	**2034**
Evaluated Length (mi)	**0.1894**
Average Future Road AADT (vpd)	**6,843**
Predicted Crashes	
Total Crashes	**7.79**
Fatal and Injury Crashes	**1.84**
Fatal and Serious Injury Crashes	**1.37**
Property-Damage-Only Crashes	**5.96**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**24**
Percent Fatal and Serious Injury Crashes (%)	**18**
Percent Property-Damage-Only Crashes (%)	**76**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**4.1139**
FI Crash Rate (crashes/mi/yr)	**0.9697**
FI no/C Crash Rate (crashes/mi/yr)	**0.7225**
PDO Crash Rate (crashes/mi/yr)	**3.1442**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**4.73**
Travel Crash Rate (crashes/million veh-mi)	**1.65**
Travel FI Crash Rate (crashes/million veh-mi)	**0.39**
Travel FI no/C Crash Rate (crashes/million veh-mi)	**0.29**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.26**

USH 45 and CTH I - Alternative 1 (RCUT) Crash Prediction

Table 5. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/ yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	0.000	2+50.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
2	2+50.000	5+00.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
USH 45 at CTH I (v1)	5+00.000			5.122	0.5122	0.0394	0.0411	0.4728			0.19
3	5+00.000	7+50.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
4	7+50.000	10+00.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
All Segments			0.1894	2.669	0.2669	0.1442	0.0957	0.1227	1.4094	0.56	
All Intersections				5.122	0.5122	0.0394	0.0411	0.4728			0.19
Total			0.1894	7.792	0.7792	0.1837	0.1368	0.5955	4.1139		

Table 6. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	10+00.000	0.1894	2.669	0.2669	0.1442	0.0957	0.1227	1.4094	0.56

Table 7. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	FI/no C Crashes	Percent FI/no C (%)	PDO Crashes	Percent PDO (%)
2025	0.75	0.18	23.766	0.13	17.739	0.57	76.234
2026	0.76	0.18	23.702	0.13	17.686	0.58	76.298
2027	0.76	0.18	23.631	0.14	17.626	0.58	76.370
2028	0.77	0.18	23.570	0.14	17.575	0.59	76.430
2029	0.78	0.18	23.501	0.14	17.517	0.60	76.499
2030	0.79	0.18	23.505	0.14	17.511	0.60	76.495
2031	0.79	0.19	23.509	0.14	17.505	0.60	76.492
2032	0.79	0.19	23.512	0.14	17.499	0.61	76.488
2033	0.80	0.19	23.516	0.14	17.493	0.61	76.484
2034	0.80	0.19	23.520	0.14	17.487	0.61	76.480
Total	7.79	1.84	23.571	1.37	17.562	5.96	76.429
Average	0.78	0.18	23.571	0.14	17.562	0.60	76.429

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Fatal and Serious Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Single	1.05	13.5	0.74	9.6	0.97	12.5	2.05	26.3
Highway Segment	Total Single Vehicle Crashes	1.05	13.5	0.74	9.6	0.97	12.5	2.05	26.3
Highway Segment	Angle Collision	0.07	0.9	0.04	0.6	0.05	0.6	0.12	1.5
Highway Segment	Head-on Collision	0.02	0.2	0.02	0.2	0.00	0.0	0.02	0.2
Highway Segment	Rear-end Collision	0.23	3.0	0.11	1.4	0.11	1.4	0.31	4.0
Highway Segment	Sideswipe	0.04	0.5	0.02	0.3	0.07	0.8	0.12	1.5
Highway Segment	Total Multiple Vehicle Crashes	0.36	4.6	0.19	2.4	0.23	2.9	0.56	7.1
Highway Segment	Total Highway Segment Crashes	1.44	18.5	0.96	12.3	1.23	15.8	2.67	34.3
Highway Segment	Other Collision	0.03	0.4	0.02	0.3	0.03	0.4	0.06	0.8
Intersection	Single	0.07	0.9	0.00	0.0	2.55	32.8	2.23	28.6
Intersection	Total Single Vehicle Crashes	0.07	0.9	0.00	0.0	2.55	32.8	2.23	28.6
Intersection	Angle Collision	0.24	3.0	0.00	0.0	0.97	12.4	1.64	21.1
Intersection	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Rear-end Collision	0.05	0.7	0.00	0.0	0.56	7.2	0.63	8.1
Intersection	Sideswipe	0.03	0.3	0.00	0.0	0.60	7.8	0.57	7.3
Intersection	Total Multiple Vehicle Crashes	0.32	4.1	0.00	0.0	2.13	27.4	2.84	36.4
Intersection	Total Intersection Crashes	0.39	5.1	0.00	0.0	4.73	60.7	5.12	65.7
Intersection	Other Collision	0.01	0.1	0.00	0.0	0.04	0.5	0.05	0.7
	Total Crashes	1.84	23.6	0.96	12.3	5.96	76.4	7.79	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

<u>IHSDM</u>
<u>USH 45 at CTH I</u>
Alternative 2

USH 45 and CTH I - Alternative 2 (Roundabout) Crash Prediction

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 19, 2021

USH 45 and CTH I - Alternative 2 (Roundabout) Crash Prediction

Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Nov 19, 2021 9:06 AM
Report Template: System: Single Page [System] (mlcpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Fri Nov 19 09:04:56 CST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example
Project Comment: Created Thu Nov 18 16:41:31 CST 2021
Project Unit System: U.S. Customary

Highway Title: USH 45
Highway Comment: Created Thu Nov 18 16:55:45 CST 2021
Highway Version: 1

Evaluation Title: USH 45 at CTH I - Alternative 2
Evaluation Comment: Created Fri Nov 19 09:04:20 CST 2021

Minimum Location: 0.000
Maximum Location: 10+00.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 10+00.000
Area Type: Rural

Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Rural, Multilane
Calibration Factor: 4D=1.0; RML 42R=1.0;

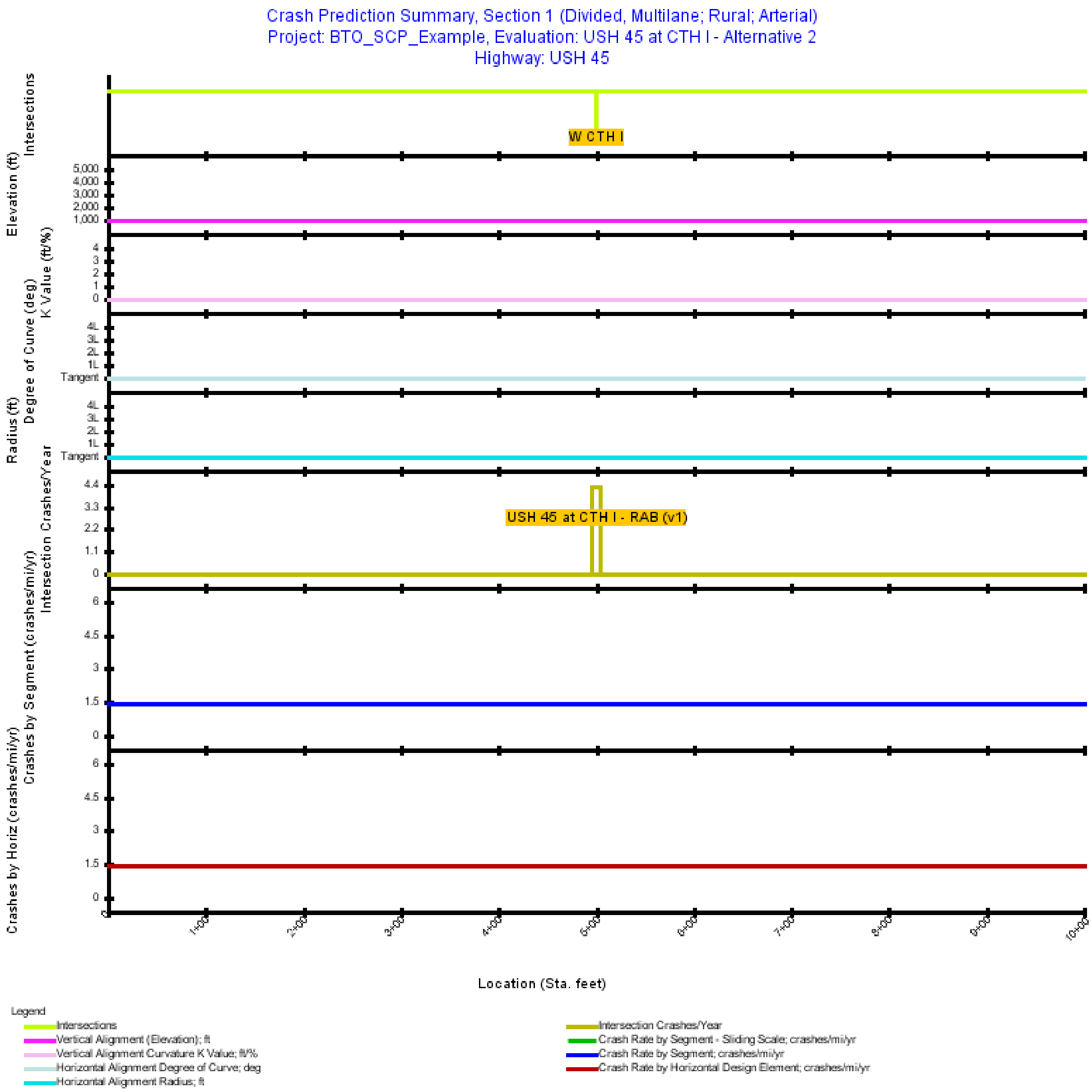

Figure 1. Crash Prediction Summary (Section 1)

USH 45 and CTH I - Alternative 2 (Roundabout) Crash Prediction

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Median Width (ft)	Median Type	Effective Median Width (ft)	Lighting	Automated Speed Enforcement	Left Side Slope	Right Side Slope
1	Rural Multi-Lane Segment Four-lane Divided	0.000	2+50.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	42.00	false	false		
2	Rural Multi-Lane Segment Four-lane Divided	2+50.000	5+00.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	54.00	false	false		
3	Rural Multi-Lane Segment Four-lane Divided	5+00.000	7+50.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	54.00	false	false		
4	Rural Multi-Lane Segment Four-lane Divided	7+50.000	10+00.000	250.00	0.0473	2025: 6,650; 2026: 6,693; 2027: 6,736; 2028: 6,779; 2029: 6,822; 2030: 6,865; 2031: 6,908; 2032: 6,951; 2033: 6,994; 2034: 7,037	12.00	12.00	6.00	6.00	30.00	Non-Traversable Median	42.00	false	false		

Table 2. Evaluation Roundabout - Site (Section 1)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Entering AADT
1	USH 45 at CTH I - RAB (v1)	Roundabout 42R - Roundabout with 4 legs and two circulating lanes	Rural	4	5+00.000	Leg 1: 2025: 3,325; 2026: 3,346; 2027: 3,368; 2028: 3,389; 2029: 3,411; 2030: 3,432; 2031: 3,454; 2032: 3,475; 2033: 3,497; 2034: 3,518; Leg 2: 2025: 222; 2026: 226; 2027: 230; 2028: 233; 2029-2034: 237; Leg 3: 2025: 3,325; 2026: 3,346; 2027: 3,368; 2028: 3,389; 2029: 3,411; 2030: 3,432; 2031: 3,454; 2032: 3,475; 2033: 3,497; 2034: 3,518; Leg 4: 2025: 222; 2026: 226; 2027: 230; 2028: 233; 2029-2034: 237

Table 3. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2025**
Last Year of Analysis	**2034**
Evaluated Length (mi)	**0.1894**
Average Future Road AADT (vpd)	**6,843**
Predicted Crashes	
Total Crashes	**45.39**
Fatal and Injury Crashes	**6.16**
Fatal and Serious Injury Crashes	**0.96**
Property-Damage-Only Crashes	**39.23**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**14**
Percent Fatal and Serious Injury Crashes (%)	**2**
Percent Property-Damage-Only Crashes (%)	**86**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**23.9652**
FI Crash Rate (crashes/mi/yr)	**3.2507**
FI no/C Crash Rate (crashes/mi/yr)	**0.5054**
PDO Crash Rate (crashes/mi/yr)	**20.7145**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**4.73**
Travel Crash Rate (crashes/million veh-mi)	**9.59**
Travel FI Crash Rate (crashes/million veh-mi)	**1.30**
Travel FI no/C Crash Rate (crashes/million veh-mi)	**0.20**
Travel PDO Crash Rate (crashes/million veh-mi)	**8.29**

USH 45 and CTH I - Alternative 2 (Roundabout) Crash Prediction

Table 4. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	0.000	2+50.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
2	2+50.000	5+00.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
USH 45 at CTH I - RAB (v1)	5+00.000			42.719	4.2719	0.4714		3.8005			1.60
3	5+00.000	7+50.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
4	7+50.000	10+00.000	0.0473	0.667	0.0667	0.0361	0.0239	0.0307	1.4094	0.56	
All Segments			0.1894	2.669	0.2669	0.1442	0.0957	0.1227	1.4094	0.56	
All Intersections				42.719	4.2719	0.4714		3.8005			1.60
Total			0.1894	45.389	4.5389	0.6157	0.0957	3.9232	23.9652		

Table 5. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	10+00.000	0.1894	2.669	0.2669	0.1442	0.0957	0.1227	1.4094	0.56

Table 6. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	FI/no C Crashes	Percent FI/no C (%)	PDO Crashes	Percent PDO (%)
2025	4.38	0.59	13.546	0.09	2.129	3.79	86.454
2026	4.42	0.60	13.549	0.09	2.124	3.82	86.451
2027	4.46	0.60	13.551	0.09	2.118	3.85	86.449
2028	4.49	0.61	13.555	0.10	2.113	3.88	86.445
2029	4.53	0.61	13.557	0.10	2.107	3.92	86.443
2030	4.56	0.62	13.564	0.10	2.105	3.94	86.436
2031	4.59	0.62	13.570	0.10	2.103	3.97	86.430
2032	4.62	0.63	13.577	0.10	2.100	3.99	86.423
2033	4.65	0.63	13.583	0.10	2.098	4.02	86.417
2034	4.68	0.64	13.590	0.10	2.096	4.04	86.410
Total	45.39	6.16	13.564	0.96	2.109	39.23	86.436
Average	4.54	0.62	13.564	0.10	2.109	3.92	86.436

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Predicted Crash Severity by Ramp Terminal or Roundabout (Section 1)

Seg. No.	Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	Roundabout	0.0303	0.4846	2.0366	2.1630	38.0049

Table 8. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Fatal and Serious Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Single	1.05	2.3	0.74	1.6	0.97	2.1	2.05	4.5
Highway Segment	Total Single Vehicle Crashes	1.05	2.3	0.74	1.6	0.97	2.1	2.05	4.5
Highway Segment	Angle Collision	0.07	0.2	0.04	0.1	0.05	0.1	0.12	0.3
Highway Segment	Head-on Collision	0.02	0.0	0.02	0.0	0.00	0.0	0.02	0.0
Highway Segment	Rear-end Collision	0.23	0.5	0.11	0.2	0.11	0.2	0.31	0.7
Highway Segment	Sideswipe	0.04	0.1	0.02	0.0	0.07	0.1	0.12	0.3
Highway Segment	Total Multiple Vehicle Crashes	0.36	0.8	0.19	0.4	0.23	0.5	0.56	1.2
Highway Segment	Total Highway Segment Crashes	1.44	3.2	0.96	2.1	1.23	2.7	2.67	5.9
Highway Segment	Other Collision	0.03	0.1	0.02	0.0	0.03	0.1	0.06	0.1
Intersection	Collision with Animal	0.00	0.0	0.00	0.0	0.12	0.3	0.12	0.3
Intersection	Collision with Fixed Object	0.92	2.0	0.00	0.0	5.60	12.4	6.51	14.4
Intersection	Collision with Other Object	0.05	0.1	0.00	0.0	0.02	0.0	0.07	0.2
Intersection	Other Single-vehicle Collision	0.56	1.2	0.00	0.0	1.59	3.5	2.15	4.8
Intersection	Collision with Parked Vehicle	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Total Single Vehicle Crashes	1.53	3.4	0.00	0.0	7.33	16.2	8.86	19.6
Intersection	Angle Collision	0.72	1.6	0.00	0.0	6.91	15.2	7.63	16.8
Intersection	Head-on Collision	0.00	0.0	0.00	0.0	0.16	0.4	0.16	0.4
Intersection	Other Multiple-vehicle Collision	0.05	0.1	0.00	0.0	0.04	0.1	0.09	0.2
Intersection	Rear-end Collision	1.11	2.4	0.00	0.0	5.44	12.0	6.55	14.4
Intersection	Sideswipe	1.21	2.7	0.00	0.0	18.13	40.0	19.34	42.7
Intersection	Total Multiple Vehicle Crashes	3.10	6.8	0.00	0.0	30.67	67.7	33.77	74.5
Intersection	Total Intersection Crashes	4.63	10.2	0.00	0.0	38.01	83.9	42.63	94.1
	Total Crashes	6.07	13.4	0.96	2.1	39.23	86.6	45.30	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
USH 45 at CTH I
Economic Analysis

Interactive Highway Safety Design Model

Economic Analysis Report

March 4, 2022

USH 45 and CTH I - Economic Analysis

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Table of Contents

List of Tables

Economic Analysis Report

Economic Analysis Report Overview

Report Generated: Mar 4, 2022 8:07 AM
Report Template: System: Single Page [System] (eam3, Feb 10, 2021 8:56 AM)

Evaluation Title: EA_BTO_SCP_Example_USH 45 at CTH I
Evaluation Comment: Created Fri Mar 04 08:07:01 CST 2022
Evaluation Date: Fri Mar 04 08:07:05 CST 2022

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_USH 45 at CTH I
Project Comment: Created Fri Nov 19 09:06:24 CST 2021

Configuration Summary

Crash Cost Configuration: WisDOTEconomics_v16-1
Configuration Comment: Updated with 2020 Crash Cost Values

Table 1. Economic Analysis Configuration

Configuration Data	
Crash Unit Cost Zero Year	2020
Crash Cost Index	0.00
Discount Rate	0.05
KABCO Unit Costs	
K Cost ($/Crash)	12,694,788.00
A Cost ($/Crash)	684,064.00
B Cost ($/Crash)	217,328.00
C Cost ($/Crash)	123,679.00
O Cost ($/Crash)	10,824.00

Table 2. RTL Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL 2U Two-Lane Undivided	3.502	12.638	43.370	40.490

Table 3. RTL Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL Three-Legged w/STOP control	3.072	15.068	42.383	39.477
RTL Four-Legged w/STOP control	3.975	15.278	42.862	37.885
RTL Four-Legged Signalized	2.957	11.751	35.292	50.000

Table 4. RML Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Four-Lane Undivided	3.502	12.638	43.370	40.490
RML Four-Lane Divided	3.502	12.638	43.370	40.490

Table 5. RML Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Three-Legged w/STOP control	4.095	14.091	40.626	41.188
RML Four-Legged w/STOP control	4.711	15.912	41.988	37.389
RML Four-Legged Signalized	0.598	10.012	37.176	52.214

Table 6. USA Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Two-Lane Undivided	1.012	5.785	33.011	60.192
USA Three-Lane w/Center TWLTL	1.012	5.785	33.011	60.192
USA Four-Lane Undivided	1.012	5.785	33.011	60.192
USA Four-Lane Divided	1.012	5.785	33.011	60.192
USA Five-Lane w/Center TWLTL	1.012	5.785	33.011	60.192

Table 7. USA Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Three-Legged w/STOP control	0.744	6.558	36.725	55.973
USA Three-Legged Signalized	0.451	4.957	32.024	62.568
USA Four-Legged w/STOP control	0.864	6.637	38.161	54.338
USA Four-Legged Signalized	0.715	5.263	32.359	61.663

Analysis Output Summary

Analysis Type: Benefit/Cost

Table 8. Case Cost Summary

Is Base Case	Title	Present Value of Crash Cost ($)	Present Value of Other Cost ($)	Net Present Value of Benefits (B) ($)	Net Present Value of Costs (C) ($)	Present Value of Net Benefit (B-C) ($)	Benefit Cost Ratio (B/C)
Yes	Existing	1,561,006.24	354,000.00				
	Alternative 2 - Roundabout	2,283,622.20	2,000,000.00	-722,615.96	1,646,000.00	-2,368,615.96	-0.4390
	Alternative 1 - RCUT	1,108,867.91	788,000.00	452,138.33	434,000.00	18,138.33	1.0418

Table 9. Case Crash Summary

Is Base Case	Title	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Yes	Existing	0.1007	0.3519	1.0730	0.9825	5.2835	7.7916
	Alternative 2 - Roundabout	0.0808	0.6669	2.6621	2.7470	39.2320	45.3887
	Alternative 1 - RCUT	0.0691	0.2450	0.7911	0.7314	5.9550	7.7916

Crash Cost Data

Existing Data

Case Title: Existing

Is Base Case: true

Present Value of Crash Cost: 1,561,006.24

Present Value of Other Cost: 354,000.00

Table 10. Existing Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example	USH 45	USH 45 at CTH I - Base Case	1,561,006.24
Total			1,561,006.24

Table 11. Existing Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example	USH 45	USH 45 at CTH I - Base Case	0.1007	0.3519	1.0730	0.9825	5.2835	7.7916
Total			0.1007	0.3519	1.0730	0.9825	5.2835	7.7916

Table 12. USH 45 Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Multi-Lane Segment	0.0505	0.1823	0.6255	0.5839	1.2271	2.6693
Rural Multi-Lane Intersection	0.0502	0.1696	0.4475	0.3985	4.0564	5.1223
Total	0.1007	0.3519	1.0730	0.9825	5.2835	7.7916

Alternative 2 - Roundabout Data

Case Title: Alternative 2 - Roundabout

Is Base Case: false

Present Value of Crash Cost: 2,283,622.20

Present Value of Other Cost: 2,000,000.00

Table 13. Alternative 2 - Roundabout Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example	USH 45	USH 45 at CTH I - Alternative 2	2,283,622.20
Total			2,283,622.20

Table 14. Alternative 2 - Roundabout Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example	USH 45	USH 45 at CTH I - Alternative 2	0.0808	0.6669	2.6621	2.7470	39.2320	45.3887
Total			0.0808	0.6669	2.6621	2.7470	39.2320	45.3887

Table 15. USH 45 Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Multi-Lane Segment	0.0505	0.1823	0.6255	0.5839	1.2271	2.6693
Roundabout	0.0303	0.4846	2.0366	2.1630	38.0049	42.7194
Total	0.0808	0.6669	2.6621	2.7470	39.2320	45.3887

Alternative 1 - RCUT Data

Case Title: Alternative 1 - RCUT

Is Base Case: false

Present Value of Crash Cost: 1,108,867.91

Present Value of Other Cost: 788,000.00

Table 16. Alternative 1 - RCUT Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example	USH 45	USH 45 at CTH I - Alternative 1	1,108,867.91
Total			1,108,867.91

Table 17. Alternative 1 - RCUT Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example	USH 45	USH 45 at CTH I - Alternative 1	0.0691	0.2450	0.7911	0.7314	5.9550	7.7916
Total			0.0691	0.2450	0.7911	0.7314	5.9550	7.7916

Table 18. USH 45 Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Multi-Lane Segment	0.0505	0.1823	0.6255	0.5839	1.2271	2.6693
Rural Multi-Lane Intersection	0.0186	0.0628	0.1656	0.1475	4.7279	5.1223
Total	0.0691	0.2450	0.7911	0.7314	5.9550	7.7916

Evaluation Message

IHSDM
USH 45 at CTH C
Base Case

USH 45 and CTH C - Base Case Crash Prediction

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 19, 2021

USH 45 and CTH C - Base Case Crash Prediction

Disclaimer

Limited Warranty and Limitations of Remedies

Notice

Table of Contents

List of Tables

Report Overview

Report Generated: Nov 19, 2021 9:55 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Fri Nov 19 09:47:01 CST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_USH45atCTHC
Project Comment: Created Fri Nov 19 09:21:47 CST 2021
Project Unit System: U.S. Customary

Site Set: USH 45 at CTH C - Base Case
Site Set Comment: Created Fri Nov 19 09:22:13 CST 2021
Site Set Version: v1

Evaluation Title: USH 45 at CTH C - Base Case
Evaluation Comment: Created Fri Nov 19 09:46:27 CST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: USH 45 at CTH C - Base Case
Crash History Siteset Comment: Created Fri Nov 19 09:22:13 CST 2021
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 4ST
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (4ST)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	2	2	2	0	0
2017	1	1	0	0	1
2018	2	2	0	1	1
2019	3	3	1	0	2
2020	3	3	1	0	2
All Years	11 [1]	11	4	1	6

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Number of Approaches with Left-Turn Lanes	Number of Approaches with Right-Turn Lanes	Skew Angle 1 (deg)	Skew Angle 2 (deg)	Presence of Lighting
1	4ST	CSD:USH 45 at CTH C		2016: 3766; 2017: 3833; 2018: 3900; 2019: 3957; 2020: 4014	2016: 308; 2017: 316; 2018: 325; 2019: 335; 2020: 346	0	2	6.5000	6.5000	no
1	4ST	USH 45 at CTH C		2025: 4300; 2026: 4330; 2027: 4360; 2028: 4390; 2029: 4420; 2030: 4450; 2031: 4480; 2032: 4510; 2033: 4540; 2034: 4570	2025: 400; 2026: 405; 2027: 410; 2028: 415; 2029: 420; 2030: 425; 2031: 430; 2032: 435; 2033: 440; 2034: 445	0	2	6.5000	6.5000	no

Table 3. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	4ST	USH 45 at CTH C		16.845	4.165	1.6845	0.5672	1.1174	0.4165	0.1274	0.2890	1.2680	0.4397	0.8283	0.95	1.6845
		Total	Total	16.845	4.165	1.6845	0.5672	1.1174	0.4165	0.1274	0.2890	1.2680	0.4397	0.8283	0.95	1.6845

Table 4. Predicted Crash Frequencies by Year (4ST)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	0.40	0.12	30.600	0.27	69.400
2026	0.40	0.12	30.600	0.28	69.400
2027	0.41	0.12	30.600	0.28	69.400
2028	0.41	0.12	30.600	0.28	69.400
2029	0.41	0.13	30.600	0.29	69.400
2030	0.42	0.13	30.600	0.29	69.400
2031	0.42	0.13	30.600	0.29	69.400
2032	0.43	0.13	30.600	0.30	69.400
2033	0.43	0.13	30.600	0.30	69.400
2034	0.44	0.13	30.600	0.30	69.400
Total	4.17	1.27	30.600	2.89	69.400
Average	0.42	0.13	30.600	0.29	69.400

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 5. Expected Crash Frequencies by Year (4ST)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	1.60	0.54	33.669	1.06	66.331
2026	1.62	0.55	33.669	1.07	66.331
2027	1.64	0.55	33.669	1.09	66.331
2028	1.66	0.56	33.669	1.10	66.331
2029	1.68	0.56	33.669	1.11	66.331
2030	1.69	0.57	33.669	1.12	66.331
2031	1.71	0.58	33.669	1.14	66.331
2032	1.73	0.58	33.669	1.15	66.331
2033	1.75	0.59	33.669	1.16	66.331
2034	1.77	0.60	33.669	1.17	66.331
Total	16.84	5.67	33.669	11.17	66.331
Average	1.69	0.57	33.669	1.12	66.331

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Comparing Predicted and Expected Crashes for the Evaluation Period (4ST)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	4.17	1.27	30.600	2.89	69.400
Expected	16.84	5.67	33.669	11.17	66.331
Expected - Predicted	12.68	4.40		8.28	
Percent Difference	75.28	77.53		74.13	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Expected 4ST Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Collision with Animal	0.06	0.4	2.84	16.8	3.03	18.0
Intersection	Collision with Bicycle	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Other Single-vehicle Collision	1.16	6.9	2.41	14.3	3.58	21.2
Intersection	Overturned	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Collision with Pedestrian	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Run Off Road	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Total Single Vehicle Crashes	1.22	7.2	5.25	31.2	6.61	39.2
Intersection	Angle Collision	2.59	15.4	2.40	14.2	4.87	28.9
Intersection	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Other Multiple-vehicle Collision	0.21	1.3	0.24	1.4	0.44	2.6
Intersection	Rear-end Collision	1.22	7.2	1.93	11.5	3.13	18.6
Intersection	Sideswipe	0.43	2.5	1.35	8.0	1.80	10.7
Intersection	Total Multiple Vehicle Crashes	4.45	26.4	5.92	35.1	10.24	60.8
Intersection	Total Intersection Crashes	5.67	33.7	11.17	66.3	16.85	100.0
	Total Crashes	5.67	33.7	11.17	66.3	16.85	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
USH 45 at CTH C
Alternative 1

USH 45 and CTH C - Alternative 1 (Left Turn Lane) Crash Prediction

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 22, 2021

USH 45 and CTH C - Alternative 1 (Left Turn Lane) Crash Prediction

Table of Contents

List of Tables

USH 45 and CTH C - Alternative 1 (Left Turn Lane) Crash Prediction

Report Overview

Report Generated: Nov 22, 2021 8:54 AM
Report Template: System: Single Page [System] (sscpm3, Feb 10, 2021 8:56 AM)

Evaluation Date: Mon Nov 22 08:22:08 CST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_USH45atCTHC
Project Comment: Created Fri Nov 19 09:21:47 CST 2021
Project Unit System: U.S. Customary

Site Set: USH 45 at CTH C - Alternative 1
Site Set Comment: Copied from USH 45 at CTH C - Base Case (v1)
Site Set Version: v1

Evaluation Title: Evaluation 3
Evaluation Comment: Created Mon Nov 22 08:21:35 CST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: WisDOT_Calibration_v16-1
Crash Distribution: WisDOT_Distributions_v16-1
Model/CMF: WisDOT_Models_v16-1
Note: A Model Data Set other than the HSM (Highway Safety Manual) Configuration was selected for this Evaluation. If Crash Modification Factors (CMFs) were modified, then the results will not be in accordance with the HSM (see HSM Appendix to Part C, section A.1.3).
First Year of Analysis: 2025
Last Year of Analysis: 2034
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: USH 45 at CTH C - Base Case
Crash History Siteset Comment: Created Fri Nov 19 09:22:13 CST 2021
Crash History Siteset Version: 1
First Year of Observed Crashes: 2016
Last Year of Observed Crashes: 2020

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural Two Lane Site Set CPM Evaluation

Site Type

Type: 4ST
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (4ST)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2016	2	2	2	0	0
2017	1	1	0	0	1
2018	2	2	0	1	1
2019	3	3	1	0	2
2020	3	3	1	0	2
All Years	11 [1]	11	4	1	6

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Number of Approaches with Left-Turn Lanes	Number of Approaches with Right-Turn Lanes	Skew Angle 1 (deg)	Skew Angle 2 (deg)	Presence of Lighting
1	4ST	CSD:USH 45 at CTH C		2016: 3766; 2017: 3833; 2018: 3900; 2019: 3957; 2020: 4014	2016: 308; 2017: 316; 2018: 325; 2019: 335; 2020: 346	0	2	6.5000	6.5000	no
1	4ST	USH 45 at CTH C		2025: 4300; 2026: 4330; 2027: 4360; 2028: 4390; 2029: 4420; 2030: 4450; 2031: 4480; 2032: 4510; 2033: 4540; 2034: 4570	2025: 400; 2026: 405; 2027: 410; 2028: 415; 2029: 420; 2030: 425; 2031: 430; 2032: 435; 2033: 440; 2034: 445	2	2	6.5000	6.5000	no

Table 3. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	4ST	USH 45 at CTH C		8.759	2.166	0.8759	0.2949	0.5810	0.2166	0.0663	0.1503	0.6594	0.2287	0.4307	0.49	0.8759
		Total	Total	8.759	2.166	0.8759	0.2949	0.5810	0.2166	0.0663	0.1503	0.6594	0.2287	0.4307	0.49	0.8759

Table 4. Predicted Crash Frequencies by Year (4ST)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	0.21	0.06	30.600	0.14	69.400
2026	0.21	0.06	30.600	0.14	69.400
2027	0.21	0.06	30.600	0.15	69.400
2028	0.21	0.07	30.600	0.15	69.400
2029	0.21	0.07	30.600	0.15	69.400
2030	0.22	0.07	30.600	0.15	69.400
2031	0.22	0.07	30.600	0.15	69.400
2032	0.22	0.07	30.600	0.15	69.400
2033	0.23	0.07	30.600	0.16	69.400
2034	0.23	0.07	30.600	0.16	69.400
Total	2.17	0.66	30.600	1.50	69.400
Average	0.22	0.07	30.600	0.15	69.400

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 5. Expected Crash Frequencies by Year (4ST)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2025	0.83	0.28	33.669	0.55	66.331
2026	0.84	0.28	33.669	0.56	66.331
2027	0.85	0.29	33.669	0.56	66.331
2028	0.86	0.29	33.669	0.57	66.331
2029	0.87	0.29	33.669	0.58	66.331
2030	0.88	0.30	33.669	0.58	66.331
2031	0.89	0.30	33.669	0.59	66.331
2032	0.90	0.30	33.669	0.60	66.331
2033	0.91	0.31	33.669	0.60	66.331
2034	0.92	0.31	33.669	0.61	66.331
Total	8.76	2.95	33.669	5.81	66.331
Average	0.88	0.29	33.669	0.58	66.331

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Comparing Predicted and Expected Crashes for the Evaluation Period (4ST)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	2.17	0.66	30.600	1.50	69.400
Expected	8.76	2.95	33.669	5.81	66.331
Expected - Predicted	6.59	2.29		4.31	
Percent Difference	75.28	77.53		74.13	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Expected 4ST Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Collision with Animal	0.03	0.4	1.48	16.8	1.57	18.0
Intersection	Collision with Bicycle	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Other Single-vehicle Collision	0.60	6.9	1.25	14.3	1.86	21.2
Intersection	Overturned	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Collision with Pedestrian	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Run Off Road	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Total Single Vehicle Crashes	0.63	7.2	2.73	31.2	3.44	39.2
Intersection	Angle Collision	1.35	15.4	1.25	14.2	2.53	28.9
Intersection	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Other Multiple-vehicle Collision	0.11	1.3	0.12	1.4	0.23	2.6
Intersection	Rear-end Collision	0.63	7.2	1.01	11.5	1.63	18.6
Intersection	Sideswipe	0.22	2.5	0.70	8.0	0.94	10.7
Intersection	Total Multiple Vehicle Crashes	2.31	26.4	3.08	35.1	5.33	60.8
Intersection	Total Intersection Crashes	2.95	33.7	5.81	66.3	8.76	100.0
	Total Crashes	2.95	33.7	5.81	66.3	8.76	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM
USH 45 at CTH C
Economic Analysis

USH 45 and CTH C - Economic Analysis

Interactive Highway Safety Design Model

Economic Analysis Report

November 29, 2021

USH 45 and CTH C - Economic Analysis

Table of Contents

List of Tables

Economic Analysis Report

Economic Analysis Report Overview

Report Generated: Nov 29, 2021 11:14 AM
Report Template: System: Single Page [System] (eam3, Feb 10, 2021 8:56 AM)

Evaluation Title: EA_BTO_SCP_Example_USH 45 at CTH C
Evaluation Comment: Created Mon Nov 29 11:13:51 CST 2021
Evaluation Date: Mon Nov 29 11:13:58 CST 2021

User Name: Bureau of Traffic Operations
Organization Name: WisDOT-BTO
Phone: .
E-Mail: .

Project Title: BTO_SCP_Example_USH 45 at CTH C
Project Comment: Created Fri Nov 19 09:50:57 CST 2021

Configuration Summary

Crash Cost Configuration: WisDOTEconomics_v16-1
Configuration Comment: Updated with 2020 Crash Cost Values

Table 1. Economic Analysis Configuration

Configuration Data	
Crash Unit Cost Zero Year	2020
Crash Cost Index	0.00
Discount Rate	0.05
KABCO Unit Costs	
K Cost ($/Crash)	12,694,788.00
A Cost ($/Crash)	684,064.00
B Cost ($/Crash)	217,328.00
C Cost ($/Crash)	123,679.00
O Cost ($/Crash)	10,824.00

Table 2. RTL Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL 2U Two-Lane Undivided	3.502	12.638	43.370	40.490

Table 3. RTL Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RTL Three-Legged w/STOP control	3.072	15.068	42.383	39.477
RTL Four-Legged w/STOP control	3.975	15.278	42.862	37.885
RTL Four-Legged Signalized	2.957	11.751	35.292	50.000

Table 4. RML Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Four-Lane Undivided	3.502	12.638	43.370	40.490
RML Four-Lane Divided	3.502	12.638	43.370	40.490

Table 5. RML Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
RML Three-Legged w/STOP control	4.095	14.091	40.626	41.188
RML Four-Legged w/STOP control	4.711	15.912	41.988	37.389
RML Four-Legged Signalized	0.598	10.012	37.176	52.214

Table 6. USA Segment FI Proportion Data

Segment Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Two-Lane Undivided	1.012	5.785	33.011	60.192
USA Three-Lane w/Center TWLTL	1.012	5.785	33.011	60.192
USA Four-Lane Undivided	1.012	5.785	33.011	60.192
USA Four-Lane Divided	1.012	5.785	33.011	60.192
USA Five-Lane w/Center TWLTL	1.012	5.785	33.011	60.192

Table 7. USA Intersection FI Proportion Data

Intersection Type	Fatal Crash (K) Proportion of FI (%)	Incapacitating Injury Crash (A) Proportion of FI (%)	Non-incapacitating Injury Crash (B) Proportion of FI (%)	Possible Injury Crash (C) Proportion of FI (%)
USA Three-Legged w/STOP control	0.744	6.558	36.725	55.973
USA Three-Legged Signalized	0.451	4.957	32.024	62.568
USA Four-Legged w/STOP control	0.864	6.637	38.161	54.338
USA Four-Legged Signalized	0.715	5.263	32.359	61.663

Analysis Output Summary

Analysis Type: Benefit/Cost

Table 8. Case Cost Summary

Is Base Case	Title	Present Value of Crash Cost ($)	Present Value of Other Cost ($)	Net Present Value of Benefits (B) ($)	Net Present Value of Costs (C) ($)	Present Value of Net Benefit (B-C) ($)	Benefit Cost Ratio (B/C)
Yes	Existing	3,526,873.21	45,000.00				
	Alternative 1 - Left Turn Lanes	1,833,974.06	238,000.00	1,692,899.15	193,000.00	1,499,899.15	8.7715

Table 9. Case Crash Summary

Is Base Case	Title	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Yes	Existing	0.2254	0.8665	2.4309	2.1487	11.1736	16.8451
	Alternative 1 - Left Turn Lanes	0.1172	0.4506	1.2641	1.1173	5.8102	8.7595

Crash Cost Data

Existing Data

Case Title: Existing

Is Base Case: true

Present Value of Crash Cost: 3,526,873.21

Present Value of Other Cost: 45,000.00

Table 10. Existing Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_USH45atCTHC	USH 45 at CTH C - Base Case	USH 45 at CTH C - Base Case	3,526,873.21
Total			3,526,873.21

Table 11. Existing Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_USH45atCTHC	USH 45 at CTH C - Base Case	USH 45 at CTH C - Base Case	0.2254	0.8665	2.4309	2.1487	11.1736	16.8451
Total			0.2254	0.8665	2.4309	2.1487	11.1736	16.8451

Table 12. USH 45 at CTH C - Base Case Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Intersection	0.2254	0.8665	2.4309	2.1487	11.1736	16.8451
Total	0.2254	0.8665	2.4309	2.1487	11.1736	16.8451

Alternative 1 - Left Turn Lanes Data

Case Title: Alternative 1 - Left Turn Lanes
Is Base Case: false
Present Value of Crash Cost: 1,833,974.06
Present Value of Other Cost: 238,000.00

Table 13. Alternative 1 - Left Turn Lanes Evaluation Cost

Project or Interchange	Selected Facility	Selected Evaluation	Present Value of Crash Cost ($)
BTO_SCP_Example_USH45atCTHC	USH 45 at CTH C - Alternative 1	USH 45 at CTH C - Alternative 1	1,833,974.06
Total			1,833,974.06

Table 14. Alternative 1 - Left Turn Lanes Evaluation Crashes

Project or Interchange	Selected Facility	Selected Evaluation	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
BTO_SCP_Example_USH45atCTHC	USH 45 at CTH C - Alternative 1	USH 45 at CTH C - Alternative 1	0.1172	0.4506	1.2641	1.1173	5.8102	8.7595
Total			0.1172	0.4506	1.2641	1.1173	5.8102	8.7595

Table 15. USH 45 at CTH C - Alternative 1 Facility Type Crashes

Facility Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)	Total Crashes (crashes)
Rural Two-Lane Intersection	0.1172	0.4506	1.2641	1.1173	5.8102	8.7595
Total	0.1172	0.4506	1.2641	1.1173	5.8102	8.7595

Evaluation Message

Example 2

This example provides a walkthrough of the Safety Certification Process using a Method 1 analysis. This example is an abbreviated document which excludes certain materials and steps. This example helps demonstrate what is needed to complete a Method 1 analysis and how to document it within the SCD. See Example 1 for a more detailed walkthrough of what is needed as part of a complete SCD.

The information within this example was adjusted and modified for example purposes only and is not representative of the actual conditions.

Project Description:

A 2-mile preservation project is programmed for an urban highway. When performing the *Network Screening for Safety Sites of Promise*, one intersection was identified as a Safety Site of Promise. A *Diagnosis of Safety Sites of Promise* was performed, and the location had several pedestrian crashes.

Example Description:

This example shows a Method 1 analysis which utilizes the Safety Benefit-Cost Analysis spreadsheet.

To: **EXAMPLE**
The information within this example was adjusted and modified for example purposes only and is not representative of the actual conditions.

From: WisDOT – Bureau of Traffic Operations

Date: 6/1/2023
RE: Design ID: XXXX-XX-XX
Construction ID: XXXX-XX-XX
Highway: USH 45
Project Title: Jackson St, City of Oshkosh
Project Subtitle: Algoma Blvd to Irving Ave
Winnebago County
Scheduled Construction Year: 2028
Improvement Concept Code: PSRS40

Having considered the safety performance of the existing corridor and any proposed improvements, we believe this document reflects the intent of the policy and guidelines described in section 11-38 of the Wisconsin Facilities Development Manual.

If applicable, having considered the operational performance of the existing corridor and any proposed improvements, we believe this document reflects the intent of the policy and guidelines described in section 11-52 of the Wisconsin Facilities Development Manual.

Preparer:

____ _________
Region Analyst Date

Approval:

____ _________
Bureau of Traffic Operations Date
Traffic Engineering and Safety Section

____ _________
Region Supervisor Date

1. Certification Processes Completed

1.1. According to FDM 11-1-10 Attachment 10.1, does the improvement concept code and scope of work require the Safety Certification Process to be completed? Yes ☒ No ☐

If yes is selected and alternatives are evaluated as indicated in Section 5, send to BTO at DOTBTOSafetyEngineering@dot.wi.gov

1.2. Was the Operations Certification Process (FDM 11-52-15) completed for proposed improvements within this project? Yes ☐ No ☒

If yes, send to BTO at DOTTrafficAnalysisModeling@dot.wi.gov

2. Network Screening

2.1. Safety Sites of Promise

2.1.1. Did the project have Safety Sites of Promise from the network screening? Yes ☒ No ☐

List Safety Sites of Promise:
The project does not have a flagged segment within the project limits.

The project has one flagged intersection within the project limits:
IX_70_02446: USH 45 at Lincoln Ave

2.2 Operational Sites of Promise (If Applicable)

2.2.1 Did the project identify Operational Sites of Promise from the network screening? Yes ☐ No ☐ N/A ☒

2.2.2 Did the project identify Operational Sites of Promise based on local knowledge? Yes ☐ No ☐ N/A ☒

List Operational Sites of Promise:

2.3 Additional Sites

2.3.1 Were additional sites evaluated? Yes ☐ No ☒

List sites:

3. Diagnosis

3.1. Diagnosis of Crashes

3.1.1. Did relevant crashes remain after crash vetting? Yes ☒ No ☐

3.1.2. If yes, list each site and discuss the crashes and contributing factors (including geometric conditions) for the remaining crash(es) or note that no crashes remained after the vetting process.

IX_70_02446: USH 45 at Lincoln Ave

Six crashes remain after vetting. There are several pedestrian crashes in which pedestrians attempting to cross the roadway were struck by vehicles. There were no other identified crash trends.

- Two crashes involved vehicles striking pedestrians.
  - One crash occurred when an eastbound pedestrian was struck by a southbound vehicle.
  - One crash occurred when an eastbound pedestrian was struck by an eastbound left-turning vehicle.
- One crash was a southbound rear-end crash that was caused by a pedestrian entering the roadway and the lead vehicle abruptly stopping.

- One crash was an eastbound vehicle failing to yield to a northbound vehicle.
- One crash was a northbound left-turning vehicle failing to yield to a southbound vehicle.
- One crash was a northbound vehicle which sideswiped another northbound vehicle due to an attempt to make a right-turn from the incorrect lane.

Contributing Factors:

- USH 45 is a multi-lane undivided highway at this location.
- USH 45 and Lincoln Avenue have sidewalk through the corridor.
- There are no apparent sight distance concerns at the intersection. The intersection does not have a skew angle that is causing vision issues.
- USH 45 is posted at 30 mph and Lincoln Ave is posted at 25 mph.
- The area is residential with a university located nearby.
- The crash trend is attributed to lack of pedestrian visibility for motorists.

3.2 Diagnosis of Operational Issues (If Applicable)

3.2.1. Provide a narrative of existing operational concerns and geometric deficiencies contributing to the delay or queuing.

N/A

4. Countermeasure/Alternative Identification

4.1 Were alternatives analyzed in this project? Yes ☒ No ☐

For intersections only, a Phase I: Scoping Intersection Control Evaluation (ICE) is required if traffic control changes are considered. See FDM 11-25-3 for more information.

4.2. Provide a brief description of the alternative(s) and the contributing factors that are being targeted:

Location:

Reason for improvement (check all that apply): Safety ☒ Operations ☐

Alternative(s)	General Description	How improvements address safety/operational issues
Alternative Name: Future No Build	This alternative will follow the programmed improvement concept and maintain existing conditions.	This alternative will not address the existing crash issues and trends.
Alternative Name: High Visibility Crosswalks	This alternative will provide high visibility crosswalk markings at the intersection.	This alternative will reduce pedestrian crashes at the intersection.
Alternative Name: Rapid Rectangular Flashing Beacon (RRFB)	This alternative will install an RRFB at the intersection.	This alternative will reduce pedestrian crashes at the intersection. The RRFB will help provide safer gaps for pedestrians using the intersection.
Alternative Name: High Visibility Crosswalks & Rapid Rectangular Flashing Beacon	This alternative will install an RRFB and provide high visibility crosswalk markings at the intersection.	This alternative will reduce pedestrian crashes at the intersection and help provide safer gaps for crossing movements.

Alternative Name: Pedestrian Hybrid Beacon	This alternative will construct a pedestrian hybrid beacon at the intersection.	This alternative will reduce pedestrian crashes at the intersection. The beacon will provide safer gaps for pedestrians crossing.

5. Analysis Results and Economic Appraisal

Analysis Location:	IX_70_02446: USH 45 at Lincoln Ave
Safety Analysis Method:	Method 1
External CMF Value:	Alternative 1 (High Visibility Crosswalks): 1. 0.60 for All Pedestrian crashes Alternative 2 (RRFB): 1. 0.526 for All Pedestrian crashes Alternative 3 (High Visibility Crosswalks + RRFB): 1. 0.60 for All Pedestrian crashes 2. 0.526 for All Pedestrian crashes Alternative 4 (Pedestrian Hybrid Beacon): 1. 0.309 for All Pedestrian crashes
External CMF Source:	WisDOT CMF Table
Unique Safety Analysis Notes:	None

		Base	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Alternative Name		Future No Build	High Visibility Crosswalks	RRFB	High Visibility Crosswalks and RRFB	Pedestrian Hybrid Beacon
Safety Certification Process (See FDM 11-38)	Fatal & Injury Crashes	4.2	2.5	2.2	2.3	1.3
	Property Damage Only Crashes	0	0	0	0	0
	Total Crashes	4.2	2.5	2.2	2.3	1.3
	Crash Cost Value	$1,490,338	$894,203	$783,918	$812,514	$460,515
	Project Cost	$0	$3,500	$6,500	$10,000	$225,000
	Net Safety Benefit	-	$596,135	$706,420	$677,824	$1,029,824
	Net Cost	-	$3,500	$6,500	$10,000	$225,000
	Safety B/C	-	170.3	108.7	67.8	4.6

6. Other Information

6.1. Describe other information relevant to the project such as community considerations, unique features, potential funding sources, etc.

All the investigated alternatives will be reviewed for Highway Safety Improvement Program (HSIP) funding.

ATTACHMENTS

Include all attachments in the final Safety & Operations Certification Document and submit as a single PDF.

This example is an abbreviated document and does not include all required attachments. For an example of a complete SCD with all attachments, see Example 1.

A. Project Information
    a. Project Location/Overview Map
B. Network Screening Documentation
    a. Meta-Manager spreadsheet
    b. Intersection Network Screening spreadsheet
    c. Overview Map of Safety Sites of Promise Locations (optional)
C. Diagnosis Documentation
    a. WisTransPortal crash data spreadsheet with vetting comments
    b. Crash Diagram(s)
D. Countermeasure/Alternative Identification
    a. Safety Certification Worksheet
    b. Layout/Schematic for each alternative
E. Analysis Results and Economic Appraisal
    a. Cost estimate for each alternative
    ~~b. IHSDM Crash Prediction Evaluation Report for each alternative~~
    ~~c. IHSDM Economic Analysis Report~~
    d. Highway Safety Benefit-Cost Analysis Tool results (if applicable)
~~F. Operations Certification Summary (if applicable)~~
    ~~a. Turning movement counts~~
    ~~b. Diagram of traffic volumes for each analysis period~~
    ~~c. AWSC warrants~~
    ~~d. Signal warrants~~
    ~~e. Software reports for operation analysis~~
    ~~f. DT 1887~~
    ~~g. Exhibit highlighting queues vs. available storage for each analysis period~~
    ~~h. OCP Benefit-Cost Tool printouts~~

APPENDIX A
PROJECT INFORMATION

Certain attachments are not included with this example. See Example 1 for an example of a complete SCD with all available attachments.

APPENDIX B
NETWORK SCREENING DOCUMENTATION

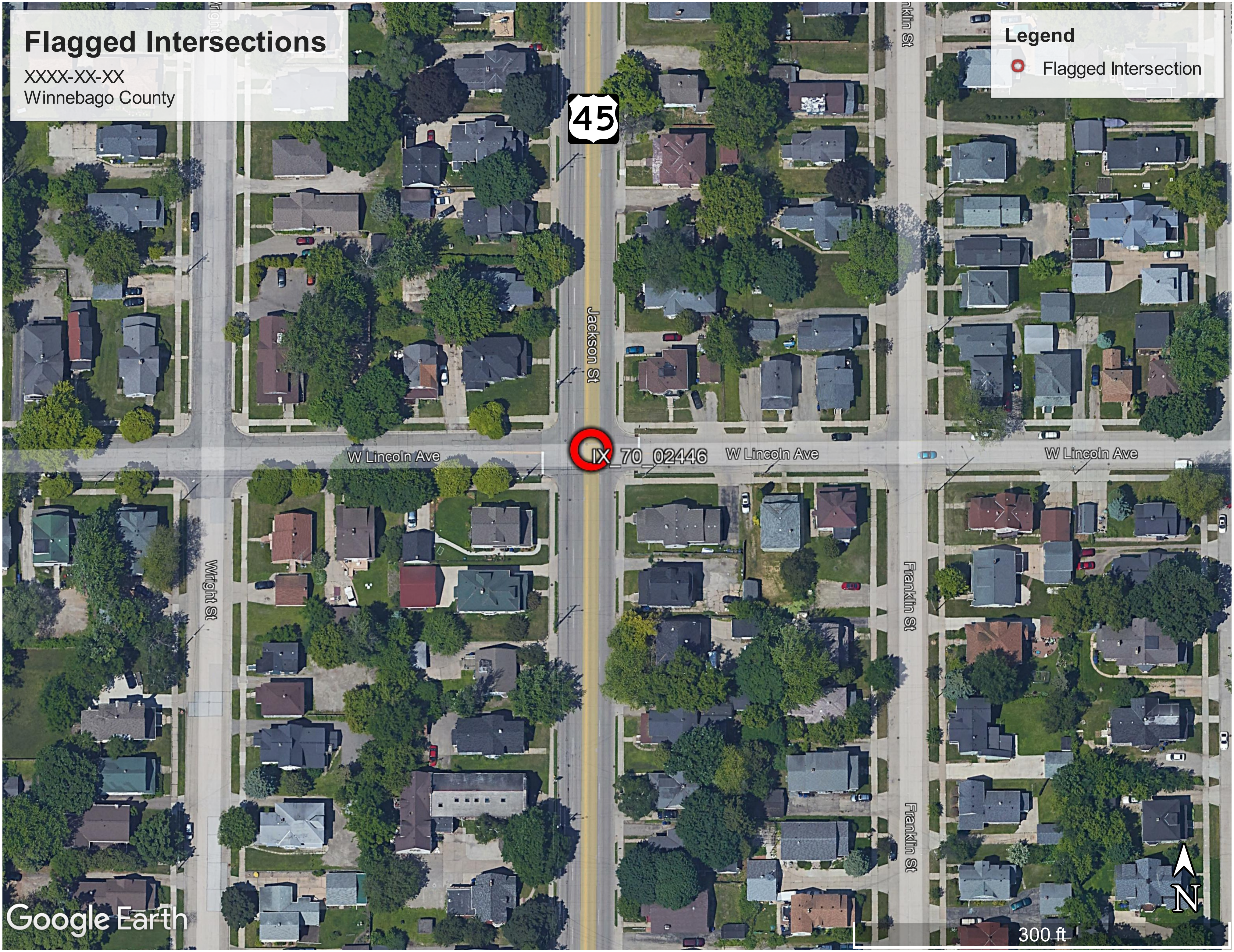
Certain attachments are not included with this example. See Example 1 for an example of a complete SCD with all available attachments.

Flagged Intersections

XXXX-XX-XX
Winnebago County

Legend

Flagged Intersection



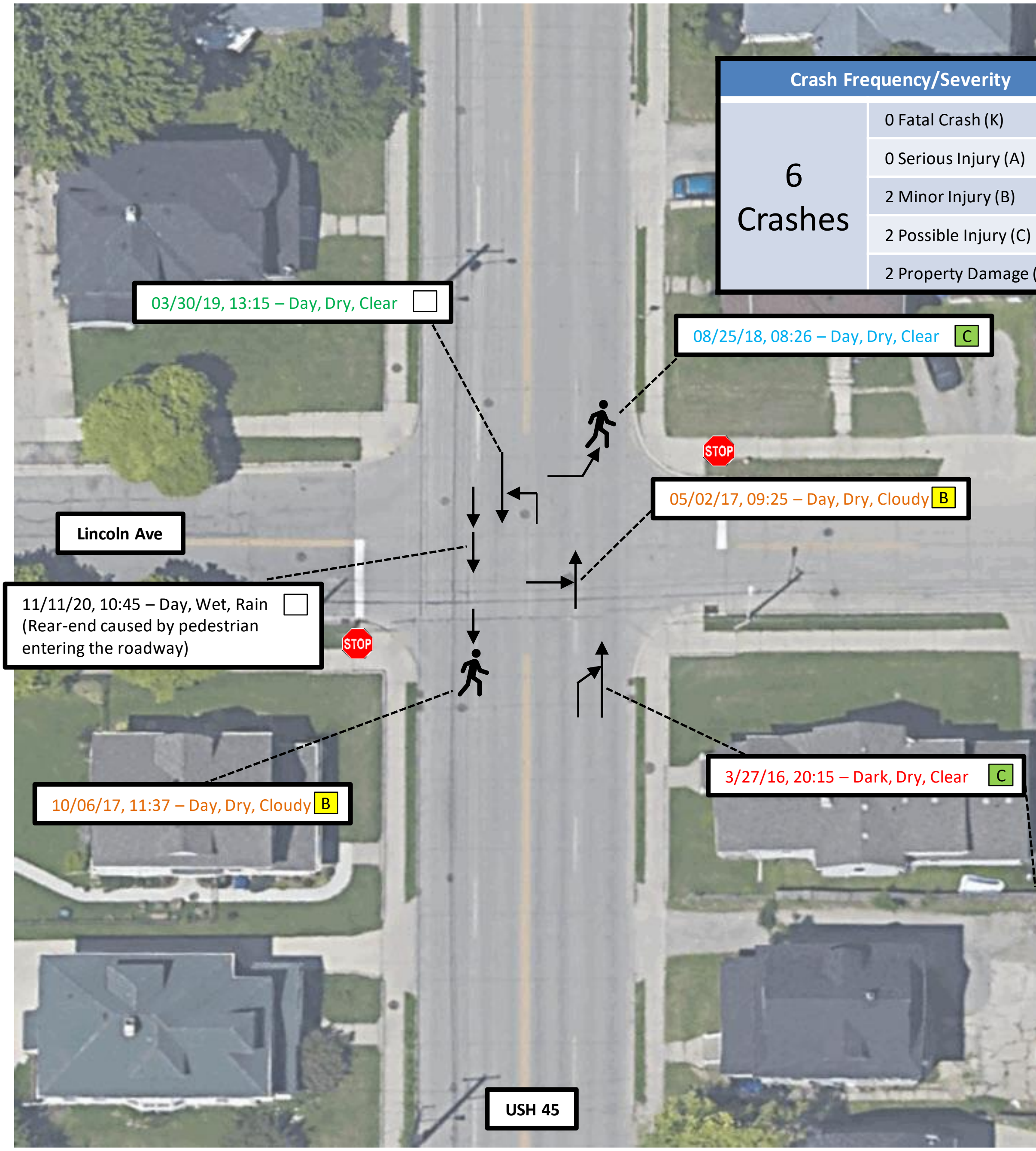
APPENDIX C
DIAGNOSIS DOCUMENTATION

Certain attachments are not included with this example. See Example 1 for an example of a complete SCD with all available attachments.

Sample crash data is not provided for this example.

See FDM 11-38 for sample of crash data documentation with vetting comments.

CRASH DIAGRAMS



LEGEND

CRASH YEAR	SEVERITY		CRASH TYPE
2016 = Red	Fatal (K)	K	Angle
2017 = Orange	Serious Injury (A)	A	Rear-end
2018 = Cyan	Minor Injury (B)	B	Head-on
2019 = Green	Possible Injury (C)	C	SS Same
2020 = Black	Property Damage (PD)		SS Opposite
			ROR Fixed Object
	Alcohol or Drug Flag		ROR Overturn
			ROR
			Pedestrian
			Bicycle

N

16-20 Crash Diagram
USH 45 at Lincoln Ave
Winnebago County

APPENDIX D
COUNTERMEASURE IDENTIFICATION, SAFETY EVALUATION AND ECONOMIC APPRAISAL DOCUMENTATION

Project Information

Project ID: XXXX-XX-XX
Region: NE
County: Winnebago
Segment/Intersection: USH 45 at Lincoln Ave
Analyst: WisDOT BTO
Date of Analysis: 1/1/2022

Method 1 Analysis Information

	Year	AADT
First Year of Analysis Period	2028	13000
Last Year of Analysis Period	2037	13400

Observed Crash History

	Year	Avg. AADT
First Year of Observed Data	2016	12700
Last Year of Observed Data	2020	

	Crash Totals	Average
Fatal Crashes		0
Injury A Crashes		0
Injury B Crashes	1	0.2
Injury C Crashes	1	0.2
PDO Crashes		0
Fatal & Injury Crashes	2	0.4
Total	2	0.4

Economic Analysis Factors

Year of Crash Costs: 2020
Crash Cost Index: 0.00%
Discount Rate: 5.00%

	Crash Cost	KABC Distribution
Fatal	$ 12,694,778	1.8%
Injury A	$ 684,064	9.1%
Injury B	$ 217,328	41.2%
Injury C	$ 123,679	48.0%
Property Damage	$ 10,824	
Fatal & Injury	$ -	

* The KABC Distribution was developed using 2016-2020 statewide data. It does not contain the distributions that were developed during the calibration process.

Summary

	Treatment Used	Treatment Costs	Cost Difference	Crash Costs (in 2028 Dollars)	Benefits (in 2028 Dollars)	Benefit/Cost Ratio	Crash Totals for Analysis Period: Fatal & Injury	Property Damage	All Crashes
Base Case		$ -	-	$ 1,490,338	-	-	4.2	0.0	4.2
Alternative 1	High Visibility Crosswalks	$ 3,500	$ 3,500	$ 894,203	$ 596,135	170.3	2.5	0.0	2.5
Alternative 2	RRFB	$ 6,500	$ 6,500	$ 783,918	$ 706,420	108.7	2.2	0.0	2.2
Alternative 3	RRFB+High Visibility Crosswalks	$ 10,000	$ 10,000	$ 812,514	$ 677,824	67.8	2.3	0.0	2.3
Alternative 4	Pedestrian Hybrid Beacon	$ 225,000	$ 225,000	$ 460,515	$ 1,029,824	4.6	1.3	0.0	1.3
Alternative 5			-	-	-	-	-	-	-

Inputs for Base Case and Alternatives

Base Case:

Period	Year	AADT	Crash Data Entry		CMF 1			CMF 2			Combined CMF		Adjusted Crashes					
			Estimated Crashes		All	KABC	PDO	All	KABC	PDO								
			KABC	PDO							KABC	PDO	KABC	Fatal	Injury A	Injury B	Injury C	PDO
1	2028	13000	0.41	0.00	-	-	-	-	-	-	1.00	1.00	0.41	0.01	0.04	0.17	0.20	0.00
2	2029	13044	0.41	0.00	-	-	-	-	-	-	1.00	1.00	0.41	0.01	0.04	0.17	0.20	0.00
3	2030	13089	0.41	0.00	-	-	-	-	-	-	1.00	1.00	0.41	0.01	0.04	0.17	0.20	0.00
4	2031	13133	0.41	0.00	-	-	-	-	-	-	1.00	1.00	0.41	0.01	0.04	0.17	0.20	0.00
5	2032	13178	0.42	0.00	-	-	-	-	-	-	1.00	1.00	0.42	0.01	0.04	0.17	0.20	0.00
6	2033	13222	0.42	0.00	-	-	-	-	-	-	1.00	1.00	0.42	0.01	0.04	0.17	0.20	0.00
7	2034	13266	0.42	0.00	-	-	-	-	-	-	1.00	1.00	0.42	0.01	0.04	0.17	0.20	0.00
8	2035	13311	0.42	0.00	-	-	-	-	-	-	1.00	1.00	0.42	0.01	0.04	0.17	0.20	0.00
9	2036	13355	0.42	0.00	-	-	-	-	-	-	1.00	1.00	0.42	0.01	0.04	0.17	0.20	0.00
10	2037	13400	0.42	0.00	-	-	-	-	-	-	1.00	1.00	0.42	0.01	0.04	0.17	0.20	0.00
TOTALS		-	4.16	0.00	-	-	-	-	-	-	-	-	4.16	0.08	0.38	1.71	1.99	0.00

Period	Crash Costs by Year (2028 - 2037)						Crash Costs in 2028 Dollars					
	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal	Injury A	Injury B	Injury C	PDO	Total
1	$ 94,987	$ 25,382	$ 36,626	$ 24,282	$ -	$ 181,277	$ 94,987	$ 25,382	$ 36,626	$ 24,282	$ -	$ 181,277
2	$ 95,311	$ 25,468	$ 36,751	$ 24,365	$ -	$ 181,896	$ 90,773	$ 24,256	$ 35,001	$ 23,205	$ -	$ 173,234
3	$ 95,636	$ 25,555	$ 36,876	$ 24,448	$ -	$ 182,515	$ 86,744	$ 23,179	$ 33,448	$ 22,175	$ -	$ 165,547
4	$ 95,960	$ 25,642	$ 37,002	$ 24,531	$ -	$ 183,134	$ 82,894	$ 22,150	$ 31,963	$ 21,191	$ -	$ 158,198
5	$ 96,285	$ 25,728	$ 37,127	$ 24,614	$ -	$ 183,754	$ 79,214	$ 21,167	$ 30,544	$ 20,250	$ -	$ 151,174
6	$ 96,609	$ 25,815	$ 37,252	$ 24,697	$ -	$ 184,373	$ 75,696	$ 20,227	$ 29,188	$ 19,351	$ -	$ 144,461
7	$ 96,933	$ 25,902	$ 37,377	$ 24,780	$ -	$ 184,992	$ 72,333	$ 19,328	$ 27,891	$ 18,491	$ -	$ 138,044
8	$ 97,258	$ 25,988	$ 37,502	$ 24,863	$ -	$ 185,611	$ 69,119	$ 18,469	$ 26,652	$ 17,669	$ -	$ 131,910
9	$ 97,582	$ 26,075	$ 37,627	$ 24,946	$ -	$ 186,230	$ 66,047	$ 17,649	$ 25,467	$ 16,884	$ -	$ 126,048
10	$ 97,907	$ 26,162	$ 37,752	$ 25,029	$ -	$ 186,849	$ 63,112	$ 16,864	$ 24,335	$ 16,134	$ -	$ 120,445
TOTALS	$ 964,468	$ 257,717	$ 371,892	$ 246,554	$ -	$ 1,840,631	$ 780,919	$ 208,671	$ 301,117	$ 199,632	$ -	$ 1,490,338

Alternative 1: High Visibility Crosswalks

Period	Year	AADT	Crash Data Entry		CMF 1			CMF 2			Combined CMF		Adjusted Crashes					
			Estimated Crashes		All	KABC	PDO	All	KABC	PDO								
			KABC	PDO	0.60						KABC	PDO	KABC	Fatal	Injury A	Injury B	Injury C	PDO
1	2028	13000	0.41	0.00	0.60	0.60	0.60	-	-	-	0.60	0.60	0.25	0.00	0.02	0.10	0.12	0.00
2	2029	13044	0.41	0.00	0.60	0.60	0.60	-	-	-	0.60	0.60	0.25	0.00	0.02	0.10	0.12	0.00
3	2030	13089	0.41	0.00	0.60	0.60	0.60	-	-	-	0.60	0.60	0.25	0.00	0.02	0.10	0.12	0.00
4	2031	13133	0.41	0.00	0.60	0.60	0.60	-	-	-	0.60	0.60	0.25	0.00	0.02	0.10	0.12	0.00
5	2032	13178	0.42	0.00	0.60	0.60	0.60	-	-	-	0.60	0.60	0.25	0.00	0.02	0.10	0.12	0.00
6	2033	13222	0.42	0.00	0.60	0.60	0.60	-	-	-	0.60	0.60	0.25	0.00	0.02	0.10	0.12	0.00
7	2034	13266	0.42	0.00	0.60	0.60	0.60	-	-	-	0.60	0.60	0.25	0.00	0.02	0.10	0.12	0.00
8	2035	13311	0.42	0.00	0.60	0.60	0.60	-	-	-	0.60	0.60	0.25	0.00	0.02	0.10	0.12	0.00
9	2036	13355	0.42	0.00	0.60	0.60	0.60	-	-	-	0.60	0.60	0.25	0.00	0.02	0.10	0.12	0.00
10	2037	13400	0.42	0.00	0.60	0.60	0.60	-	-	-	0.60	0.60	0.25	0.00	0.02	0.10	0.12	0.00
TOTALS		-	4.16	0.00	-	-	-	-	-	-	-	-	2.49	0.05	0.23	1.03	1.20	0.00

Period	Crash Costs by Year (2028 - 2037)						Crash Costs in 2028 Dollars					
	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal	Injury A	Injury B	Injury C	PDO	Total
1	$ 56,992	$ 15,229	$ 21,976	$ 14,569	$ -	$ 108,766	$ 56,992	$ 15,229	$ 21,976	$ 14,569	$ -	$ 108,766
2	$ 57,187	$ 15,281	$ 22,051	$ 14,619	$ -	$ 109,138	$ 54,464	$ 14,553	$ 21,001	$ 13,923	$ -	$ 103,941
3	$ 57,381	$ 15,333	$ 22,126	$ 14,669	$ -	$ 109,509	$ 52,047	$ 13,907	$ 20,069	$ 13,305	$ -	$ 99,328
4	$ 57,576	$ 15,385	$ 22,201	$ 14,719	$ -	$ 109,881	$ 49,736	$ 13,290	$ 19,178	$ 12,714	$ -	$ 94,919
5	$ 57,771	$ 15,437	$ 22,276	$ 14,768	$ -	$ 110,252	$ 47,528	$ 12,700	$ 18,327	$ 12,150	$ -	$ 90,705
6	$ 57,965	$ 15,489	$ 22,351	$ 14,818	$ -	$ 110,624	$ 45,417	$ 12,136	$ 17,513	$ 11,610	$ -	$ 86,676
7	$ 58,160	$ 15,541	$ 22,426	$ 14,868	$ -	$ 110,995	$ 43,400	$ 11,597	$ 16,735	$ 11,095	$ -	$ 82,826
8	$ 58,355	$ 15,593	$ 22,501	$ 14,918	$ -	$ 111,367	$ 41,472	$ 11,082	$ 15,991	$ 10,602	$ -	$ 79,146
9	$ 58,549	$ 15,645	$ 22,576	$ 14,967	$ -	$ 111,738	$ 39,628	$ 10,589	$ 15,280	$ 10,131	$ -	$ 75,629
10	$ 58,744	$ 15,697	$ 22,651	$ 15,017	$ -	$ 112,110	$ 37,867	$ 10,118	$ 14,601	$ 9,680	$ -	$ 72,267
TOTALS	$ 578,681	$ 154,630	$ 223,135	$ 147,932	$ -	$ 1,104,379	$ 468,551	$ 125,202	$ 180,670	$ 119,779	$ -	$ 894,203

Alternative 2: RRFB

Period	Year	AADT	Crash Data Entry		CMF 1			CMF 2			Combined CMF		Adjusted Crashes					
			Estimated Crashes		All	KABC	PDO	All	KABC	PDO								
			KABC	PDO	0.53						KABC	PDO	KABC	Fatal	Injury A	Injury B	Injury C	PDO
1	2028	13000	0.41	0.00	0.53	0.53	0.53	-	-	-	0.53	0.53	0.22	0.00	0.02	0.09	0.10	0.00
2	2029	13044	0.41	0.00	0.53	0.53	0.53	-	-	-	0.53	0.53	0.22	0.00	0.02	0.09	0.10	0.00
3	2030	13089	0.41	0.00	0.53	0.53	0.53	-	-	-	0.53	0.53	0.22	0.00	0.02	0.09	0.10	0.00
4	2031	13133	0.41	0.00	0.53	0.53	0.53	-	-	-	0.53	0.53	0.22	0.00	0.02	0.09	0.10	0.00
5	2032	13178	0.42	0.00	0.53	0.53	0.53	-	-	-	0.53	0.53	0.22	0.00	0.02	0.09	0.10	0.00
6	2033	13222	0.42	0.00	0.53	0.53	0.53	-	-	-	0.53	0.53	0.22	0.00	0.02	0.09	0.11	0.00
7	2034	13266	0.42	0.00	0.53	0.53	0.53	-	-	-	0.53	0.53	0.22	0.00	0.02	0.09	0.11	0.00
8	2035	13311	0.42	0.00	0.53	0.53	0.53	-	-	-	0.53	0.53	0.22	0.00	0.02	0.09	0.11	0.00
9	2036	13355	0.42	0.00	0.53	0.53	0.53	-	-	-	0.53	0.53	0.22	0.00	0.02	0.09	0.11	0.00
10	2037	13400	0.42	0.00	0.53	0.53	0.53	-	-	-	0.53	0.53	0.22	0.00	0.02	0.09	0.11	0.00
TOTALS		-	4.16	0.00	-	-	-	-	-	-	-	-	2.19	0.04	0.20	0.90	1.05	0.00

Period	Crash Costs by Year (2028 - 2037)						Crash Costs in 2028 Dollars					
	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal	Injury A	Injury B	Injury C	PDO	Total
1	$ 49,963	$ 13,351	$ 19,265	$ 12,772	$ -	$ 95,352	$ 49,963	$ 13,351	$ 19,265	$ 12,772	$ -	$ 95,352
2	$ 50,134	$ 13,396	$ 19,331	$ 12,816	$ -	$ 95,677	$ 47,746	$ 12,758	$ 18,411	$ 12,206	$ -	$ 91,121
3	$ 50,304	$ 13,442	$ 19,397	$ 12,860	$ -	$ 96,003	$ 45,628	$ 12,192	$ 17,594	$ 11,664	$ -	$ 87,078
4	$ 50,475	$ 13,488	$ 19,463	$ 12,903	$ -	$ 96,329	$ 43,602	$ 11,651	$ 16,813	$ 11,146	$ -	$ 83,212
5	$ 50,646	$ 13,533	$ 19,529	$ 12,947	$ -	$ 96,654	$ 41,666	$ 11,134	$ 16,066	$ 10,651	$ -	$ 79,518
6	$ 50,816	$ 13,579	$ 19,594	$ 12,991	$ -	$ 96,980	$ 39,816	$ 10,639	$ 15,353	$ 10,178	$ -	$ 75,986
7	$ 50,987	$ 13,624	$ 19,660	$ 13,034	$ -	$ 97,306	$ 38,047	$ 10,167	$ 14,671	$ 9,726	$ -	$ 72,611
8	$ 51,158	$ 13,670	$ 19,726	$ 13,078	$ -	$ 97,631	$ 36,357	$ 9,715	$ 14,019	$ 9,294	$ -	$ 69,385
9	$ 51,328	$ 13,716	$ 19,792	$ 13,121	$ -	$ 97,957	$ 34,741	$ 9,283	$ 13,396	$ 8,881	$ -	$ 66,301
10	$ 51,499	$ 13,761	$ 19,858	$ 13,165	$ -	$ 98,283	$ 33,197	$ 8,871	$ 12,800	$ 8,486	$ -	$ 63,354
TOTALS	$ 507,310	$ 135,559	$ 195,615	$ 129,687	$ -	$ 968,172	$ 410,763	$ 109,761	$ 158,387	$ 105,007	$ -	$ 783,918

Alternative 3: RRFB+High Visibility Crosswalks

Period	Year	AADT	Crash Data Entry		CMF 1			CMF 2			Combined CMF		Adjusted Crashes					
			Estimated Crashes		All	KABC	PDO	All	KABC	PDO								
			KABC	PDO	0.53			0.60			KABC	PDO	KABC	Fatal	Injury A	Injury B	Injury C	PDO
1	2028	13000	0.41	0.00	0.53	0.53	0.53	0.60	0.60	0.60	0.55	0.55	0.22	0.00	0.02	0.09	0.11	0.00
2	2029	13044	0.41	0.00	0.53	0.53	0.53	0.60	0.60	0.60	0.55	0.55	0.22	0.00	0.02	0.09	0.11	0.00
3	2030	13089	0.41	0.00	0.53	0.53	0.53	0.60	0.60	0.60	0.55	0.55	0.22	0.00	0.02	0.09	0.11	0.00
4	2031	13133	0.41	0.00	0.53	0.53	0.53	0.60	0.60	0.60	0.55	0.55	0.23	0.00	0.02	0.09	0.11	0.00
5	2032	13178	0.42	0.00	0.53	0.53	0.53	0.60	0.60	0.60	0.55	0.55	0.23	0.00	0.02	0.09	0.11	0.00
6	2033	13222	0.42	0.00	0.53	0.53	0.53	0.60	0.60	0.60	0.55	0.55	0.23	0.00	0.02	0.09	0.11	0.00
7	2034	13266	0.42	0.00	0.53	0.53	0.53	0.60	0.60	0.60	0.55	0.55	0.23	0.00	0.02	0.09	0.11	0.00
8	2035	13311	0.42	0.00	0.53	0.53	0.53	0.60	0.60	0.60	0.55	0.55	0.23	0.00	0.02	0.09	0.11	0.00
9	2036	13355	0.42	0.00	0.53	0.53	0.53	0.60	0.60	0.60	0.55	0.55	0.23	0.00	0.02	0.09	0.11	0.00
10	2037	13400	0.42	0.00	0.53	0.53	0.53	0.60	0.60	0.60	0.55	0.55	0.23	0.00	0.02	0.09	0.11	0.00
TOTALS		-	4.16	0.00	-	-	-	-	-	-	-	-	2.27	0.04	0.21	0.93	1.09	0.00

Period	Crash Costs by Year (2028 - 2037)						Crash Costs in 2028 Dollars					
	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal	Injury A	Injury B	Injury C	PDO	Total
1	$ 51,786	$ 13,838	$ 19,968	$ 13,238	$ -	$ 98,830	$ 51,786	$ 13,838	$ 19,968	$ 13,238	$ -	$ 98,830
2	$ 51,963	$ 13,885	$ 20,036	$ 13,284	$ -	$ 99,168	$ 49,488	$ 13,224	$ 19,082	$ 12,651	$ -	$ 94,445
3	$ 52,139	$ 13,932	$ 20,105	$ 13,329	$ -	$ 99,505	$ 47,292	$ 12,637	$ 18,235	$ 12,090	$ -	$ 90,254
4	$ 52,316	$ 13,980	$ 20,173	$ 13,374	$ -	$ 99,843	$ 45,193	$ 12,076	$ 17,426	$ 11,553	$ -	$ 86,248
5	$ 52,493	$ 14,027	$ 20,241	$ 13,419	$ -	$ 100,180	$ 43,186	$ 11,540	$ 16,652	$ 11,040	$ -	$ 82,418
6	$ 52,670	$ 14,074	$ 20,309	$ 13,464	$ -	$ 100,518	$ 41,268	$ 11,027	$ 15,913	$ 10,550	$ -	$ 78,758
7	$ 52,847	$ 14,121	$ 20,377	$ 13,510	$ -	$ 100,855	$ 39,435	$ 10,538	$ 15,206	$ 10,081	$ -	$ 75,260
8	$ 53,024	$ 14,169	$ 20,446	$ 13,555	$ -	$ 101,193	$ 37,683	$ 10,069	$ 14,530	$ 9,633	$ -	$ 71,916
9	$ 53,201	$ 14,216	$ 20,514	$ 13,600	$ -	$ 101,530	$ 36,008	$ 9,622	$ 13,885	$ 9,205	$ -	$ 68,720
10	$ 53,378	$ 14,263	$ 20,582	$ 13,645	$ -	$ 101,868	$ 34,408	$ 9,194	$ 13,267	$ 8,796	$ -	$ 65,665
TOTALS	$ 525,816	$ 140,504	$ 202,751	$ 134,418	$ -	$ 1,003,489	$ 425,747	$ 113,765	$ 164,165	$ 108,837	$ -	$ 812,514

Alternative 4: Pedestrian Hybrid Beacon

Period	Year	AADT	Crash Data Entry		CMF 1			CMF 2			Combined CMF		Adjusted Crashes					
			Estimated Crashes		All	KABC	PDO	All	KABC	PDO								
			KABC	PDO	0.31						KABC	PDO	KABC	Fatal	Injury A	Injury B	Injury C	PDO
1	2028	13000	0.41	0.00	0.31	0.31	0.31	-	-	-	0.31	0.31	0.13	0.00	0.01	0.05	0.06	0.00
2	2029	13044	0.41	0.00	0.31	0.31	0.31	-	-	-	0.31	0.31	0.13	0.00	0.01	0.05	0.06	0.00
3	2030	13089	0.41	0.00	0.31	0.31	0.31	-	-	-	0.31	0.31	0.13	0.00	0.01	0.05	0.06	0.00
4	2031	13133	0.41	0.00	0.31	0.31	0.31	-	-	-	0.31	0.31	0.13	0.00	0.01	0.05	0.06	0.00
5	2032	13178	0.42	0.00	0.31	0.31	0.31	-	-	-	0.31	0.31	0.13	0.00	0.01	0.05	0.06	0.00
6	2033	13222	0.42	0.00	0.31	0.31	0.31	-	-	-	0.31	0.31	0.13	0.00	0.01	0.05	0.06	0.00
7	2034	13266	0.42	0.00	0.31	0.31	0.31	-	-	-	0.31	0.31	0.13	0.00	0.01	0.05	0.06	0.00
8	2035	13311	0.42	0.00	0.31	0.31	0.31	-	-	-	0.31	0.31	0.13	0.00	0.01	0.05	0.06	0.00
9	2036	13355	0.42	0.00	0.31	0.31	0.31	-	-	-	0.31	0.31	0.13	0.00	0.01	0.05	0.06	0.00
10	2037	13400	0.42	0.00	0.31	0.31	0.31	-	-	-	0.31	0.31	0.13	0.00	0.01	0.05	0.06	0.00
TOTALS		-	4.16	0.00	-	-	-	-	-	-	-	-	1.28	0.02	0.12	0.53	0.62	0.00

Period	Crash Costs by Year (2028 - 2037)						Crash Costs in 2028 Dollars					
	Fatal	Injury A	Injury B	Injury C	PDO	Total	Fatal	Injury A	Injury B	Injury C	PDO	Total
1	$ 29,351	$ 7,843	$ 11,318	$ 7,503	$ -	$ 56,015	$ 29,351	$ 7,843	$ 11,318	$ 7,503	$ -	$ 56,015
2	$ 29,451	$ 7,870	$ 11,356	$ 7,529	$ -	$ 56,206	$ 28,049	$ 7,495	$ 10,815	$ 7,170	$ -	$ 53,529
3	$ 29,551	$ 7,896	$ 11,395	$ 7,554	$ -	$ 56,397	$ 26,804	$ 7,162	$ 10,335	$ 6,852	$ -	$ 51,154
4	$ 29,652	$ 7,923	$ 11,433	$ 7,580	$ -	$ 56,589	$ 25,614	$ 6,844	$ 9,877	$ 6,548	$ -	$ 48,883
5	$ 29,752	$ 7,950	$ 11,472	$ 7,606	$ -	$ 56,780	$ 24,477	$ 6,541	$ 9,438	$ 6,257	$ -	$ 46,713
6	$ 29,852	$ 7,977	$ 11,511	$ 7,631	$ -	$ 56,971	$ 23,390	$ 6,250	$ 9,019	$ 5,979	$ -	$ 44,638
7	$ 29,952	$ 8,004	$ 11,549	$ 7,657	$ -	$ 57,162	$ 22,351	$ 5,972	$ 8,618	$ 5,714	$ -	$ 42,656
8	$ 30,053	$ 8,030	$ 11,588	$ 7,683	$ -	$ 57,354	$ 21,358	$ 5,707	$ 8,235	$ 5,460	$ -	$ 40,760
9	$ 30,153	$ 8,057	$ 11,627	$ 7,708	$ -	$ 57,545	$ 20,409	$ 5,453	$ 7,869	$ 5,217	$ -	$ 38,949
10	$ 30,253	$ 8,084	$ 11,665	$ 7,734	$ -	$ 57,736	$ 19,501	$ 5,211	$ 7,520	$ 4,985	$ -	$ 37,217
TOTALS	$ 298,021	$ 79,635	$ 114,915	$ 76,185	$ -	$ 568,755	$ 241,304	$ 64,479	$ 93,045	$ 61,686	$ -	$ 460,515

Example 3

This example provides a walkthrough of the Safety Certification Process when an alternative has a lower cost than perpetuation of the existing highway conditions (i.e. Future No Build). This example is an abbreviated document which excludes certain materials and steps. This example helps demonstrate how to compare alternatives when one of the build conditions is less costly than rebuilding existing conditions and how to set up the alternative as a base case within IHSDM. See Example 1 for a more detailed walkthrough of what is needed as part of a complete SCD.

The information within this example was adjusted and modified for example purposes only and is not representative of the actual conditions.

Project Description:

An intersection pavement replacement project is programmed for a rural highway. When performing the *Network Screening for Safety Sites of Promise*, one intersection was identified as a Safety Site of Promise. A *Diagnosis of Safety Sites of Promise* was performed, and the location had several crashes that could be mitigated with safety improvements.

Example Description:

This example shows how to compare alternatives when one of the build conditions is cheaper than perpetuation of the existing highway conditions.

To: **EXAMPLE**
The information within this example was adjusted and modified for example purposes only and is not representative of the actual conditions.

From: WisDOT – Bureau of Traffic Operations

Date: 6/1/2023
RE: Design ID: XXXX-XX-XX
Construction ID: XXXX-XX-XX
Highway: STH 73/80
Project Title: City of Pittsville
Project Subtitle: STH 73 and STH 80 Intersection
Wood County
Scheduled Construction Year: 2027
Improvement Concept Code: PVRPLA

Having considered the safety performance of the existing corridor and any proposed improvements, we believe this document reflects the intent of the policy and guidelines described in section 11-38 of the Wisconsin Facilities Development Manual.

If applicable, having considered the operational performance of the existing corridor and any proposed improvements, we believe this document reflects the intent of the policy and guidelines described in section 11-52 of the Wisconsin Facilities Development Manual.

Preparer:

_______________________________________ ________
Region Analyst Date

Approval:

_______________________________________ ________
Bureau of Traffic Operations Date
Traffic Engineering and Safety Section

_______________________________________ ________
Region Supervisor Date

1. Certification Processes Completed

1.1. According to FDM 11-1-10 Attachment 10.1, does the improvement concept code and scope of work require the Safety Certification Process to be completed? Yes ☒ No ☐

If yes is selected and alternatives are evaluated as indicated in Section 5, send to BTO at DOTBTOSafetyEngineering@dot.wi.gov

1.2. Was the Operations Certification Process (FDM 11-52-15) completed for proposed improvements within this project? Yes ☐ No ☒

If yes, send to BTO at DOTTrafficAnalysisModeling@dot.wi.gov

2. Network Screening

2.1. Safety Sites of Promise

2.1.1. Did the project have Safety Sites of Promise from the network screening? Yes ☒ No ☐

List Safety Sites of Promise:
There were no flagged segments located within the project limits.

There was one flagged intersection located within the project limits:
IX_71_03495: STH 73 at STH 80/CTH A

2.2 Operational Sites of Promise (If Applicable)

2.2.1 Did the project identify Operational Sites of Promise from the network screening? Yes ☐ No ☐ N/A ☒

2.2.2 Did the project identify Operational Sites of Promise based on local knowledge? Yes ☐ No ☐ N/A ☒

List Operational Sites of Promise:

2.3 Additional Sites

2.3.1 Were additional sites evaluated? Yes ☐ No ☒

List sites:

3. Diagnosis

3.1. Diagnosis of Crashes

3.1.1. Did relevant crashes remain after crash vetting? Yes ☒ No ☐

3.1.2. If yes, list each site and discuss the crashes and contributing factors (including geometric conditions) for the remaining crash(es) or note that no crashes remained after the vetting process.

IX_71_03495: STH 73 at STH 80/CTH A

Six crashes remain after vetting. All six crashes were angle crashes.

- One crash was a southbound vehicle failing to yield to an eastbound vehicle.
- One crash was a southbound vehicle failing to yield to a westbound vehicle.
- Two crashes were northbound vehicles failing to yield to eastbound vehicles.
- Two crashes were northbound vehicles failing to yield to westbound vehicles.

Contributing Factors:

- All crashes at the intersection are angle crashes which vehicles from STH 80 and CTH A failed to yield to STH 73 traffic.
- The current intersection geometry was constructed 30 years ago with the anticipation that traffic signals would be warranted and installed during the pavement lifecycle. The existing intersection is a two-way stop-controlled (TWSC) intersection.
- STH 73 is a 2-lane highway with left and right turn lanes that are separated by curb and gutter
- STH 80/CTH A is a 2-lane highway that is stop-controlled with shared through and left turn lanes and a separated right turn lane with pork-chop islands
- STH 73 has a posted speed limit of 45 mph
- The STH 80 approach has a posted speed of 35 mph.
- The CTH A approach has a posted speed limit of 55 mph and has transverse rumble strips for the stop condition.
- The existing J-panel assembly signage may be obstructing vision of drivers. There are no other apparent sight distance concerns.

3.2 Diagnosis of Operational Issues (If Applicable)

3.2.1. Provide a narrative of existing operational concerns and geometric deficiencies contributing to the delay or queuing.

N/A

4. Countermeasure/Alternative Identification

4.1 Were alternatives analyzed in this project? Yes ☒ No ☐

For intersections only, a Phase I: Scoping Intersection Control Evaluation (ICE) is required if traffic control changes are considered. See FDM 11-25-3 for more information.

4.2. Provide a brief description of the alternative(s) and the contributing factors that are being targeted:

Location: STH 73 and STH 80/CTH A

Reason for improvement (check all that apply): Safety ☒ Operations ☐

Alternative(s)	General Description	How improvements address safety/operational issues
Alternative Name: Future No Build	This alternative will follow the programmed improvement concept and maintain existing conditions.	This alternative will not address the existing crash issues and trends.
Alternative Name: Reconstruct with new geometrics (TWSC)	This alternative will maintain the existing traffic control, but reduce the overall footprint based on current standards.	This will reduce the overall intersection footprint. Reducing the intersection size will provide better gap selection and shorten the crossing distance.
Alternative Name: Reconstruct with new geometrics (AWSC)	This alternative will change the control type to an all-way stop as well as reduce the overall footprint of the intersection.	This alternative will reduce crash potential and severity at the intersection. It will also shorten the crossing distance.

Alternative Name: Reconstruct with existing geometrics (AWSC)	This alternative will change the control type to an all-way stop and maintain the current intersection configuration.	This alternative will reduce the crash potential and severity at the intersection.
Alternative Name: Single-Lane Roundabout	This alternative will reconstruct the intersection into a single-lane roundabout.	This alternative will address the right angle crashes occurring at the intersection as well as reduce the overall footprint.

5. Analysis Results and Economic Appraisal

In this example, a proposed alternative is cheaper than perpetuation of the existing roadway geometry. In order to perform the economic analysis for this project, the future no build alternative needs to be swapped with the lowest cost alternative as the "base case". See Appendix D for how to complete this within IHSDM.

Analysis Location:	IX_71_03495: STH 73 at STH 80/CTH A
Safety Analysis Method:	Method 2
External CMF Value:	Alternative 2: 0.319 for all severities Alternative 3: 0.319 for all severities
External CMF Source:	WisDOT CMF Table
Unique Safety Analysis Notes:	None

		Alt. 1	No Build	Alt. 2	Alt. 3	Alt. 4
Alternative Name		Reconstruct with new geometrics (TWSC)	Future No Build	Reconstruct with new geometrics (AWSC)	Reconstruct with existing geometrics (AWSC)	Single-Lane Roundabout
Safety Certification Process (See FDM 11-38)	Fatal & Injury Crashes	3.8	2.0	1.2	0.6	2.9
	Property Damage Only Crashes	8.6	4.5	2.8	1.4	9.6
	Total Crashes	12.4	6.5	4.0	2.0	12.5
	Crash Cost Value	$1,384,247	$720,597	$442,693	$230,988	$725,639
	Project Cost	$1,072,000	$1,349,000	$1,104,000	$1,381,000	$2,248,000
	Net Safety Benefit	-	$663,650	$941,554	$1,153,259	$658,608
	Net Cost	-	$277,000	$32,000	$309,000	$1,176,000
	Safety B/C	-	2.4	29.4	3.7	0.60

6. Other Information

6.1. Describe other information relevant to the project such as community considerations, unique features, potential funding sources, etc.

Alternatives 2, 3 and 4 will be reviewed for Highway Safety Improvement Program (HSIP) funding.

ATTACHMENTS

Include all attachments in the final Safety & Operations Certification Document and submit as a single PDF.

This example is an abbreviated document and does not include all required attachments. For an example of a complete SCD with all attachments, see Example 1.

A. Project Information
    a. Project Location/Overview Map
B. Network Screening Documentation
    a. Meta-Manager spreadsheet
    b. Intersection Network Screening spreadsheet
    c. Overview Map of Safety Sites of Promise Locations (optional)
C. Diagnosis Documentation
    a. WisTransPortal crash data spreadsheet with vetting comments
    b. Crash Diagram(s)
D. Countermeasure/Alternative Identification
    a. Safety Certification Worksheet
    b. Layout/Schematic for each alternative
E. Analysis Results and Economic Appraisal
    a. Cost estimate for each alternative
    b. IHSDM Crash Prediction Evaluation Report for each alternative
    c. IHSDM Economic Analysis Report
    ~~d. Highway Safety Benefit-Cost Analysis Tool results (if applicable)~~
~~F. Operations Certification Summary (if applicable)~~
    ~~a. Turning movement counts~~
    ~~b. Diagram of traffic volumes for each analysis period~~
    ~~c. AWSC warrants~~
    ~~d. Signal warrants~~
    ~~e. Software reports for operation analysis~~
    ~~f. DT 1887~~
    ~~g. Exhibit highlighting queues vs. available storage for each analysis period~~
    ~~h. OCP Benefit-Cost Tool printouts~~

APPENDIX A
PROJECT INFORMATION

Certain attachments are not included with this example. See Example 1 for an example of a complete SCD with all available attachments.

APPENDIX B
NETWORK SCREENING DOCUMENTATION

Certain attachments are not included with this example. See Example 1 for an example of a complete SCD with all available attachments.

Flagged Intersections

XXXX-XX-XX
Wood County

APPENDIX C

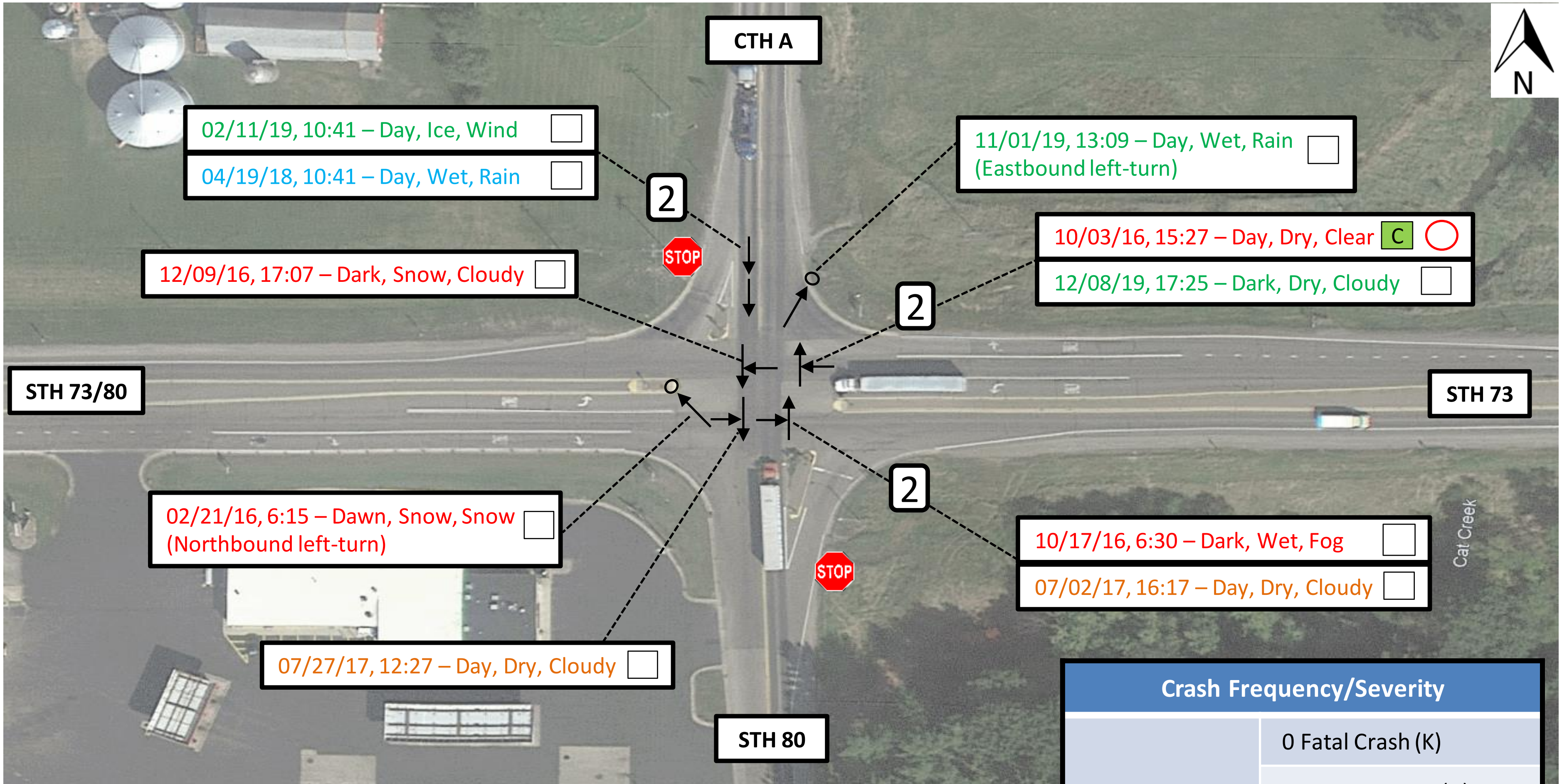
DIAGNOSIS DOCUMENTATION

Certain attachments are not included with this example. See Example 1 for an example of a complete SCD with all available attachments.

Sample crash data is not provided for this example.

See FDM 11-38 for sample of crash data documentation with vetting comments.

CRASH DIAGRAMS



LEGEND

CRASH YEAR	SEVERITY		CRASH TYPE
2016 = Red	Fatal (K)	K	Angle
2017 = Orange	Serious Injury (A)	A	Rear-end
2018 = Cyan	Minor Injury (B)	B	Head-on
2019 = Green	Possible Injury (C)	C	SS Same
2020 = Black	Property Damage (PD)		SS Opposite
			ROR Fixed Object
			ROR Overturn
	Alcohol or Drug Flag		ROR
			Pedestrian
			Bicycle

Crash Frequency/Severity	
10 Crashes	0 Fatal Crash (K)
	0 Serious Injury (A)
	0 Minor Injury (B)
	1 Possible Injury (C)
	9 Property Damage (PD)

16-20 Crash Diagram
STH 73 at STH 80/CTH A
Wood County

APPENDIX D
COUNTERMEASURE IDENTIFICATION, SAFETY EVALUATION AND ECONOMIC APPRAISAL DOCUMENTATION

Certain attachments are not included with this example. See Example 1 for an example of a complete SCD with all available attachments.

IHSDM: Change the "Base Case" Alternative

When an alternative is cheaper than perpetuation of the existing conditions, the "Base Case" alternative within IHSDM needs to be changed to whichever alternative has the lowest overall cost. In order to do this, when the lowest cost alternative is entered it needs to have the "*Is Base Case*" box selected. See Figure 1.

Figure 2 displays how an example project should look prior to running the Economic Analysis when the base case is replaced with a lower cost alternative.

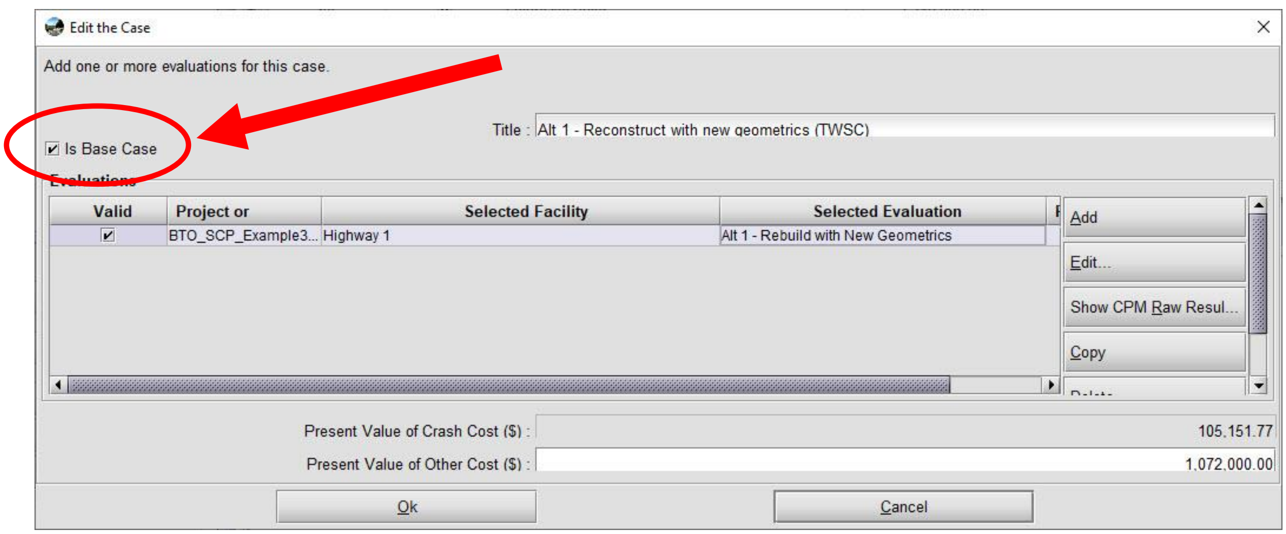


Figure 1: Base Case Selection Box

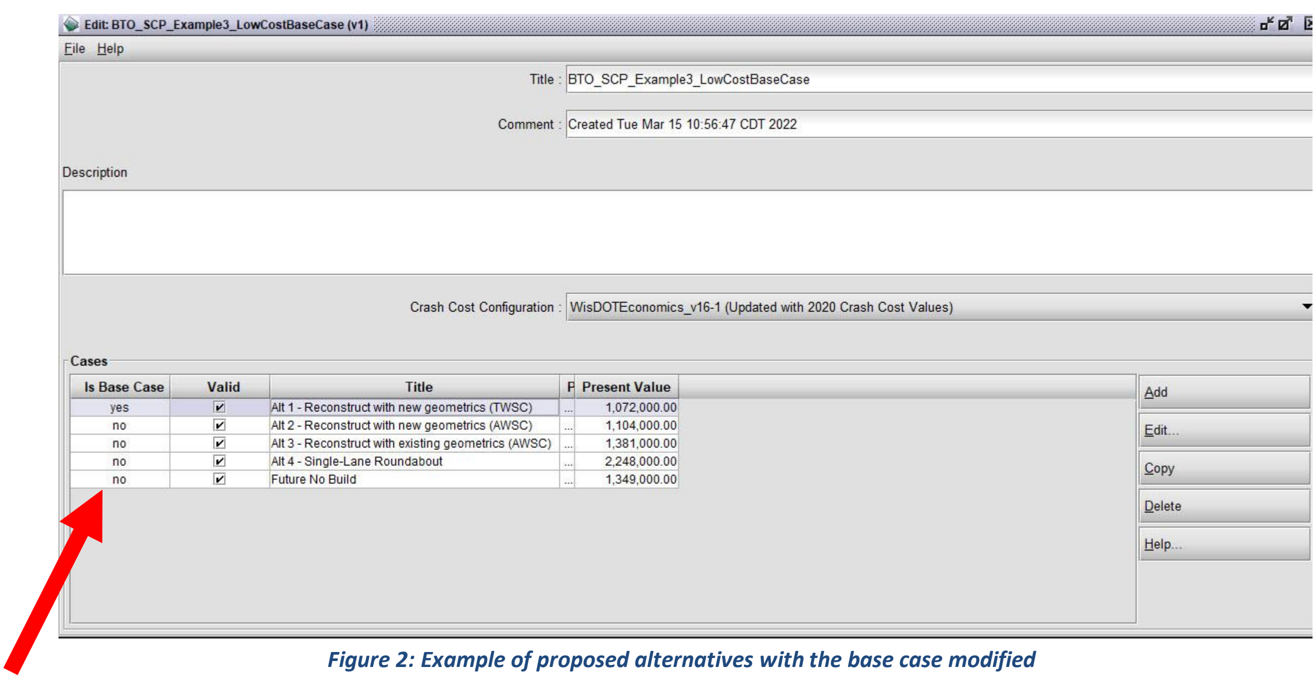


Figure 2: Example of proposed alternatives with the base case modified