BERGMANN
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Road Safety Audit Report

M-35 FROM FORD RIVER BRIDGE TO LAKE SHORE DRIVE

CS 21031 - JN 203002 EPE

January 2020

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1.0 Introduction

The State of Michigan, through the Governor's Traffic Safety Advisory Commission, has created a plan to help improve the traffic safety culture through the Strategic Highway Safety Plan and the Toward Zero Deaths statewide campaign. As part of the implementation of these plans, Road Safety Audits (RSA) are utilized to formally examine the safety performance of an existing or future road or intersection by an independent, multi-disciplinary team. The goal of an RSA is to answer the following questions:

- What elements of the road may present a safety concern: to what extent, to which road users, and under what circumstances?
- What opportunities exist to eliminate or mitigate identified safety concerns?

The subject roadway segments and approximate limits that were investigated for this RSA are described in the following table:

M-35 - CS 21031 - Escanaba & Ford River Township, MI						
Bound	**PR**	**BMP**	**EMP**	**Length (+/-)**	**Cross Section**	**County**
NEB SWB	1349006	11.0	15.6	4.6 Miles	2-Lane Rural Road	Delta

Table 1: RSA Location

This RSA was performed in the City of Escanaba and Ford River Township, Delta County, Michigan on November 6th and 7th, 2019 for the existing M-35 roadway segment from the Ford River bridge to Lake Shore Drive. The RSA study area also included the local road intersections and key access points within these limits. The project location is depicted on the aerial shown on Figure 1. The RSA was conducted in a manner consistent with the Federal Highway Administration (FHWA) *Road Safety Audit Guidelines* adopted by the Michigan Department of Transportation (MDOT).

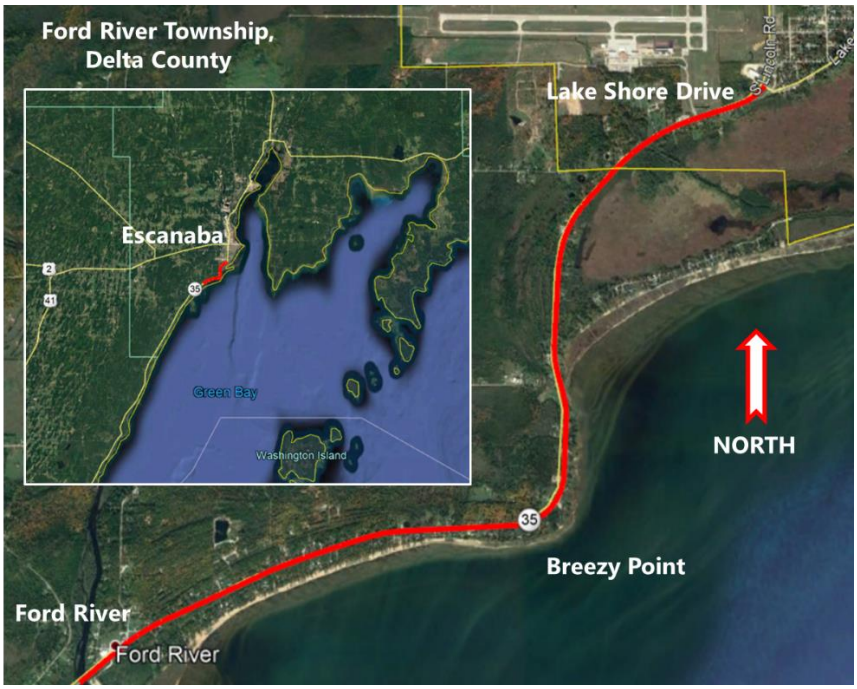

Figure 1: RSA Study Area

2.0 Road Safety Audit

2.1 RSA TEAM

The RSA Team was comprised of state representatives and led by members of the consultant team. The Team consisted of knowledgeable individuals with diverse areas of expertise including geometrics, operations, and safety. The RSA Team included the following individuals:

- **Jason Ealy**, MDOT Geometrics
- **Jack Frost**, MDOT Traffic & Safety
- **Jason Cole**, MDOT Operations
- **Timothy J. Likens**, Bergmann
- **Steven Russo**, Bergmann

2.2 RSA OVERVIEW

An RSA is a proactive, formal safety performance examination of an existing (or future) transportation facility by an unbiased, multidisciplinary team. An RSA considers the safety of all users, examines the interaction between the facility and user, identifies risks to users, and suggests safety improvement measures. An RSA is not a check of adherence to published standards. RSAs involve an on-site field investigation as well as review of available plans and data. The goal is to suggest measures with the potential to prevent crashes from occurring and/or suggestions with the potential to mitigate the severity of a crash if one occurs.

The study limits of M-35 were selected for an RSA by MDOT based on current project programming practices. The RSA was conducted in a manner consistent with the FHWA *Road Safety Audit Guidelines*. The assessment took place between November 6th (kick-off meeting, office reviews, afternoon and nighttime field visits) and November 7th (morning field visit, synthesis and prioritization of observations, and presentation of findings), 2019.

Information utilized by the RSA Team during the course of the assessment included the following:

- Aerial photographs;
- Traffic volume data;
- Crash data and safety studies;
- Available roadway plans;
- Adjacent land use information; and
- Known safety concerns.

2.2.1 RSA Kick-Off Meeting

On the morning of November 6th, a kick-off meeting was held at the State Office Building in Escanaba. In attendance were all members of the RSA Team, MDOT Crystal Falls TSC and Superior Region staff, City of Escanaba staff (including public safety), Delta County Sheriff's Lieutenant, Michigan State Police, Delta County Road Commission, and other local stakeholders. The purpose of this meeting was to provide those in attendance an overview of the RSA process and the work that would be completed by the RSA Team.

MDOT, County, City, and local stakeholders also provided background information to the RSA Team relative to their anecdotal knowledge and history of the study area. Key information provided included:

- Five-year (2014-18) historical crash data indicate two A-level incapacitating injury crashes and one fatal crash on the study segment. A second fatal crash occurred in 2019.
- Pedestrian and bicycle activity are regularly observed on the shoulders, particularly during the summer months in the vicinity of the residential cottages SW of Breezy Point.
- A pedestrian crash was stated to have occurred in the past, but the date was not determined, and the most recent five years of data indicate no pedestrian or bicycle crashes on this road segment.
- This route is a State Recreational Byway, which may attribute to encouraged use of the shoulders for bicycles and pedestrians.
- Commercial (heavy vehicle) traffic is significantly noticeable on this route.
- Travel speeds are generally above posted speed, particularly on the SW bound leaving Escanaba, where drivers tend to pick up speed quickly entering the more rural context.
- Local stakeholders have frequently requested a lower speed limit, in contrast to apparent prevailing speeds.
- Driveway density is high along the corridor, particularly given the frequency of individual residential parcels.
- Vehicles often use the wide paved shoulders to pass left turning vehicles on the right, or to get out of the traffic stream due to typical speed and heavy vehicle composition of trailing platoons.
- Mail delivery and summer lawn maintenance services also stage on the wide paved shoulders.
- Delta County provides winter maintenance services for this roadway. There are frequent challenges with keeping the roadway clear of ice and snow between Ford River and Breezy Point.
- Several drainage structures in the study area have experienced blockages and flow issues due to current lake levels, which has resulted in isolated flooding near the road surface.
- The Ford River boat launch is planning on paving improvements to the parking area, which is expected to increase vehicle / boat trailer traffic at this location.
- The Michigan Department of Natural Resources (DNR) has a recreational area at the end of Portage Point Lane that was recently improved, which may attract additional vehicle traffic.
- Left turn movements are of concern at the Breezy Point bar / restaurant, and Portage Point Lane, although conditions may not meet warranting criteria for left turn treatments.
- This corridor has been investigated several times for safety funding, potentially including a center lane for left turns.
- At the northern end of the study area, the inside SWB lane of the four-lane section has recently been converted into a center lane for left turns.
- Horizontal curves on this roadway, particularly at Breezy Point, may contribute to lane departure and even rollover crashes.

2.2.2 RSA Team Reviews

Following the RSA Kick-off meeting (on the morning of November 6th), the RSA Team convened in the State office conference room to review background information and project data. The RSA Team next went into the field to conduct a daytime site visit. Weather conditions were cold with partial sun and clouds. The site visit was documented with digital images supplemented by notes and sketches. That same evening, the RSA Team conducted a review of the corridor under darkness, making additional notes relevant to nighttime observations.

The Team noted that weekday traffic volumes on this route were relatively consistent throughout the daytime period. Neither the RSA Team nor the MDOT stakeholders identified particular times of peak commuting activity in either direction.

The RSA Team reconvened on November 7th to complete field reviews and synthesize observations, notes, and recommendations. Preliminary findings and suggestions for safety improvements were discussed and documented. Relative likelihood and severity of crash occurrence for each safety related finding were reviewed, rated, and prioritized based on a consensus by the RSA Team.

2.2.3 RSA Findings Meeting

In the early afternoon on November 7th, the findings compiled by the RSA Team were presented to MDOT. During the course of the findings meeting, there were some discussions to elaborate on the observations and findings of the RSA Team as well as reflect relevant information back to the RSA Team from the project Owners. The information, observations, and findings presented at this meeting are further documented in this report.

2.3 STUDY AREA CHARACTERISTICS, OPERATIONS, AND SAFETY

The project section of M-35 is a principal arterial with a posted speed limit of 50 miles per hour (mph). M-35 generally traverses in the north-south directions through Michigan's Upper Peninsula between Wisconsin and Marquette, MI. In the study area, M-35 follows a northeast-southwest path along the western shore of at the mouth of Little Bay de Noc (Lake Michigan). This portion of M-35 has several horizontal alignment changes and curves as the route navigates along the shoreline.

Within the study limits M-35 traffic is free flow, with minor approaches under STOP control. The MDOT-owned Right-Of-Way (R.O.W.) along this segment of M-35 varies, with a minimum typical width of 100 feet. The ROW and horizontal alignment have been modified as recently as 1992 to facilitate improved horizontal curves, as illustrated on Figure 2.

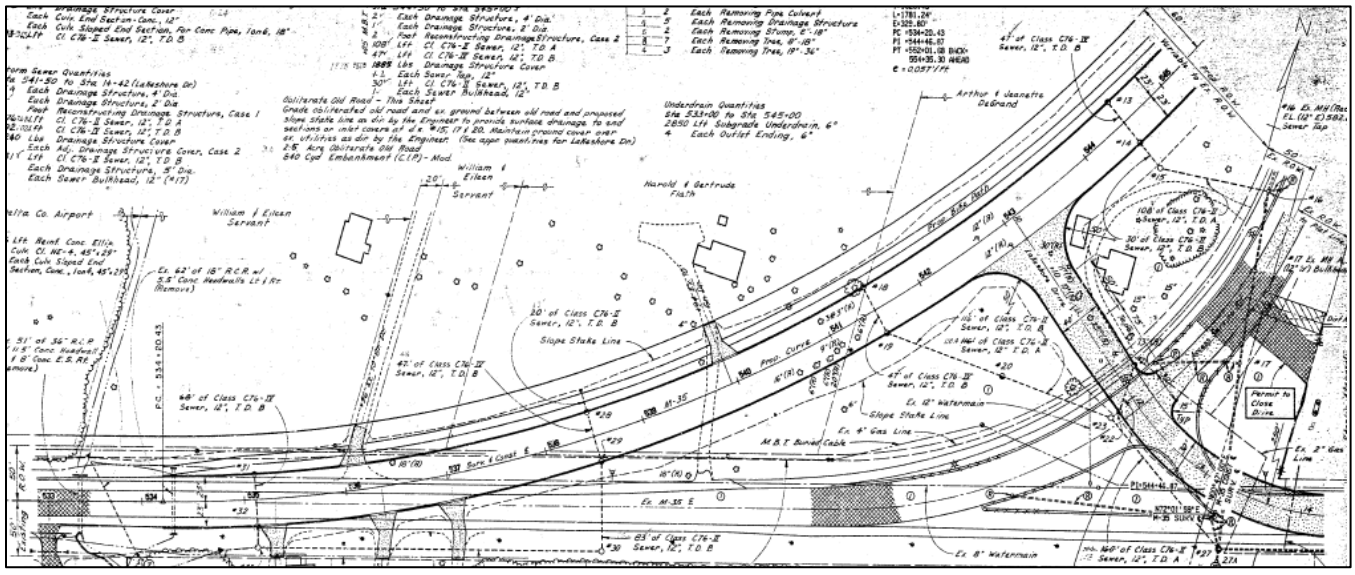

Figure 2: M-35 Horizonal Curve at Lake Shore Drive

This route has a typical two-lane cross section, with 12-foot lanes and 8-foot shoulders on both bounds. Drainage is mostly open ditching with spot enclosures and cross culverts, with curb where the section widens to four lanes approaching Lake Shore Drive from the southwest, near the City of Escanaba limits. Turn lanes are generally not provided at cross streets and driveways, except at Airport Road. Grades are moderately flat, with some steeper side slopes near the shoreline. The route is typically lined with woods and other fixed objects; however roadside slopes appear generally recoverable. Guardrail is appropriately provided at the structures over the Ford River and Portage Creek.

Primary adjacent land uses are residential, with spot commercial uses including restaurants and convenience stores. The highest concentration of residential parcels exists between the Ford River and Breezy Point, which is lined with cottage style residences and rental properties. There is also a concentration of homes along Portage Point Lane, which intersects M-35 north of Breezy Pont. The majority of surrounding land is natural and undeveloped including woods and wetlands. The Delta County Airport is located at the north end of the study limits.

Average Daily Traffic (ADT) volumes on this segment of M-35 were identified based on data obtained from the MDOT Transportation Data Management System (TDMS). Daily traffic volume counts were collected near Lake Shore Drive and the Ford River in 2018 and 2019, respectively. These data indicate that the ADT approaches 5,000 at the southern end of the project, and 10,000 into the City of Escanaba. Traffic is comprised of approximately 18% heavy vehicles. Particularly in the summer months, other road users include pedestrians and bicyclists, specifically using the roadway shoulder.

As noted by the RSA Team and reflected by these data, typical weekday traffic volumes on the route are relatively consistent throughout the daytime period, with no particular directionality. Two-way volumes are generally in the range of 300 to 350 vehicles per hour near the Ford River between the hours of 9:00 AM and 5:00 PM. At Lake Shore Drive, two-way volumes are between 600 and 700 vehicles per hour during this time period. Congestion is not known to be an issue on this route; however, turning movements are known to interrupt through vehicles, which are often platooned and include heavy trucks.

Despite the degree of horizontal curvature on this route, sightlines along M-35 appear to be generally adequate and appropriate to posted speeds. Particular issues related to intersection sight distance are noted in the RSA findings that follow. Superelevation at the Lake Shore Drive and Breezy point horizontal curves is noticeable from both a visual and driver comfort perspective. Traffic control signs and markings on the route are generally appropriate and visible. Reflectors, vertical reflective panels, and chevrons provide positive delineation for horizontal curves and other warning signs. Lighting along the corridor is regularly spaced on the north end, with all intersections lit overhead.

Figure 3: Horizontal Curve at Breezy Point

2.3.1 Crash History

Crash data were provided by MDOT for the period from January 1st, 2014 through May 1st, 2019, inclusive. These data included CS 21031 from BMP 11.11 to EMP 15.57, which is representative of the RSA study limits. These data indicate that a total of 41 crashes occurred on (or on immediate approach to) the study segment of M-35 during the 5 1/3 year period, excluding animal crashes.

Bergman also obtained data for the approximate project limits from 2014-2018 from the Michigan Traffic Crash Facts website, which references the Michigan State Police database. These data demonstrate similar results relative to crash type and severity, and in addition indicate that 60% of all crashes on this route are animal (deer) related. Tabulated crash summaries as provided by MDOT are shown by type and severity in Table 2 below.

Crash Type	Number of Crashes by Severity				
	Fatal	A Injury	B/C and Property Damage	Other	Total
Angle Driveway	0	0	2	0	2
Percent			100		
Angle Straight	0	0	3	0	3
Percent			100		
Fixed Object	1	0	14	0	15
Percent	6.7		93.3		
Head-On Left-Turn Not Associated with Driveway	0	0	1	0	1
Percent			100		
Misc. Multiple Vehicle	0	0	2	0	2
Percent			100		
Misc. Single Vehicle	0	0	1	0	1
Percent			100		
Other Object	0	0	4	0	4
Percent			100		
Overturn	0	2	2	0	4
Percent		50	50		
Parking	0	0	1	0	1
Percent			100		
Rear End Driveway	0	0	1	0	1
Percent			100		
Rear End Straight	0	0	3	0	3
Percent			100		
Side-Swipe Opposite	0	0	2	0	2
Percent			100		
Side-Swipe Same	0	0	2	0	2
Percent			100		
Totals	1	2	38	0	41
Percent	2.4	4.9	92.7		

Table 2: Crash Data Summary

The majority of crashes were single vehicle types (24, 59% of non-animal). There were an additional 59 animal (typically, deer) crashes spread across the corridor, with a noted concentration near the Ford River. Other multi-vehicle types (17) included angle, rear-end, and sideswipe crashes. The vast majority (85%) of all crashes resulted in property damage only (PDO), with 10 C-level possible injuries, and 2 B-level non-incapacitating injuries. Within the approximate five-year reporting period, there were also two A-level incapacitating injury crashes and one fatal crash on the study segment of M-35. A second fatal crash occurred in 2019 outside of the reporting period. The 2016 fatal crash involved an apparently intoxicated (drugs) driver departing the roadway and striking a tree north of the Ford River. The more recent 2019 fatal crash occurred when a passenger vehicle crossed the center line between the Ford River and Breezy Point, and was struck head-on by a truck. One A-level injury crash involved an overturned truck rounding Breezy Point, and the other a motorcycle that was fleeing police.

Overall, there was no particular location of note with a concentrated frequency or elevated severity of crashes. Crashes were generally spread along the corridor, with no more than 4 crashes occurring (over 5 years) in any single quarter-mile segment. The histogram shown on Figure 4 does not indicate any roadway features (i.e. intersection, horizontal curve) that are contributing to a concentration of crashes at a particular location. The majority (55%) of non-animal crashes occurred in icy, snowy, or wet conditions.

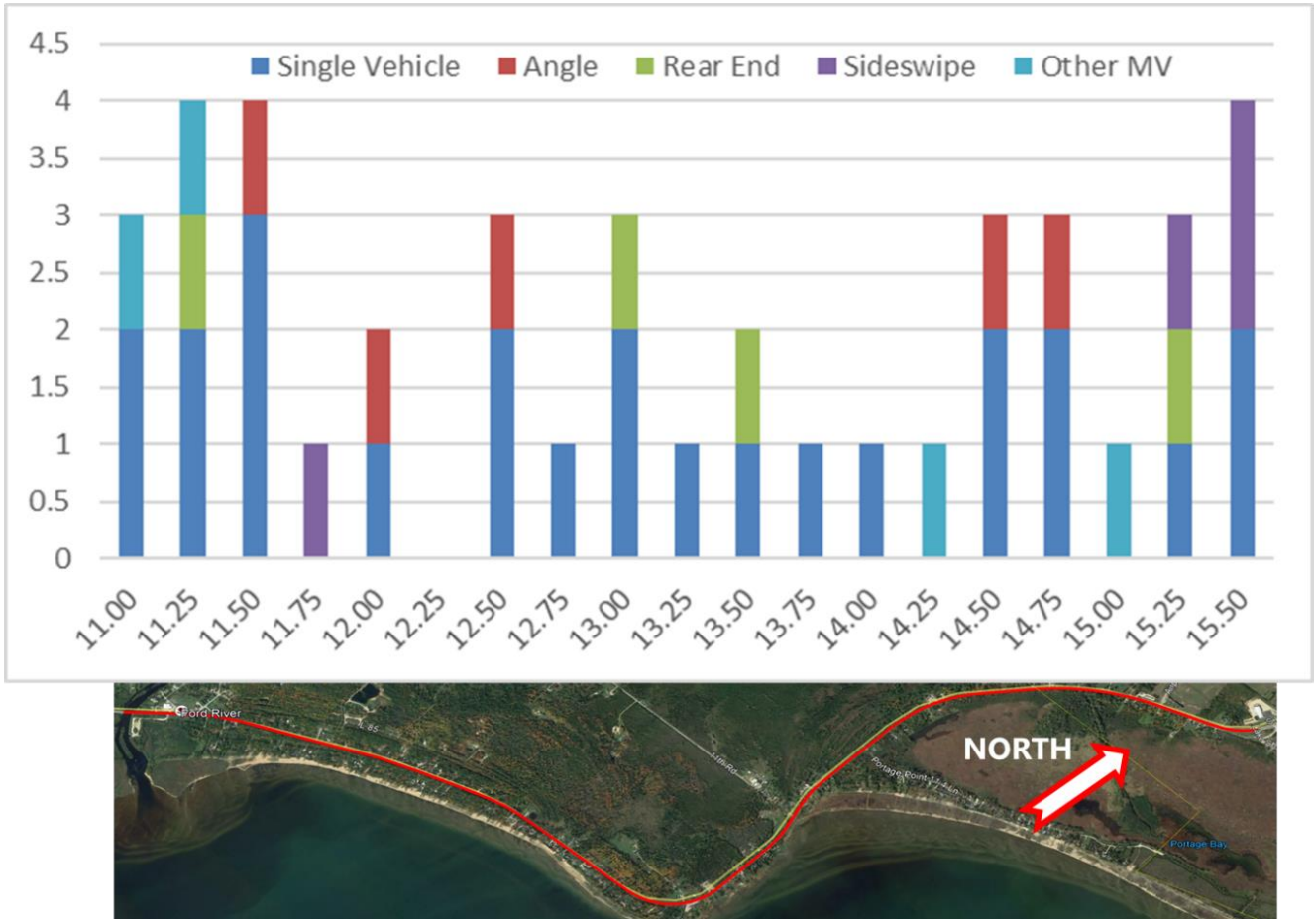

Figure 4: Crash Frequency (non-animal)

3.0 Safety Benefit & Performance

This report provides information on issues identified by the RSA Team and deemed relevant to the stated goal of identifying opportunities to improve road safety within the study area. Opportunities to improve safety on M-35 are outlined herein based on observations and expertise of the RSA Team. Where appropriate, an assessment of road user safety risk and suggestions for improvement are included. A draft of this report was prepared by the consultant team and circulated among all RSA Team members for review prior to being finalized. The findings of this report were developed based on discussions throughout the RSA process and consensus by all RSA Team members. Upon acceptance, MDOT will prepare a formal Owner's Response which will also be appended to the Report.

The suggestions and illustrations (e.g. exhibits and photographs) should not be viewed as design or operational recommendations. They are intended to be illustrative of existing issues and potential solutions to identified safety issues. They are presented for consideration only. Based on the information provided in this report and other potential considerations, some suggestions may be rejected via a formal Owner's Response. Depending on the complexity of an accepted suggestion, subsequent tasks may include the completion of detailed engineering studies, further benefit-cost assessments, identification of funding partners, environmental studies, detailed design, and ultimately construction.

3.1.1 Estimating Benefits

For comparative purposes, where possible, a benefit-to-cost ratio has been calculated for the key safety improvements that have been suggested for consideration. This ratio compares the net annual benefits resulting from an individual improvement to the annual installation cost over the expected service life of the improvement. A five-step process was utilized to determine this ratio as follows:

1. Estimate the expected crash frequency at each location of interest.
2. Estimate the change in crashes by severity for each suggested safety improvement.
3. Estimate the net benefit resulting from the change in crashes.
4. Estimate cost for installation of each suggested safety improvement.
5. Calculate the annual benefit-to-cost ratio.

The *Highway Safety Manual* (HSM) provides a structured methodology to estimate expected crash frequency and severity for facilities with known characteristics. The HSM was utilized to determine average expected crash frequencies based on statistics for similar facilities as well as available crash history. To estimate the expected crash frequency at each location of interest, predictive methods of the HSM were referenced from Chapter 10 (Rural Two-Lane, Two-Way Roads) and Chapter 11 (Rural Multilane Highways). Although the northern ¼ mile 4-lane section of M-35 is entering the City of Escanaba, this section still holds a rural context, which is consistent with the majority of the study route.

Once average crash frequency was estimated, methodologies presented in Chapter 13 (Roadway Segments) of the HSM were referenced to estimate the change in crashes resulting from each safety improvement based on relevant Crash Modification Factors (CMF). CMFs quantify the change in expected average crash frequency by implementing a particular improvement. After the change in crashes was determined for each safety improvement, traffic crash costs by casualty / severity were used to estimate the resultant net benefit. Crash costs were determined based on data published by the University of Michigan Transportation Research Institute (UMTRI) as well as FHWA.

Installation costs for each safety improvement were estimated based on typical values, annualized service life, and a five percent (5.00%) discount rate, where applicable. Cost estimates were developed on generalized order of magnitude basis and not actual unit pricing. Finally, an annual benefit-to-cost ratio was calculated for relevant suggestions and can be used to evaluate treatment options at locations identified by this RSA. Benefit-costs should not be referenced on an absolute basis to select nor disqualify any potential treatment. Rather, this information can be compared to draw conclusions for the relative efficacy of treatment options as well as order of magnitude cost considerations for short and long-term improvements.

3.1.2 Safety Performance

The application of HSM methodologies is being advanced nationally and in the State of Michigan through the development of various spreadsheets and software. For the analysis of M-35, Safety Performance Functions (SPFs) included in the HSM Predictive Methods analysis spreadsheet developed by MDOT were utilized. HSM analysis of rural routes requires the overall roadway be broken down into homogeneous segments and intersections. As defined above, the study portion of M-35 typically has two lanes, which widens to four lanes for the northern ¼ mile of the study limits near Lake Shore Drive.

HSM analysis of M-35 was completed for the individual segments within the approximately 4.6-mile study limits. Crash data were reviewed to determine the number of crashes that occurred along project segments, and which crashes were related to each intersection (reported location, traffic control, turning movements). There are several local roads that intersect M-35 through the study area; however, most carry low volumes or experience little or no crash history. The five-year crash history indicates that four crashes coded as multi-vehicle intersection crashes have occurred in the vicinity of Lake Shore Drive. These four crashes included two sideswipe and two angle crashes; whereby the sideswipe crashes are more directly related to the widening to four lanes than the presence of an intersection. Therefore, intersections within the study limits were counted as driveways along each segment, as opposed to isolating each intersection for the purposes of HSM modeling.

Crash history was also disaggregated by single vehicle and multi-vehicle types to correspond with the HSM predictive calculations. Annual crash statistics were calculated with and without application of the Empirical Bayes (E-B) method, which references actual crash experience to account for regression to the mean. The actual crash experience for the corridor was identified as 8.2 non-animal crashes per year and 20.0 total crashes per year within the study limits of M-35.

The results of the HSM analysis indicate that this arterial roadway is predicted to experience approximately 16.4 crashes per year. The expected number of annual crashes is 17.5 with application of the E-B method. Crash type distributions were referenced from Table 10-4 of the HSM, as well as locally-derived (Michigan) values published by the Michigan Technological University Center for Technology & Training. HSM data indicate that 12.1% of all crashes on rural two-lane road segments are expected to involve collision with animal. In Michigan, this value is 67.7%. Although a direct correlation cannot be drawn, the delta between the actual observed frequency of crashes on M-35 and the predicted and expected values can be attributed to the proportionally high actual frequency (59%) of animal crashes.

Therefore, M-35 is performing in a manner consistent with the base physical and operational characteristics of similar sites based on HSM methodologies. This does not negate the potential opportunity to reduce crash occurrence and/or severity along the corridor.

4.0 Assessment Findings and Suggestions

The findings and suggestions of this RSA were developed by the RSA Team based on office reviews, field reviews, collaborative discussions, and via the drafting and review of this report. Each safety concern is outlined with a summary of relevant observations, an analysis of the associated risk, and a detailed list of suggestions intended to address each concern. These suggestions are based on the RSA Team's knowledge and understanding of current best practices and applicable safety enhancement treatments.

Each list of suggested safety concerns provided in the following subsections is presented according to risk categorization. A safety concern that has the potential to result in crashes that could have a generally *high severity* (potential to result in death or incapacitating injury) on a *frequent basis* may be categorized as an "F" (highest relative risk), while a safety concern that has the potential to result in crashes that could have a generally *low severity* (property damage only) on a *rare basis* may be categorized as an "A" (lowest relative risk). This is illustrated on Figure 5 below.

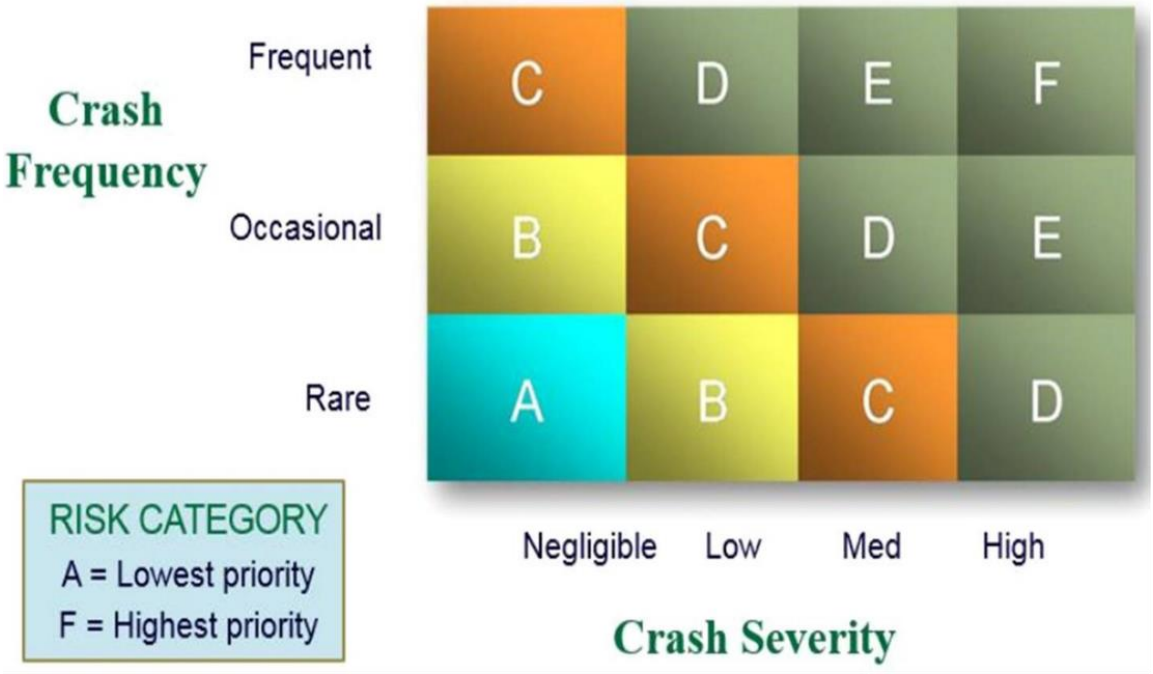

Figure 5: Prioritization of Safety Issues using Relative Risk

Safety concerns identified by the RSA Team are outlined in the following subsections from southwest to northeast along the M-35 study corridor, starting with overall corridor observations. Safety concerns are presented with suggested improvement measures, which are listed in order of increasing intensity from less invasive, lower cost treatments (i.e. signing and marking) to those that require reconstruction. Suggestions are presented independent of explicit costs, feasibility of installation, and benefit-cost analyses; however, relative factors are evaluated and summarized on a comparative basis in the subsequent section(s) of this report.

The effectiveness of lower-level (lower cost and easier implementation) treatments should be monitored, especially with respect to their ability to reduce the occurrence of severe crashes. If a particular treatment does not result in a measurable safety improvement, higher-level, more intense (greater cost and more complex implementation) treatments (or a combination thereof) may then be considered.

4.1 SAFETY CONCERNS

4.1.1 Safety Concern #1: Lane Departure Crashes

Observations: Overall, roadside slopes are generally recoverable within the study limits. However, this route is lined with trees, utility poles, mailboxes, and signs which are sometimes within the clear zone. Steeper slopes exist at spots along the shoreline, and a drop-off from the shoulder was noted on the north side of M-35 through the residential cottage area. Lane and shoulder widths are appropriate, with 12-foot lanes and 8-foot shoulders. The paved shoulders provide width for recovery for outside lane departures; however, M-35 lacks both centerline and shoulder corrugations throughout the limits of this RSA. Two locations were noted where trees had clearly been struck:

- South side of M-35 just north of the Ford River; and
- North side of M-35 in Cottage Section between the Ford River and Breezy Point (near "Son of a Beach" property).

Risk Analysis: The primary risk on roads without corrugations is lane departure. Severe outcomes have resulted from lane departure crashes, with two fatalities having occurred with a vehicle crossing the centerline. One resulted in a fatal single vehicle crash when the vehicle departed the far outside of the roadway and struck a tree. The other fatality was a result of a head-on collision with an oncoming truck. Two A-level injury crashes have occurred when vehicles departed the roadway to the outside and lost control. Review of UD-10 crash reports also indicates that several drivers have fallen asleep, resulting in lane departure crashes.

Frequency	Severity	Grade
Occasional	High	E

Table 3: Relative Risk Analysis of M-35 Safety Concern #1

Suggestions:

1. **Install Corrugations:** MDOT research has demonstrated significant crash, injury, and fatality reductions with this cost-effective treatment on rural roadways where the posted speed is 55 mph. Although current guidelines do not require corrugations for this 50 mph segment of M-35, such treatment should be considered.

Priority for Consideration: High

Figure 6: Tree Struck by Vehicle

4.1.2 Safety Concern #2: Intersection Safety

Observations: Most of the local road intersections are conspicuous upon approach, and the minor approaches have adequate sight distance along M-35. However, there are utility poles that appear to be within the clear zone along the corridor, which sometimes obscure sight distance. Vegetative growth exacerbates sight distance restrictions on some minor approaches, where brush limits a driver's ability to see around fixed objects such as utility poles.

All local road intersections within the RSA limits are "T" intersections. Minor approaches typically have no STOP bar; however, some do have vertical reflective panels on the STOP sign post. Minor roads also lack bi-directional arrow (W1-7) warning signs opposite of the T-approach to M-35 that would enhance awareness that the roadway ends. On M-35, intersections are not typically signed in advance, with neither an intersection warning sign (W2-2), nor with advance street name guide signs (D3-series). Existing street name signs for roads that intersect with M-35 are small, aged, and lack retroreflectivity.

Risk Analysis: Lack of sight distance at intersections can lead to angle crashes, which at high speeds can result in severe outcome. Failure to stop at minor approaches can also result in angle crashes with high-speed opposing traffic, or single vehicle roadway departure crashes. M-35 traffic may also experience rear-end or sideswipe crashes related to slowing and turning, particularly when approaching intersections are not conspicuous, leading to rapid braking. Concerns noted by the RSA Team related to specific study area intersections are outlined by location in the subsequent sections of this report.

Concern	Frequency	Severity	Grade
Sight Distance	Occasional	Medium	D
Conspicuity	Infrequent	High	

Table 4: Relative Risk Analysis of M-35 Safety Concern #2

Suggestions:

1. **Clear Brush:** Clearing overgrown vegetation, especially at intersections, would improve sight distance, and thus reduce the risk of crashes related to intersection sight distance.
2. **Enhance Signs & Markings:** Install STOP bars and W1-7 bi-directional arrow signs on and opposing minor road approaches. Install advanced intersection warning signs or improve street guide signs for traffic on M-35. Enhancements should be considered at local road intersections with higher traffic generation, including Lake Shore Drive, Airport Road, and Portage Point Lane; whereas additions to all local road intersections would likely result in over-signing for this route.

Priority for Consideration: Moderate

Figure 7: Utility Poles (left) and Minor Approach (right)

4.1.3 Safety Concern #3: Ford River Bridge Pedestrians

Observations: The Ford River Bridge, located at the western end of the study area, has a pedestrian walkway on the south side of the bridge. This walkway is separated from vehicular traffic by a concrete barricade, but does not connect directly to any other facility on either end of the bridge. There are signs of pedestrian activity, including a partially worn path leading from the bridge to the Ford River Boat Launch, worn wooden stairs connecting elevations between the bridge and the boat launch, and remnants of fishing supplies. Regardless of any restrictions on fishing from the bridge deck that may exist, fishing appears to occur off the southwest corner of the structure, to which the bridge provides connection from the boat launch.

A pedestrian connection between the bridge and the boat launch on the east side of the river passes over an apparent low marshy area and is likely impassable in wet conditions. In order to walk between the boat launch and the bridge, pedestrians would have to walk along the shoulder of M-35 until reaching the guardrail. Side slopes are difficult to traverse by foot, so pedestrians are likely to walk in front of the guardrail as well.

Risk Analysis: Pedestrians using the walkway area on the bridge to walk or fish are exposed to traffic at either end of the bridge, although the guardrail does provide some protection. The pathway connection down to the boat launch is not currently accessible due to disrepair of the wooden stairs, overgrowth on the path, and water, which may also lead to pedestrian injury.

Frequency	Severity	Grade
Rare	High	C

Table 5: Relative Risk Analysis of M-35 Safety Concern #3

Suggestions:

1. **Improve Pathway:** Rehabilitate the pedestrian connection between the bridge and the boat launch area. This would likely require paving, stairway reconstruction, and drainage culvert(s) to pass water under the path.

Priority for Consideration: Low

Figure 8: Pedestrian Connection at Ford River Boat Launch

4.1.4 Safety Concern #4: Sight Distance at Ford River Boat Launch

Observations: Sight distance is moderately limited when exiting the Ford River Boat Launch, especially looking to the southwest over the Ford River bridge. The RSA Team observations were made from a large van, with a driver eye height that is expected to be similar to vehicles that may be towing a trailer / boat. From this height, the bridge, guard rail, and barrier were not seen to be a significant obstruction; however, passenger vehicle sight distance would not extend beyond the bridge as clearly. The vertical profile was observed to more significantly impact sight distance than vegetation; however the tree line and brush do block the driver's view, depending where on the minor approach a vehicle is stopped.

The boat launch access is located approximately 650 feet to the northeast of the bridge, which may be due to minimum sight distance requirements. There may also be design considerations for this location relative to sight distance to the northeast and the horizontal curve. Although this location may meet geometric standards, the RSA Team believes there may also be opportunity to consolidate access on the north side of M-35 and align the boat launch access with the opposing drive(s) that are currently offset.

Risk Analysis: Vehicles exiting the boat launch may be at risk of angle crashes when turning onto M-35. This risk is exacerbated for vehicles pulling trailers from the boat launch as the exposure time is greater. Furthermore, boat trailers take longer to accelerate to prevailing speeds, increasing the risk of a rear-end collision on M-35.

Frequency	Severity	Grade
Infrequent	High	D

Table 6: Relative Risk Analysis of M-35 Safety Concern #4

Suggestions:

1. **Relocate Driveway:** Consider moving the boat launch access slightly further to the northeast, improving alignment with commercial access and/or 9.9 Lane (refer also to Section 4.1.5).
2. **Improve Vertical Profile:** If M-35 is reconstructed, vertical profile and sight distance should be reevaluated at the boat launch driveway, giving additional consideration to slower design vehicles and critical gaps pulling onto M-35 from the minor approach.

Priority for Consideration: Moderate

Figure 9: Sight Distance over Ford River Bridge

4.1.5 Safety Concern #5: Ford River Grill Access

Observations: Access for the Ford River Grill is provided by multiple access points. Two local roads, L15 and A26, both intersect M-35 within 350 feet, and intersect each other to form a triangular configuration. Additionally, the restaurant has a quasi-loop at the M-35 frontage. The local road approaches appear to have adequate sight distance; however the approaches are skewed to M-35, requiring the driver to turn their head back over their shoulder to view traffic approaching from the northeast.

The RSA Team agreed that the multiple intersections and access points in this area are redundant and access management strategies would improve safety at this location. The triangular property is owned by the Lions Club according to current GIS parcel data. The Ford River Lions Club facility is currently located to the north of M-35 on L15; therefore, there may be opportunity to utilize this parcel to improve access (and parking) for the restaurant, residential parcels, and the Lions Club via access management and intersection realignment. Improved access management on the north side of M-35 may also provide opportunities to tie in with improvements relative to the Ford River boat launch.

Risk Analysis: Angle crashes can result from drivers turning from these access points onto M-35, which can result in severe outcome due to speeds on M-35. The skewed angles of approach complicate sightlines, which elevates this risk. Driver confusion along M-35 relative to multiple access points can also result in rear-end and sideswipe crashes. This location is a higher traffic generator as compared to other area minor approaches, thus the comparative frequency was determined to be occasional.

Frequency	Severity	Grade
Occasional	High	E

Table 7: Relative Risk Analysis of M-35 Safety Concern #5

Suggestions:

1. **Consolidate Access:** Close redundant access points and work with the Ford River Grill to improve parking and circulation relative to L15 and M-35.
2. **Cul-de-sac A26:** Eliminate this redundant intersection to M-35 and provide access to the residential properties via a cul-de-sac off L15.
3. **Realign L15:** Align L15 to a perpendicular approach to M-35. This may provide additional space to improve restaurant access and parking, but may require ROW from the Lions Club parcel.

Priority for Consideration: High

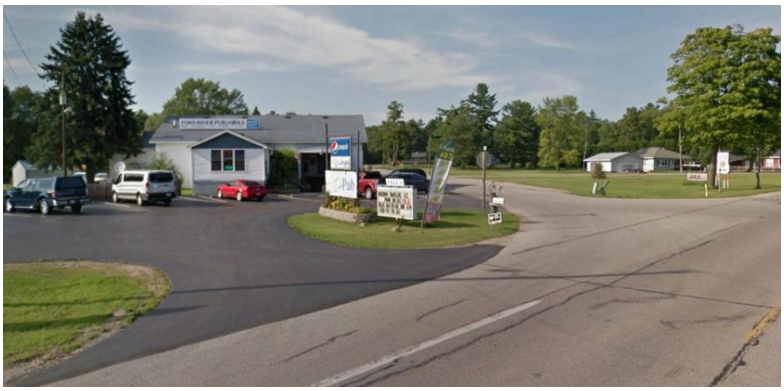

Figure 10: Ford River Grill Access

4.1.6 Safety Concern #6: Meister's Party Store Access

Observations: There are three areas of ingress / egress to Meister's Party Store, which are redundant and generally uncontrolled. These access points are separated by curbed and landscaped islands; however these islands are set back from the normal shoulder width, creating large paved areas between the travelled way and the parking area. During the summer months, this location is likely a popular destination for visitors and residents of the nearby cottages. Pedestrian and bicycle activity is likely, and current (July, 2018) Google Earth imagery shows a golf cart along the shoulder of M-35 at this location.

Risk Analysis: These access points provide no clear access, circulation, or parking pattern for patrons. Multiple uncontrolled access points in immediate proximity create the risk for rear-end and sideswipe crashes along M-35 due to driver confusion. Ingress vehicles may also be inhibited from entering the parking lot and exposed to through traffic on M-35. Egress traffic may have sightlines blocked by other vehicles, thus increasing the risk of angle crashes, which can result in severe outcome due to speeds on M-35. This location is a higher traffic generator as compared to other area minor approaches, thus the comparative frequency was determined to be occasional.

Frequency	Severity	Grade
Occasional	Medium	D

Table 8: Relative Risk Analysis of M-35 Safety Concern #6

Suggestions:

1. **Consolidate Access:** Close one access point and create more defined access for the other two in order to improve ingress, egress, site circulation, and parking. The middle access point appears to be a candidate for closure; whereby the curbed islands can be linked together to improve access control, and a directional circulation pattern may be created.

Priority for Consideration: Moderate

Figure 11: Meister's Party Store Access

4.1.7 Safety Concern #7: Residential Cottage Section

Observations: The RSA Team referred to the area between Meister's Party Store and Breezy Point as the "Cottage Section." This area has many residential driveways and signs for various cottages along the shoreline. This context extends north to Portage Point Lane, although the driveway density reduces.

Anecdotal information indicates frequent "near-misses" related to left turns on this segment, as well as vehicles passing on the shoulder. Although not observed during this Fall RSA, the RSA Team believes that pedestrian / bicycle activity is more prevalent on this section of M-35 than other areas within the study limits, due to the proximity of residences, restaurants, and the party store. The RSA Team agreed that speeds appeared faster than the posted 50 mph limit. Parking, mail delivery, and lawncare trailer staging are also reported by local stakeholders to occur on the shoulders in this section.

Risk Analysis: Vehicular use of the shoulders to pass turning vehicles at the numerous residential driveways creates risk of sideswipe crashes, which typically result in low severity. During the winter months, shoulder use may also result in single vehicle lane departure crashes. Unexpected turns at driveways can also result in rear-end or potentially more severe angle crashes. Passing maneuvers can also lead to sideswipe or potentially more severe head-on collisions.

Higher risk is realized during the summer months when these shoulders are also utilized by pedestrians and bicyclists. Pedestrian / bicycle - vehicle crashes have the highest likelihood to result in a severe outcome. Although there have been no crashes of this nature reported in the most recent 5-years of available data, this conflict raised significant concern to the RSA Team and the local stakeholders.

Frequency	Severity	Grade
Occasional	High	E

Table 9: Relative Risk Analysis of M-35 Safety Concern #7

Suggestions:

1. **Further Study:** Due to the limited pedestrian observations at the time of this RSA, MDOT may consider a study of summer pedestrian activity to more specifically determine needs in this area.
2. **Group Mail Boxes:** Consolidating residential mailboxes to grouped locations with wider shoulder bump-outs would improve safety for mail carriers and residents.
3. **Install Turn Lanes:** Turn lanes or passing flares at key locations would decrease exposure to crash occurrence; however, the intersections within the study area are unlikely to meet warranting criteria, and this would not mitigate conditions relative to residential driveway frequency.
4. **Construct Shared Use Path:** A non-motorized path adjacent to M-35 would better accommodate non-motorized users as compared to the roadway shoulder. In order to install this treatment within the ROW, shoulders may have to be narrowed, which may serve to reduce vehicle speeds, but would also reduce available space for recovery from lane departure.
5. **Construct Left Turn Lane:** Providing a continuous center lane for left turns in this area would significantly reduce the risk of crashes related to left turn movements and passing on the shoulder.

Note: The RSA Team discussed at length the contrasting merits of the currently wide shoulders and the treatments listed above. Widening the roadway would provide certain safety benefits, but may also encourage higher speeds, and may require substantial reconstruction and drainage enclosure costs.

Priority for Consideration: High

4.1.8 Safety Concern #8: Breezy Point Horizontal Alignment

Observations: The horizontal curve at Breezy Point was observed by the RSA Team to drive comfortably at or slightly above the posted 50 mph speed, even in a large van. The designed curve radius and superelevation seemed appropriate to maintain travel speed within the travel lane. Large trucks were regularly observed navigating this curve at apparent posted speeds as well. Cursory review of curve geometrics indicates the geometrics are appropriate for a 50 to 60 mph design speed.

The RSA Team observed positive signing relative to this horizontal curve. Curve warning signs are appropriately posted and visibility and curve navigation were enhanced by posted chevrons with vertical reflective panels on each chevron sign post. The RSA Team agreed that 1-2 additional chevrons should be installed at the north end of this curve.

Risk Analysis: Lane departure can occur through horizontal curves, which can lead to single vehicle crashes. Review of crash history indicates that lane departure crashes on M-35 typically result in PDO severity; however also create some risk for A-level injury or fatal severity due to overturn or head-on crash occurrence. Risk of lane departure is higher during adverse weather conditions.

Frequency	Severity	Grade
Infrequent	Medium	C

Table 10: Relative Risk Analysis of M-35 Safety Concern #8

Suggestions:

1. **Install Additional Chevrons:** Additional chevrons (1 to 2) should be installed on both bounds of M-35 at the northern PC/PT to improve visibility and navigation through the entire curve.

Priority for Consideration: Low

Figure 12: Chevrons on the Breezy Point Curve

4.1.9 Safety Concern #9: Breezy Point Bar Access

Observations: The Breezy Point Bar is located on the outside of the horizontal curve, on the southeast side of M-35. RSA Team observations indicate that sight distance relative to the curve is more restricted at the south drive than the north; however sightlines appear appropriate from both locations.

The bar / restaurant has two access points that are separated by a curbed island that is set back from the normal shoulder width, creating large paved areas between the travelled way and the parking area. These driveways are wide, and generally uncontrolled, particularly at the north access. At this location, the paved area appears to have been widened north of the original driveway approach. Additionally, there is evidence that parking is encroaching on the dirt / gravel area to the north, which has caused pavement edge deterioration and drop off.

Risk Analysis: Sight distance limitations from the site driveways along the horizontal curve may result in angle crashes, which can result in severe outcome due to speeds on M-35. This risk is elevated by lack of driver expectancy for vehicles turning onto M-35 from the inconspicuous gravel parking area. Wide driveways and uncontrolled access can also result in rear-end and sideswipe crashes. This location is a higher traffic generator as compared to other area minor approaches, thus the comparative frequency was determined to be occasional.

Frequency	Severity	Grade
Occasional	Medium	D

Table 11: Relative Risk Analysis of M-35 Safety Concern #9

Suggestions:

1. **Narrow Access:** Install additional curb to narrow and better delineate each driveway approach. Improve the northern gravel parking area and restrict direct access onto M-35. Improve delineation for parking and internal circulation, considering truck turning requirements.

Priority for Consideration: Moderate

Figure 13: Breezy Point Bar Access

4.1.10 Safety Concern #10: 11th Road Intersection

Observations: The intersection of M-35 and 11th Road is a "T" intersection, where 11th Road intersects M-35 at a slightly less than perpendicular angle. The minor approach looks out into Little Bay de Noc, and the RSA Team noted a potential infinity effect; whereby the driver cannot distinguish between the end of the road and the start of the water, particularly at night. The shoreline is closest to M-35 at this location as compared to the rest of the study area. There is limited vegetation on the roadside, therefore providing no visual queues from the minor approach.

There is a drainage culvert in the southwest quadrant, and slopes on the east side of M-35 are fairly steep down into the shoreline. These slopes are generally not recoverable. There is evidence of recent slope restoration / stabilization on the east side as well. There is also evidence of driving on the gravel / grassy portion of the shoulder. Scenic views may attract standing / parking at this location.

Risk Analysis: Lack of intersection conspicuity from the minor approach can result in failure to STOP on the minor approach, resulting in potentially severe angle crashes with higher speed M-35 traffic. Furthermore, the infinity effect may lead drivers to continue through the intersection, departing the roadway onto a steep downgrade towards the shoreline. Lane departure on M-35 may also lead to single vehicle crashes relative to the non-recoverable roadside slopes, which may result in more severe overturn crash occurrence. Parking on this shoulder may result in rear-end, sideswipe, or pedestrian crashes. Although historical crash data indicate rare occurrence of these issues, the RSA Team agreed that the risk of severity is high, should a crash occur in this location.

Frequency	Severity	Grade
Rare	High	C

Table 12: Relative Risk Analysis of M-35 Safety Concern #10

Suggestions:

1. **Enhance Signs & Markings:** Install a STOP bar and W1-7 bi-directional arrow sign on and opposing the minor road approach. The RSA Team concurred that this location is the highest priority for such treatment, relative to all minor approaches in the study area.
2. **Install Guard Rail:** In order to prevent vehicles from departing the roadway into the shoreline, install guardrail on the outside of this horizontal curve. This treatment would also restrict undesirable standing / parking on this shoulder.
3. **Enclose Drainage:** Enclosing drainage on the SW quadrant would improve roadside recovery; however noting that the existing culvert end treatments are not blunt and reasonably forgiving.

Priority for Consideration: Low

Figure 14: Infinity Effect (left) and Roadside Slope (right)

4.1.11 Safety Concern #11: Intersection Visibility

Observations: The intersections of M-35 with Portage Point Lane and 12th Road both have considerable intersection sight distance obstructions and visibility concerns relative to the minor approaches. At Portage Point Lane, sightline obstruction to the south was particularly noted on the SE quadrant due to the utility poles, trees, and brush.

At 12th Road, the intersection skew forms an acute triangle in the SW quadrant which is filled by trees that block sight to the southwest. Relative to the skew, 12th Road is turned in perpendicular to M-35, approximately 100 feet back along the minor approach. While this design does improve driver line of sight, the signing at this location is confusing. There is a supplemental left-side STOP sign on this minor approach, which obstructs view of a directional arrow (W1-6) warning sign.

Risk Analysis: Lack of sight distance from these minor approaches may lead to angle crashes, which can result in severe outcome due to speeds on M-35. Intersection skew and sign obstruction on the minor approach of 12th Road may lead to driver confusion and lane departure, which can result in single vehicle, sideswipe, or head-on crashes.

Frequency	Severity	Grade
Occasional	High	E

Table 13: Relative Risk Analysis of M-35 Safety Concern #11

Suggestions:

1. **Clear Brush:** Trees and brush should be cleared back to provide adequate intersection sight distance from the proper stopping location on each minor approach.
   Note: ROW and private parcel ownership may present conflict to tree clearing at 12th Road.
2. **Relocate Signs:** Relocate the W1-6 directional arrow sign to a more visible location.
   Note: The RSA Team also observed that this is the only minor approach with a supplemental left-side STOP sign in the study area. While this is generally viewed as a positive safety treatment, this STOP sign is redundant with respect to the W1-6 sign for the purpose of improving intersection conspicuity. Therefore, consider replacing this supplemental sign with a STOP AHEAD sign further upstream on the minor approach. As the turned-in alignment may restrict sight of the standard right-side STOP sign, an upstream warning would improve driver awareness on approach to M-35.

Priority for Consideration: High

Figure 15: Limited Sight Distance (left) and Conflicting Signs (right)

4.1.12 Safety Concern #12: Shoulder Width at Airport Road

Observations: The intersection of M-35 and Airport Road includes a left turn passing flare and a right turn deceleration lane on M-35. Although the shoulders may be slightly wider in this area than the rest of the corridor, the turn lane treatments appear to be narrow at approximately 10 feet wide. These turn treatments occupy nearly the full width of each shoulder. Stakeholders expressed to the RSA Team that corridor shoulders are often used by pedestrians and bicyclists. Although the RSA Team did not view this particular area as having a potential for frequent non-motorized shoulder use, any relative use would be in conflict with the marked turn treatments.

Risk Analysis: Sideswipe crashes may occur as a result of the narrow turn lane treatments. Pedestrians and bicyclists traveling on the shoulder are directly exposed to traffic and have no refuge in this area. There is particular risk of higher speed pedestrian – vehicle crashes in the left turn passing flare, where through vehicles maneuvering around a left turn vehicle would likely not have adequate time to see, perceive, and stop for a pedestrian in this shoulder / lane.

Frequency	Severity	Grade
Rare	High	C

Table 14: Relative Risk Analysis of M-35 Safety Concern #12

Suggestions:

1. **Extend Pathway:** There is existing sidewalk / path on both sides of M-35, approximately 1,000 feet north of this intersection. These non-motorized facilities could be extended to the south through this intersection to eliminate conflicts within the shoulder area.
   Note: The extended sidewalk / path can be transitioned back into the paved shoulder to the southwest of Airport Road, similar to the existing transition to the northeast.
2. **Improve Turn Lanes:** Construct full-width turn lanes and provide appropriate tapers, storage, and paved shoulders.
   Note: The RSA Team discussed the potential merits of extending the four-lane section from the north through this intersection. Such improvement was determined by consensus to not provide a direct operational or safety benefit for this location and condition.

Priority for Consideration: Low

Figure 16: Passing Flare at Airport Road

4.1.13 Safety Concern # 13: Lake Shore Drive Pedestrians

Observations: At the intersection of M-35 and Lake Shore Drive, there are sidewalk / pathway ramps that lead into the intersection, with no marked crosswalk or warning signs for vehicular traffic. There is an offset of approximately 30 feet between opposing curb ramps, which inherently direct pedestrians to cross diagonally through the middle of the intersection. This crossing may provide important pedestrian connection between the residential neighborhood on the east side of M-35 and the shared use pathway on the west side.

Historical aerial imagery indicates that these facilities were constructed at different times; however these designs should be brought together to provide proper pedestrian crossing. This would include relocating / aligning the ramps, designing for proper ADA compliance, and installing pavement markings and warning devices on M-35 to increase visibility of this crossing to vehicular traffic. Advanced warning and crossing conspicuity are of particular concern given the location within a horizontal curve. There is a similar crossing of the shared use pathway on the tangent section of M-35 approximately ¼ mile north.

Risk Analysis: Pedestrian / bicycle - vehicle crashes have the highest likelihood to result in a severe outcome. Although there have been no crashes of this nature reported in the most recent 5-years of available data, this conflict raised significant concern to the RSA Team. The diagonal crossing lengthens the crossing distance and therefore pedestrian exposure. The lack of ADA facilities increases risks relative to accessibility, particularly with this atypical configuration. Lack of crosswalk markings and warning signs also contributes to risk, as drivers have no expectation of pedestrian crossing at this location.

Frequency	Severity	Grade
Infrequent	High	D

Table 15: Relative Risk Analysis of M-35 Safety Concern #13

Suggestions:

1. **Relocate Pathway Ramp:** The pathway ramp on the west side of M-35 should be relocated approximately 30 feet to the northeast in order to align with the ramp to the east of M-35.
2. **Install Crosswalk**: Pavement markings and warning signs should be installed to delineate the crossing location. Due to the location and conditions of this crossing, special emphasis markings and advanced warning signs should be considered.

Priority for Consideration: Moderate

Figure 17: Unmarked Crossing at Lake Shore Drive

4.1.14 Safety Concern # 14: Lake Shore Drive Intersection

Observations: Lake Shore Drive has a wide cross-section at the intersection with M-35, with large corner radii. Aerial imagery shows tire / wear marks that indicate left and right-turning vehicles utilize the available pavement width as if the minor approach has two separate lanes. Although Lake Shore Drive does tie into the collector and arterial routes of Escanaba, there does not appear to be demand for large truck traffic or to warrant separate turn lanes. Primary land uses along Lake Shore Drive are residential, with connections to a church and a school. The RSA Team did not observe any significant queuing on Lake Shore Drive; however minor approach demands may be higher during the peak summer months.

This section of M-35 is curbed running from south Lake Shore Drive into Escanaba. Current standards indicate that shoulders should be provided for posted / design speeds over 45 mph. The posted speed for this section is 50 mph, which drops to 40 mph approximately 1 mile north of Lake Shore Drive. Overhead lighting in this area was observed to be a safety benefit, with regularly spaced cobra lights on M-35. However, the light at the intersection with Lake Shore Drive was not functional at the time of this RSA. Additionally, the STOP sign on the minor approach was noted to have low retroreflectivity.

Risk Analysis: The wide cross-section, combined with a lack of pavement markings to delineate turn lanes, introduces risk of sideswipe crashes on the minor approach. Risk of sideswipe crashes on M-35 is also increased due to the lack of shoulder on this section. Driver sightlines may be blocked by vehicles lining up side-by-side on the minor approach, which can lead to more severe angle crashes with conflicting M-35 traffic. Angle crashes may also result from low intersection conspicuity and failure to stop resulting from poor lighting and STOP sign visibility, although the frequency of occurrence is rare.

Concern	Frequency	Severity	Grade
Sideswipe	Infrequent	Low	B
Angle	Rare	High	C

Table 16: Relative Risk Analysis of M-35 Safety Concern #14

Suggestions:

1. **Install Pavement Markings**: Delineating separate left-turn and right-turn lanes would reduce driver conflict and the risk of sideswipe crashes.
2. **Narrow Minor Approach:** Reducing the paved minor approach width and corner radii would further reduce exposure to sideswipe crashes and limit sightline blockages.
3. **Reconstruct Curb:** Roadway rehab / reconstruct may require drainage modifications, shoulder provision, or design exception. Speeds through this area should be monitored for design.

Priority for Consideration: Low

Figure 18: Wide Approach / Radii (left) and Curbed Section (right)

4.1.15 Safety Concern # 15: Additional Considerations

Observations: Although the RSA Team noted generally recoverable roadside slopes with in the study area, some specific areas of concern were noted in the preceding sections. The RSA Team discussed that slopes should be flattened where feasible, especially in areas with sharp drop-offs, even where shallow. Particular attention should be paid in design of future projects to roadside slopes for the overall corridor. Particularly if any road widening is constructed with in the study area, roadside slopes could become steeper than existing in order to match grades and accommodate drainage.

Outside the limits of this RSA, two particular considerations were noted by the RSA Team:

1. White longitudinal (dashed) pavement markings are still visible in the transition area to the north of the RSA limits, where the lane configuration has been converted to include a center lane for left turns.
2. There is no passing relief lane in the vicinity of the southern RSA limits. The nearest passing lanes south of the project limits are located near the Menominee County Line, approximately 11 miles to the south. Vehicle platooning, acceleration / higher speed, and truck overtaking were regularly observed on the SW bound leaving the City of Escanaba into the more rural context.

Risk Analysis: Confusing lane markings, particularly in a section of non-balanced lane use can lead to lane departure and sideswipe crashes. Passing maneuvers and truck overtaking departing Escanaba can lead to more severe head-on crashes.

Concern	Frequency	Severity	Grade
Sideswipe	Infrequent	Low	B
Head-on	Occasional	High	E

Table 17: Relative Risk Analysis of M-35 Safety Concern #15

Suggestions:

1. **Remove Pavement Markings:** In order to eliminate driver confusion, old white pavement markings should be completely removed.

   Priority for Consideration: Low

2. **Evaluate Passing Lanes:** Conduct a review of crash history, speeds, and passing maneuvers south of the RSA limits and evaluate MDOT guidance of passing lane criteria.

   Priority for Consideration: High

Figure 19: Conflicting Pavement Markings

4.2 HSM & BENEFIT-COST ANALYSIS

There were several possible safety improvements suggested by the RSA Team relative to each project component and location. Each of these treatments was categorized based on the targeted crash type, degree of improvement, and relative level of cost (low, medium, high). Degree of improvement was generalized as follows, with cost based on high-level estimates and relative order of magnitude:

- Reconstruction: Substantial change to the cross section of the roadway including roadway profile, alignment, new pathway, or new travel lanes ($1M per lane mile, $400K per path mile).
- Modify Pavement: Reconfigure specific areas of pavement and/or curb to improve minor approaches, manage access, enclose drainage, improve pedestrian connections, and install turn lanes ($25K to $200K per location).
- Maintenance, Signs & Markings, and Systemic: Clear brush, enhance existing signing, improve pavement markings, and install guardrail or pavement corrugations ($1K to $50K per treatment).

Improvement	Location	Targeted Crashes	Degree of Improvement	Cost Level	Cost
Install Chevrons	Breezy Point	Lane Departure	Signs & Markings	Low	$ 1,000
Enhance Signs & Markings	Intersections	Angle / Sideswipe	Signs & Markings	Low	$ 5,000
Clear Brush	Intersections	Angle	Maintenance	Low	$ 5,000
Relocate Driveway	Ford River Launch	Angle	Modify Pavement	Low	$ 25,000
Pedestrian Connection	Ford River Bridge	Pedestrian	Modify Pavement	Low	$ 25,000
Crosswalk & ADA	Lake Shore Drive	Pedestrian	Signs & Markings	Low	$ 25,000
Install Corrugation	Corridor	Lane Departure	Systemic	Medium	$ 50,000
Access Management	Meister's Store	Angle / Sideswipe	Modify Pavement	Medium	$ 50,000
Guard Rail	11th Road	Lane Departure	Systemic	Medium	$ 50,000
Enclose Drainage	11th Road	Lane Departure	Modify Pavement	Medium	$ 50,000
Narrow Minor Approach	Lake Shore Drive	Angle / Sideswipe	Modify Pavement	Medium	$ 50,000
Access Management	Breezy Point Bar	Angle / Sideswipe	Modify Pavement	Medium	$ 100,000
Turn Lanes	Airport Road	Sideswipe / Rear-End	Modify Pavement	Medium	$ 100,000
Access Management	Ford River Grill	Angle / Sideswipe	Modify Pavement	Medium	$ 200,000
Turn Lanes	Cottage Section	Sideswipe / Rear-End	Modify Pavement	Medium	$ 200,000
Shared Use Path	Airport Road	Pedestrian	Reconstruction	Medium	$ 200,000
Vertical Profile	Ford River Bridge	Angle	Reconstruction	High	$ 500,000
Shared Use Path	Cottage Section	Pedestrian	Reconstruction	High	$ 1,000,000
Center Left Turn Lane	Cottage Section	Pedestrian / Sideswipe	Reconstruction	High	$ 2,500,000

Table 18: Safety Treatments and Order of Magnitude Costs

4.2.1 HSM Crash Modification Factors (CMFs)

HSM analyses indicate that overall, M-35 is performing in a manner consistent with the base physical and operational characteristics of similar sites. Although the actual observed frequency of crashes is slightly higher per year than predicted or expected, non-animal crashes occur at a less frequent rate. Additionally, HSM analysis indicates that this segment of M-35 should be expected to experience 2.3 injury (or fatal) crashes per year. There has been an average of 3.0 injury (or fatal) crashes per year during the 5-year study period, including two A-level incapacitating injury crashes and one fatal crash (plus a more recent fatal crash outside the reporting period). Although the frequency of non-animal crashes may be lower than expected, there is a statistical opportunity to reduce crash severity on this rural roadway.

In order to provide perspective as to the most impactful treatments for this corridor, the potential benefit to reduce crash occurrence was evaluated based on HSM methodologies, and related to order of

magnitude cost estimates. Pertinent Crash Modification Factors (CMF) were applied to the base SPFs to calculate the expected frequency and severity of crashes along the corridor with a particular treatment.

For the purposes of this study, all CMFs were referenced directly from the HSM, as contained in the MDOT spreadsheet. The findings of this RSA indicate that two of the highest risk ratings and priorities for this corridor are relative to lane departure and pedestrian safety. Two key CMFs were identified to be relevant to subject conditions and the highest priority suggestions for the corridor by the RSA Team:

- Shoulder / Centerline Corrugations CMF 0.84 / 0.94
- Two-Way Center Left Turn Lane CMF 0.70

Other location-specific improvements suggested in this RSA can be addressed during road reconstruction / rehabilitation (i.e. signing upgrades), or via a standalone safety project. The potential benefit of these can be evaluated on a case-by-case basis; however, not all safety suggestions included in this report have a CMF that has been documented directly in the HSM or included in the MDOT Predictive Methods spreadsheet. CMFs can also be referenced based on research and rates published by the *CMF Clearinghouse*. This online resource is funded by the FHWA and maintained by the University of North Carolina Highway Safety Research Center.

Improvements suggested in this RSA for which a CMF has not yet been identified should not be disregarded. Instead, these improvements should be considered relative to observed crash history, anecdotal knowledge of the site, and related plans for roadway improvements within the study limits. Available HSM data from reliable studies are limited relative to this RSA for some of the following reasons:

- Improvements at intersections are largely focused on conversion to roundabout, or STOP control to signalized operations, or Intersection Collision Warning Systems.
- Pedestrian treatments were studied at high crash locations; whereas the subject site has zero pedestrian crash history. More intense (HAWK) treatments typically referenced.
- Lighting improvements involve new installations, as opposed to enhancements or infill.

The results of this HSM analysis are summarized in the following section and detailed calculations are included in the appendix.

4.2.2 Benefit - Cost Analysis

The order of magnitude cost estimates outlined above are specific to the safety improvements suggested by the RSA Team and may not be equal to actual construction costs. This is especially true for reconstruction of the facility, which may require material, drainage, right-of-way, and maintenance of traffic costs that are unrelated to the subject safety treatments. However, a comparison of the relative costs and benefit to reduce crash occurrence do provide valuable information for decision making for the range of low to high cost improvements presented herein.

Benefit that would be achieved by crash reduction was measured based on monetary values published by UMTRI and FHWA. Crashes result in both tangible and intangible consequences. While economic costs can be measured directly, intangible impacts such as physical and emotional suffering are monetized by quality-adjusted life years (QALY). The lost quality of life due to death or injury is quantified in the referenced sources and included in comprehensive costs referenced for this benefit-cost analysis.

Annual benefits due to crash reductions were compared to annualized treatment costs in order to develop benefit-cost ratios. Probable crash reductions were estimated based on HSM predictive values as

described in the previous section. This analysis focuses on the two highest priority safety concerns as identified by the RSA Team for the corridor. Both lane departure crashes and potential pedestrian crashes were identified to result in a risk rating of "E" based on the potential for severe outcome, including fatality.

In the past 5 years of crash data, two A-level incapacitating injury crashes and one fatal crash were reported on this study segment of M-35. A second fatal crash occurred outside of the study period in 2019. All of these crashes involved a vehicle departing the lane and/or crossing the center line. As shown in the summary below, installing corrugations would provide significant positive benefit as compared to the relatively low cost to reduce crash occurrence. The RSA Team noted that corrugations are typically installed by MDOT on rural two-lane roads with a speed limit of 55 mph; whereas this section of M-35 has a posted speed of 50 mph. Furthermore, residents (particularly in the Cottage Section) may be sensitive to resultant noise; however, the RSA Team feels that corrugations (shoulder and centerline) would provide sufficient benefit to support installation on this segment.

The RSA Team has also referenced pedestrian safety and the concern for potentially severe or fatal pedestrian-vehicle crash occurrence, particularly in the Cottage Section of the study limits. During the November field observations and 5-year crash history for this RSA, no pedestrian activity was observed and no pedestrian-related crashes were recorded. However, local stakeholders have expressed that pedestrian activity is more frequent during the summer months. The RSA Team agrees that vehicular and pedestrian use of the shoulders in this area creates a conflict that could result in a severe or fatal crash.

One of the suggested improvements for the Cottage Section would be to construct a continuous center lane for left turns. Provision of this lane would reduce the desire for vehicles to pass on the shoulder, thus mitigating the potential vehicle-pedestrian conflict on the shoulder. Cost for such improvement was estimated at $1M per lane mile, at a distance of nearly 2.5 miles from Ford River through the Breezy Point curve. Given unknown subsurface conditions nor if the roadway would be widened or completely reconstructed, a 20-year service life was assumed. The benefit-cost results for this improvement indicate that the annual benefit would not normally offset the annual cost for this additional lane. However, if the prevention of a single fatality is considered, the monetary benefit nearly equates back to the annual cost of improvement. When quality-adjusted life years (QALY) are considered, the benefit exceeds the cost.

Treatment	Estimated Cost	Annual Cost	Annual Benefit	B/C Ratio
Install Corrugations	$ 50,000	$ 4,012	$ 84,709	21.11
Two-Way Left Turn	$2,500,000	$ 200,606	$ 69,003	0.34
Combine Treatments	$2,550,000	$ 204,619	$ 105,415	0.52
Fatal Monetary Only			$ 200,911	0.98
Fatal QALY			$ 852,503	4.17

Table 19: Benefit-Cost Analysis Comparison

5.0 Conclusions

This assessment has been prepared to assist the roadway Owner and local stakeholders in the identification and actualization of opportunities to improve safety within the study area. The suggestions contained in this report are for consideration only and not intended to serve as design or operational recommendations. The RSA Team suggests that MDOT consider making incremental improvements if lesser measures prove ineffective towards reducing the crash risks identified herein, recognizing that some treatments are contingent on future rehabilitation or reconstruction of the M-35 corridor.

In general, the RSA Team agreed that the study area of M-35 has safety related treatments that are consistent with the needs of the facility users and current best practices. However, the RSA Team has also identified opportunities where safety can be enhanced, particularly in areas where crash occurrence and/or exposure risk were determined to be more significant.

Many of the safety concerns identified by the RSA Team are related to the shoulder and pedestrian safety along M-35, absence of turn lanes, and access management. The most significant safety issues were identified within the "Cottage Section" where driveway frequency and pedestrian activity are in particular conflict during the peak summer months. Tangible improvement to existing conditions in this area would generally require reconstruction; however path installation or roadway widening may not be necessary along the entire study corridor. Absent of reconstruction, the RSA Team has identified less invasive treatments that would provide lower cost safety enhancements with minor or no physical changes to the roadway. The following table summarizes the identified safety concerns, risk ratings, and priority for improvement as identified by the RSA Team. These items are listed here in order of priority and risk.

Safety Concern	Location	Priority	Risk Grade
Lane Departure	M-35 Corridor	High	E
Pedestrians	Cottage Section	High	E
Access Management	Ford River Grill	High	E
Intersection Visibility	Portage Pt Lane, 12th Road	High	E
Intersection Safety	M-35 Corridor	Moderate	D
Sight Distance	Ford River Boat Launch	Moderate	D
Access Management	Meister's Party Store	Moderate	D
Access Management	Breezy Point Bar	Moderate	D
Pedestrians	Lake Shore Drive	Moderate	D
Pedestrians	Ford River Bridge	Low	C
Horizontal Alignment	Breezy Point	Low	C
Lane Departure	11th Road	Low	C
Shoulder Width	Airport Road	Low	C
Intersection Safety	Lake Shore Drive	Low	C

Table 20: Safety Concern Summary and Prioritization

This report does not preclude the identification of additional issues pertaining to safety by the Owner or the emergence of new issues over time. ***The findings, conclusions, and suggestions outlined in this report were developed based on consensus by the RSA Team and are not necessarily those of MDOT, the City of Escanaba, Ford River Township, or Delta County***.

It is recommended that MDOT review this report, document their responses to the issues identified in a formal response, and track their progress towards the implementation of safety improvements prompted by this assessment.

Relevant information referenced in this RSA are included in the following Appendices. Supporting electronic files (photos, spreadsheets, HSM files) are submitted to MDOT with this report.

Appendix A: RSA Kick-off Meeting Presentation and Sign-In
Appendix B: HSM & Benefit-Cost Calculations
Appendix C: MDOT Crash Summary & A/K UD-10 Crash Reports
Appendix E: RSA Findings Meeting Presentation

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Appendix A

RSA Kick-off Meeting Presentation and Sign-In

M-35 FROM FORD RIVER TO LAKE SHORE DRIVE

BERGMANN

ROAD SAFETY AUDIT KICK-OFF

Prepared for:

MDOT
Michigan Department of Transportation

NATIONAL FIRM. STRONG LOCAL CONNECTIONS.

TENTATIVE SCHEDULE

Wednesday, November 6	
9:00 - 10:30 am	Kick-Off Meeting
10:30 - 12:00 pm	Data Review / Drive Site
12:00 - 1:00 pm	Break for Lunch
1:00 - 3:30 pm	Field Reviews
3:30 - 5:00 pm	PM Peak Review / Compile Notes
7:00 - 8:00 pm	Nighttime Field Review
Thursday, November 7	
8:00 - 9:00 am	Morning Field Review (If Necessary)
9:00 am - 2:00 pm	RSA Team Prioritization Workshop
2:00 - 3:30 pm	Preliminary Findings Meeting

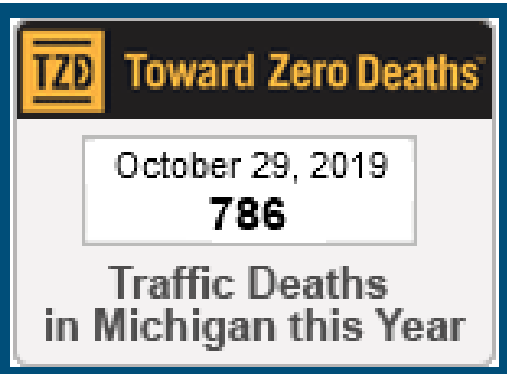
INTRODUCTIONS

- **TJ Likens, PE** – RSA Facilitator
- **Steven Russo, PE** – RSA Support
- **MDOT Team Members**
- **Project Stakeholders**

Ford River Township

ROAD SAFETY AUDIT

- What is an RSA?
- What are we trying to accomplish?
- What are the RSA Team's goals and responsibilities?



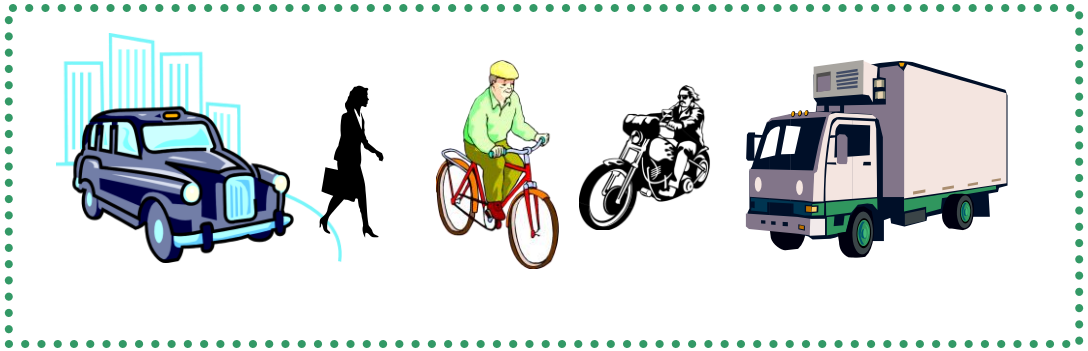
WHAT IS A ROAD SAFETY AUDIT?

- A RSA is a *formal safety performance examination* of an existing or future road or intersection by an *independent multidisciplinary RSA team*

- RSA can be conducted at any phase of a project

WHAT IS A ROAD SAFETY AUDIT?

- Considers the safety of all road users

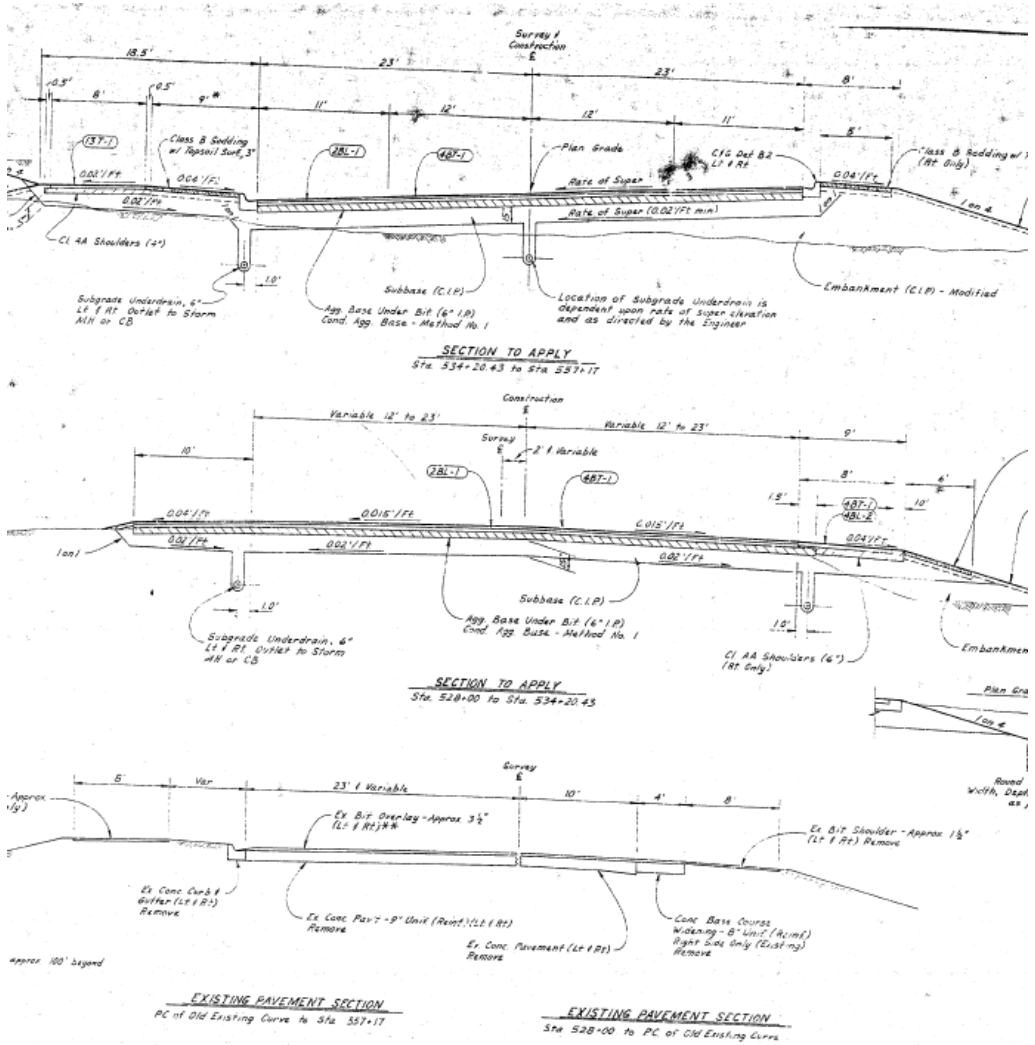


- Examines interaction between project elements and users; identifies risks
- Suggests mitigating measures

WHAT IS A ROAD SAFETY AUDIT NOT?

- *A standards check* - adherence to standards does not in and of itself guarantee a safer facility

- *An opportunity to redesign the project* - suggest improvements, provide illustrative solutions, but should not challenge past fundamental design decisions



WHY DO AN RSA?

There are many competing interests at play in road and bridge projects:

1. Cost
2. Right of way
3. Environment
4. Topographic and
5. Geotechnical conditions
6. Socio-economic issues
7. Capacity / efficiency
8. Politics
9. Safety

- Compromises and constraints are a normal part of transportation budgeting.
- RSAs demonstrate the safety implications of roadway elements.
- RSAs ensure that safety is an explicit consideration, and that safety does not "fall through the cracks".

WHAT DO WE CONSIDER DURING AN RSA?

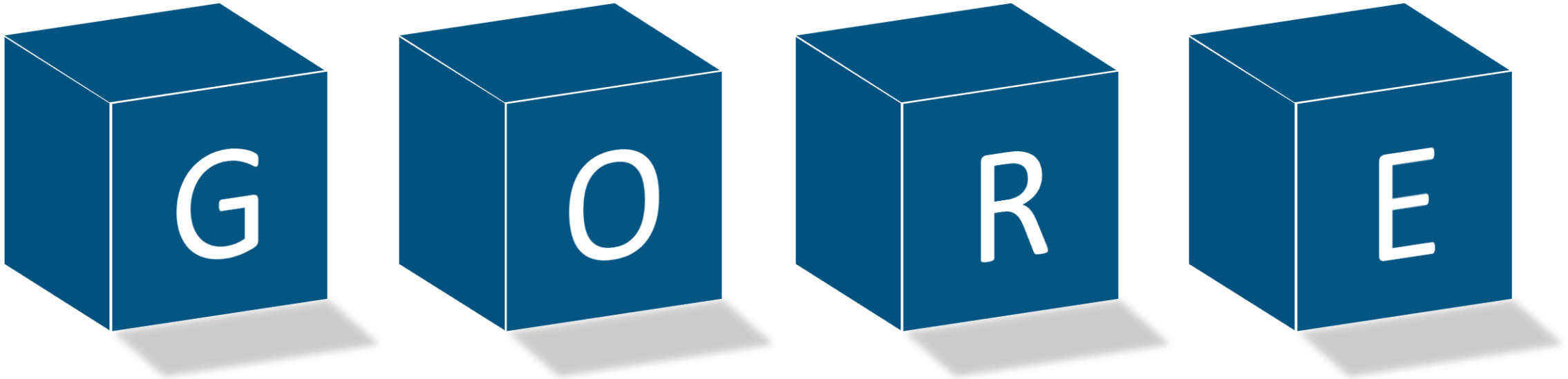
Geometry

Operations

Road users / human factors

Environment

RSA OBSERVATIONS



- Curve
- Gradient
- Cross section
- Clearance
- Sight distance
- Clear zone

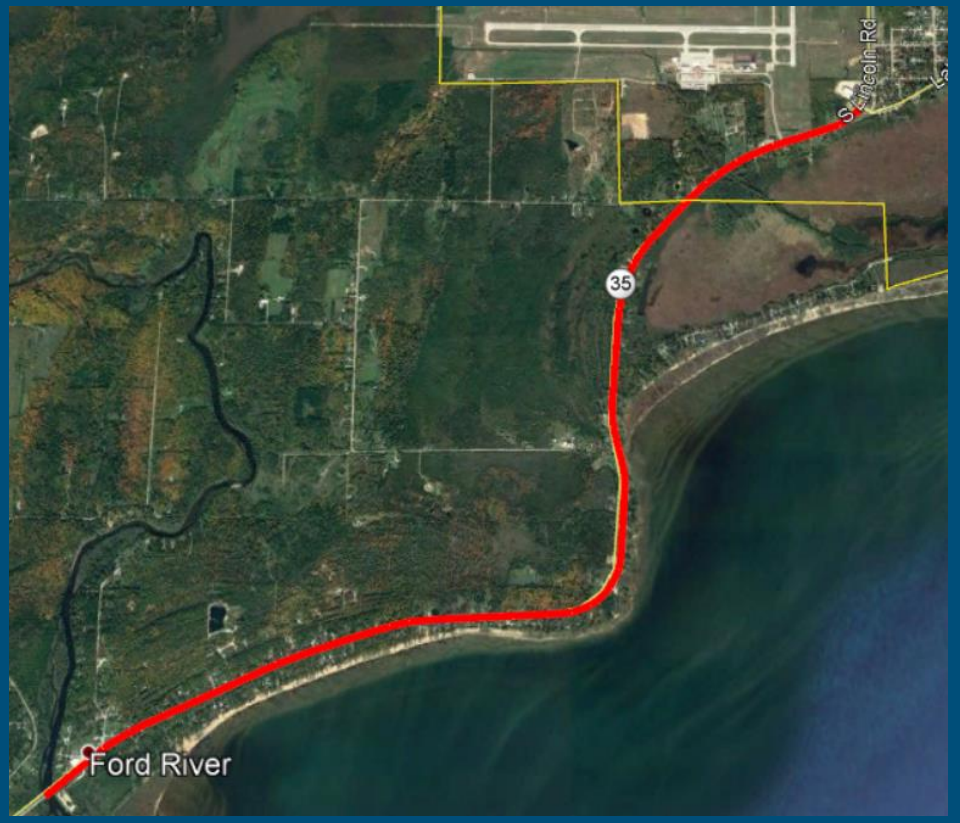
- Congestion
- Signal operation
- Speed management
- Queuing
- Turning movements

- Motorists
- Bicyclists
- Pedestrians
- Other users

- Weather
- Lighting
- Road conditions

RSA TEAM TASKS - 2 DAY ROAD SAFETY AUDIT

- ~~**Step 1:** Identify Project or Existing Location to be Assessed~~
- ~~**Step 2:** Select an RSA Team~~
- **Step 3:** Conduct a Pre-assessment Meeting to Review Project Information and Drawings
- **Step 4:** Conduct Review of Project Data and Field Review
- **Step 5:** Conduct Audit Analysis and Prepare Report of Findings/Suggestions
- **Step 6:** Present Audit Findings to Project Owner/Design Team
- **Step 7:** Review RSA Report and Prepare Response
- **Step 8:** Incorporate RSA Suggestions



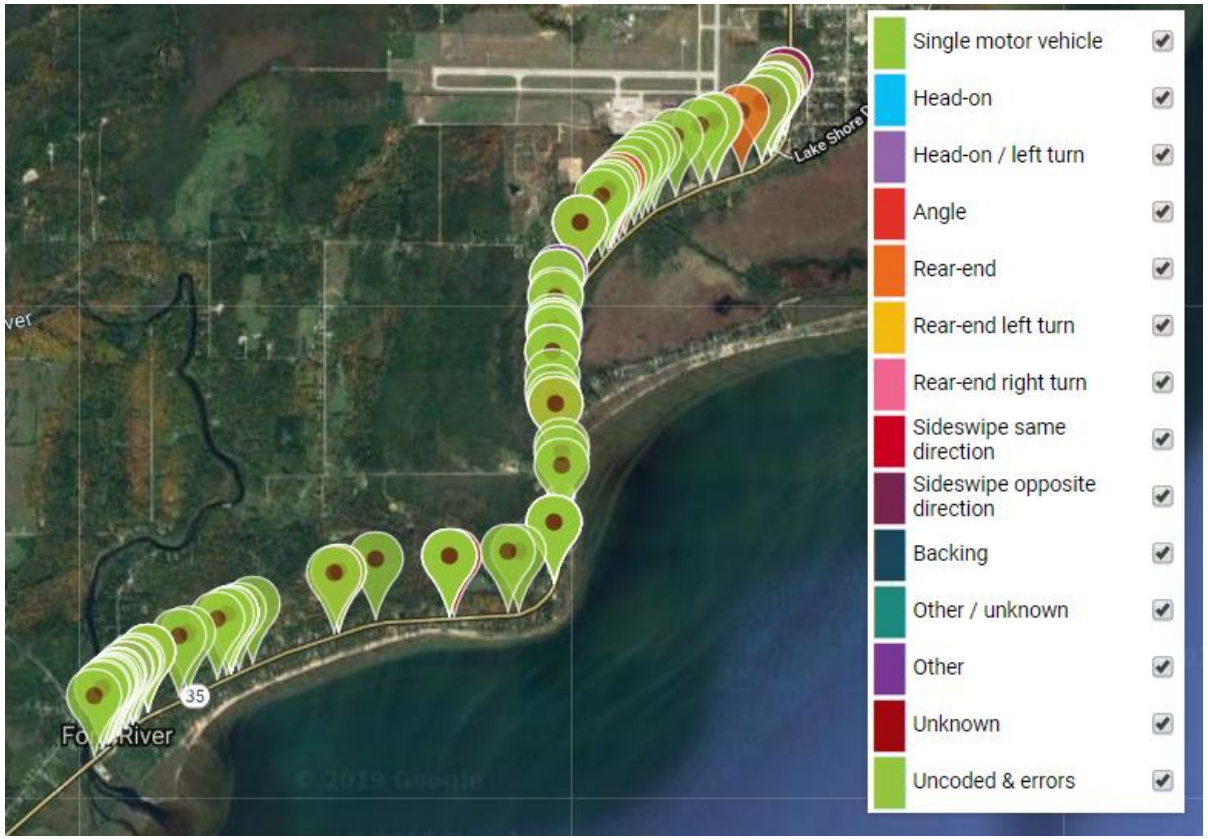
M-35: Ford River to Lakeshore Drive

CONDUCTING THE FIELD VISITS

- Lots and lots of pictures!
- Drive it, Walk it
- Note observations, thoughts
- Make day and night visits
- Use eyes, ears, mouth, and mind
- ATTENTION TO OUR OWN SAFETY!

RSA ANALYSIS

- Identify Safety Issues
  - G / O / R / E
- Prioritize Safety Issues
  - Crash frequency and severity:
    - crash history (assessments of existing roads)
    - expected crashes (planning stage assessments)
      - *qualitative* estimate of risk
      - *quantitative* estimate of risk



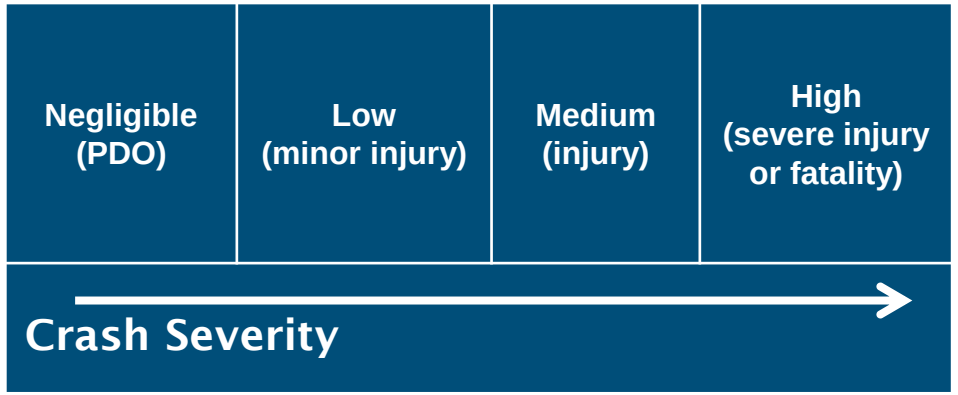
CONSIDER RISK

- For each safety issue, what is the:
  - Likelihood of a crash?
    - What probability exists
  - How severe?
    - What consequences?

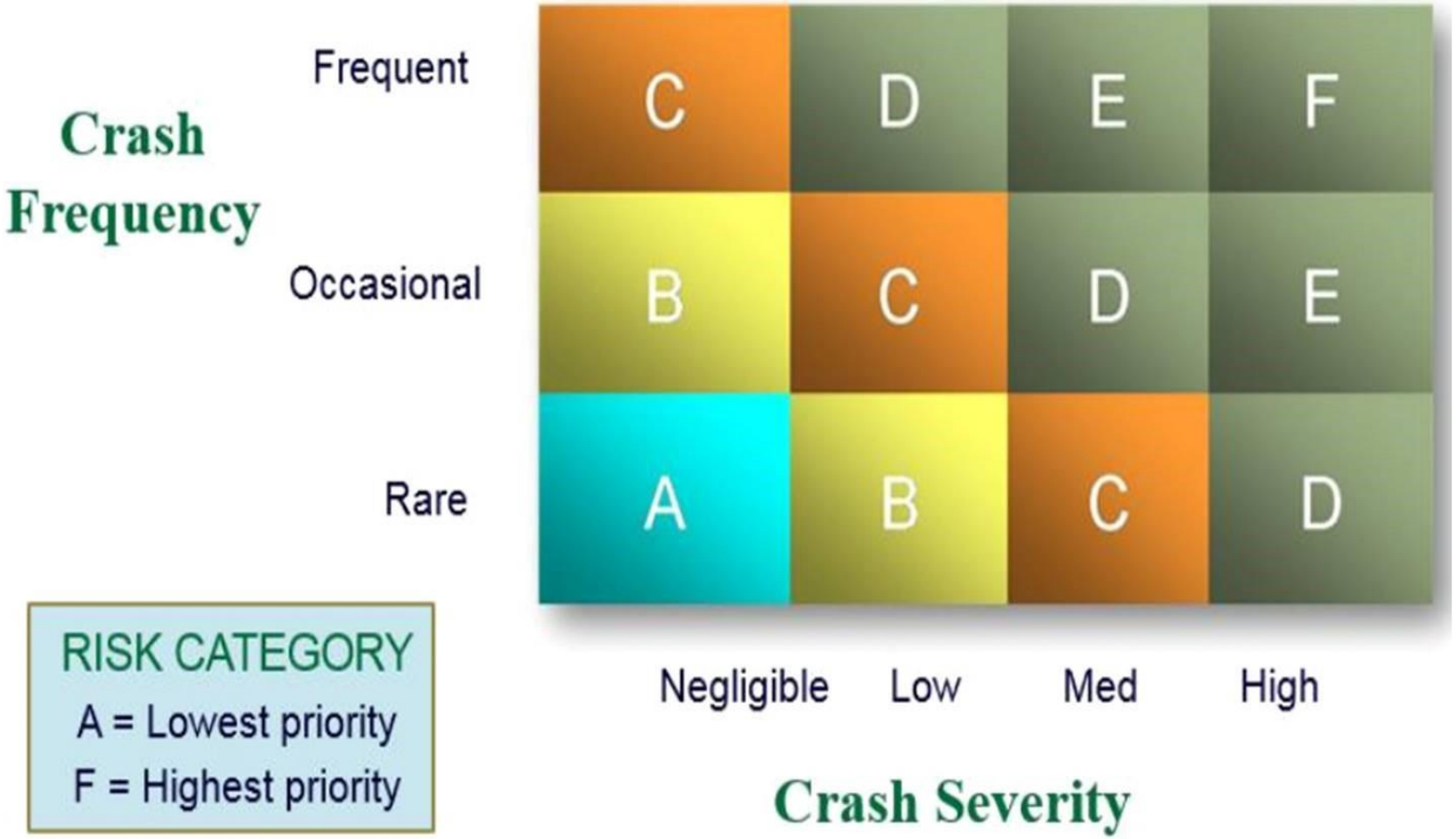
Risk =
f (Probability, Consequences)

CONSIDER SEVERITY

- Estimate the severity associated with each safety issue.
- Factors that affect severity: Speed, Crash Type, Vulnerable Road Users, Roadside Condition, and Truck Involvement.



USING RELATIVE RISK TO PRIORITIZE SAFETY ISSUES



DEVELOP POTENTIAL *MITIGATIONS* FOR IDENTIFIED SAFETY ISSUES

- For each safety issue, the assessment team may provide suggestions or possible solutions to reduce collision frequency and/or severity.

- Suggestions will be:
  - appropriate for stage of assessment
  - appropriate for all road users
  - may include short and long term strategies

PRESENTATION OF FINDINGS

1. SHOULDER NARROWING UNDER US-131

Observations

- Bridge piers are set close to roadway
- Pedestrians observed walking immediately adjacent to lane

Safety Concern

- Vehicle-pedestrian strike
- (Vehicle severity likely low)

Mitigation

- Move bridge piers / abutment
- Install pedestrian facility north side of KL

Frequency	Severity	Grade
Occasional	High	E

NATIONAL FIRM. STRONG LOCAL CONNECTIONS.

Safety issue

Description and observations

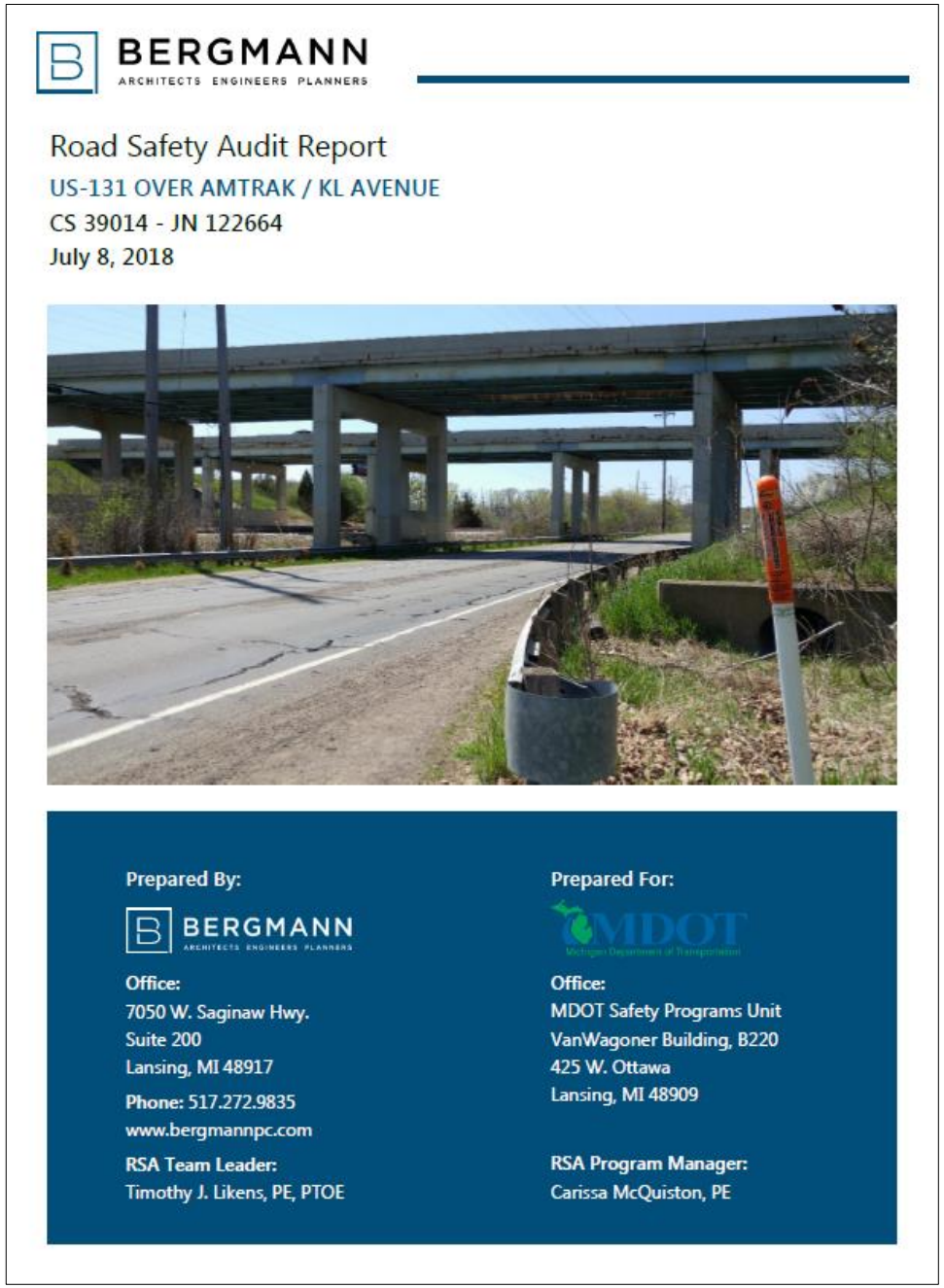
Risk assessment

Suggestions for mitigation

Priority for consideration

RSA REPORT

- Prepared by Team Leaders
- Documents the results of the RSA
- Identifies and prioritizes safety issues
- May include suggestions for improvements, to illustrate how a safety issue might be mitigated
- Owner will document a response to the RSA findings



BERGMANN
ARCHITECTS ENGINEERS PLANNERS

Road Safety Audit Report

US-131 OVER AMTRAK / KL AVENUE

CS 39014 - JN 122664

July 8, 2018

Prepared By:

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QUESTIONS?

BERGMANN

RSA: M-35 FROM FORD RIVER TO LAKE SHORE DRIVE

Prepared for:

MDOT
Michigan Department of Transportation

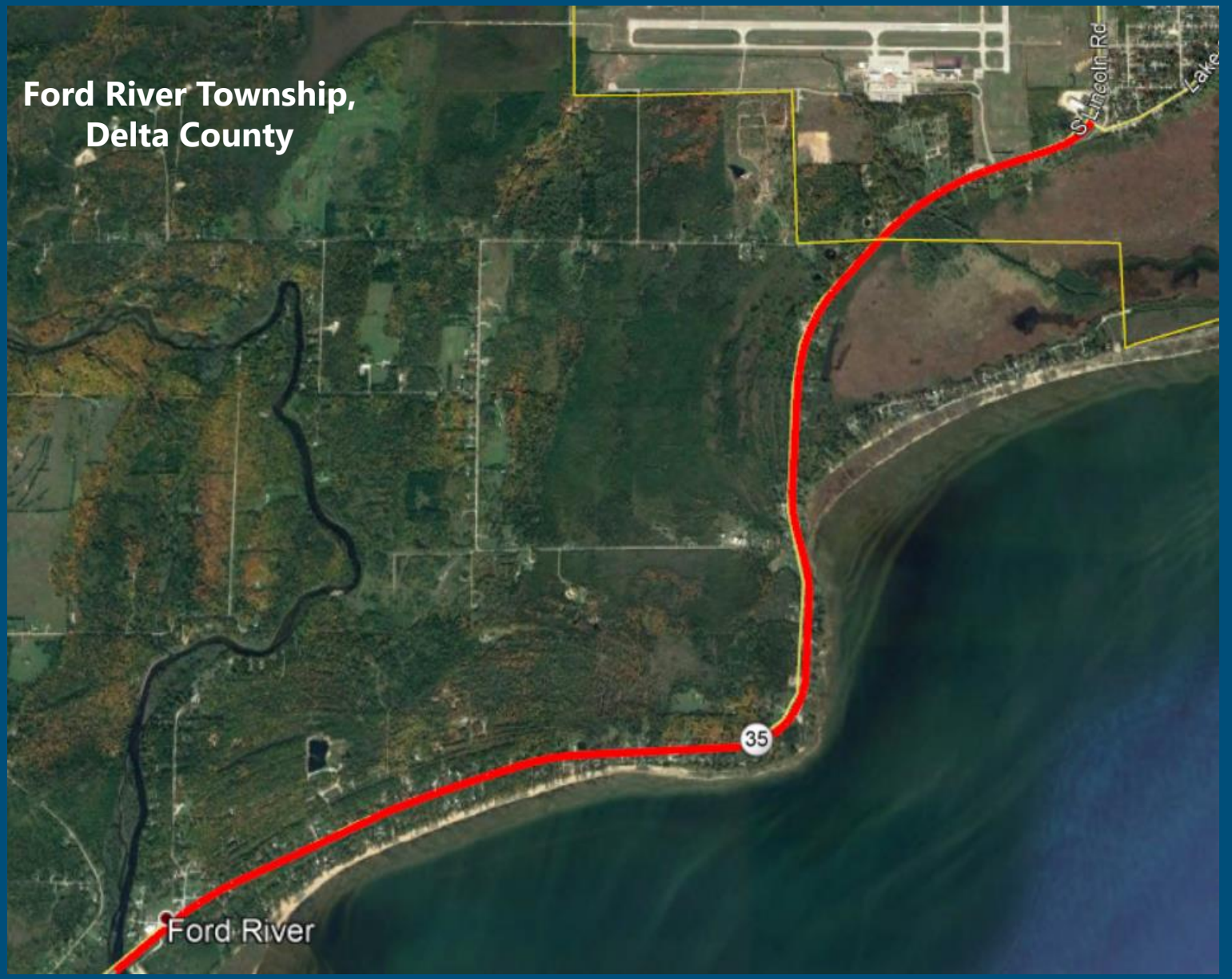
NATIONAL FIRM. STRONG LOCAL CONNECTIONS.

PROJECT LOCATION

NORTH

4.6 Miles

Lake Shore Drive



Ford River

NATIONAL FIRM. STRONG LOCAL CONNECTIONS.

PROJECT FEATURES

- M-35 – Principal Arterial
- Airport at northern end of segment
- Ford River bridge at southern end
- Primary land uses – Residential / Natural (undeveloped); some commercial
- Several county road intersections
- Mostly open drainage
- Mostly 2-lane (12 FT lane / 8 FT shoulder)
- Posted Speed - 50 mph
- 4 ½ miles free-flow (minor STOP)

Ford River

Ford River to Breezy Point

- 2-lane roadway
- Many residential driveways
- Moderate horizonal curve
- Bridge structure over Ford River
- Boat slip, commercial access

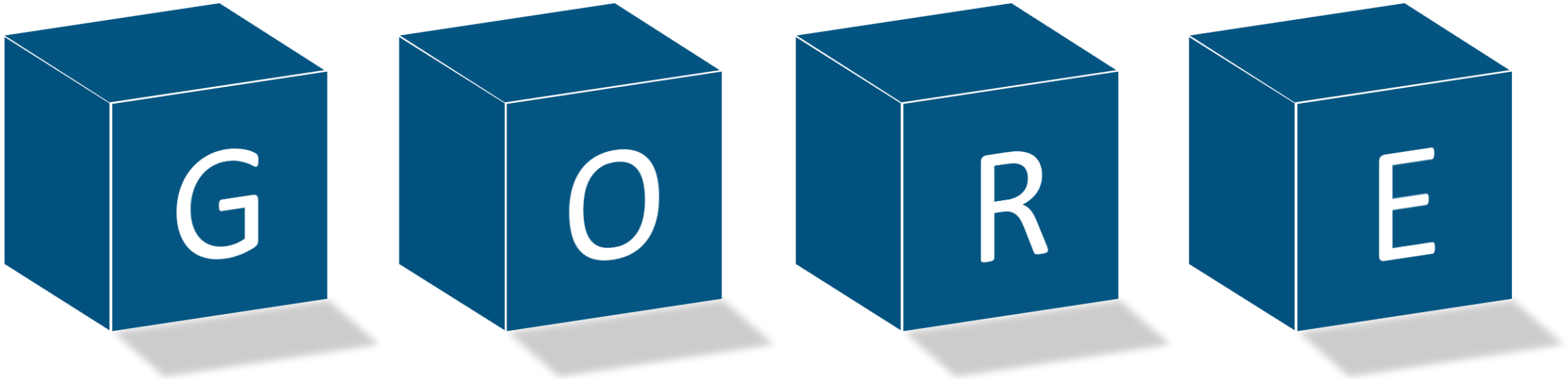
Breezy Point

- Significant Horizontal Curve
- Restaurant access at Point

Breezy Point to Lake Shore Drive

- 2-lane roadway
- Widens to 4-lane towards Escanaba
- Bridge / culvert over Portage Creek

FIELD REVIEW PREPARATION – PLEASE TAKE NOTES!



- Curve
- Gradient
- Cross section
- Clearance
- Sight distance
- Clear zone

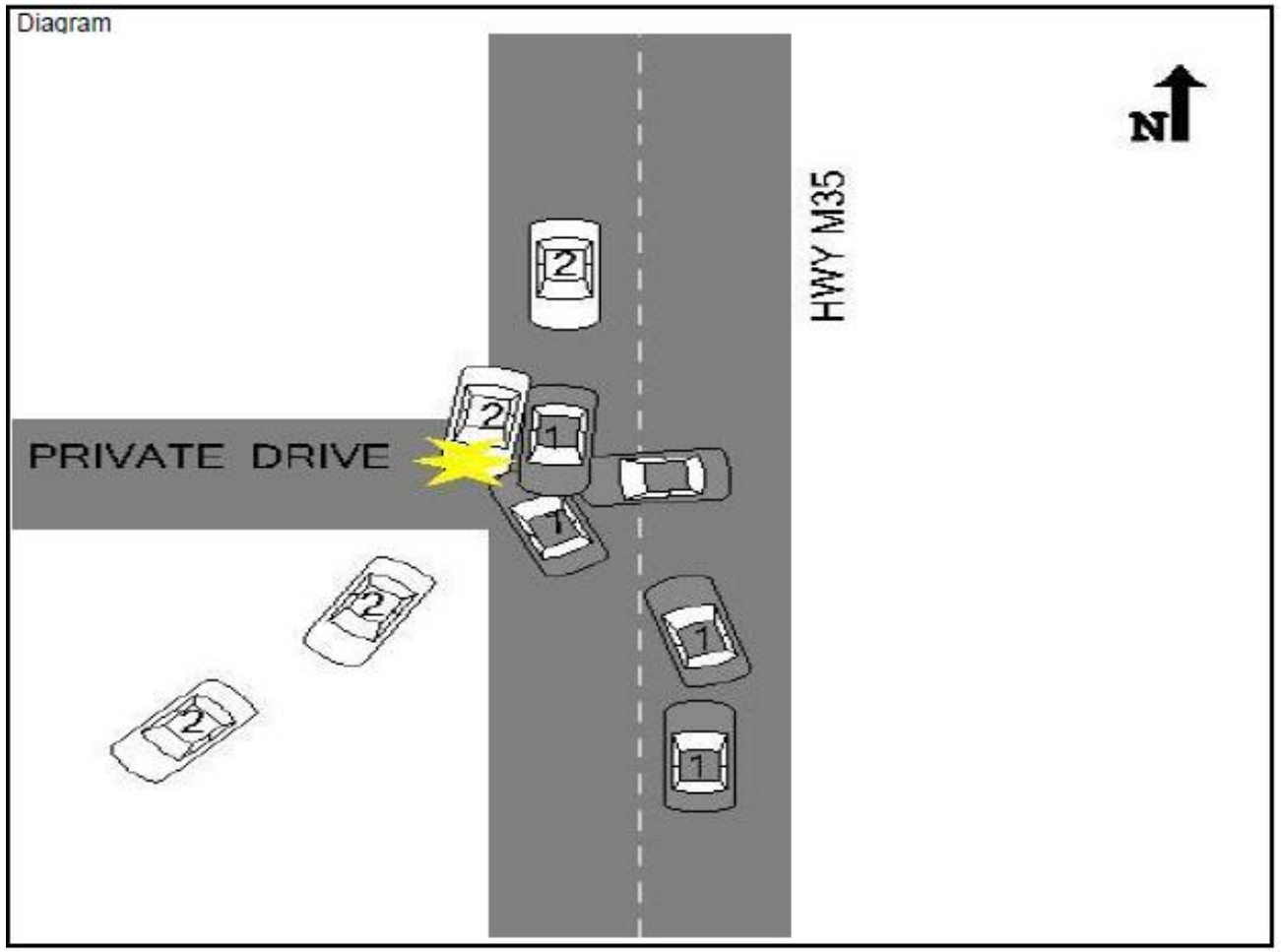
- Congestion
- Signal operation
- Speed management
- Queuing
- Turning movements

- Motorists
- Bicyclists
- Pedestrians
- Other users

- Weather
- Lighting
- Road conditions

ROAD SAFETY AUDIT FOR M-35 - FORD RIVER TO LAKE SHORE DRIVE

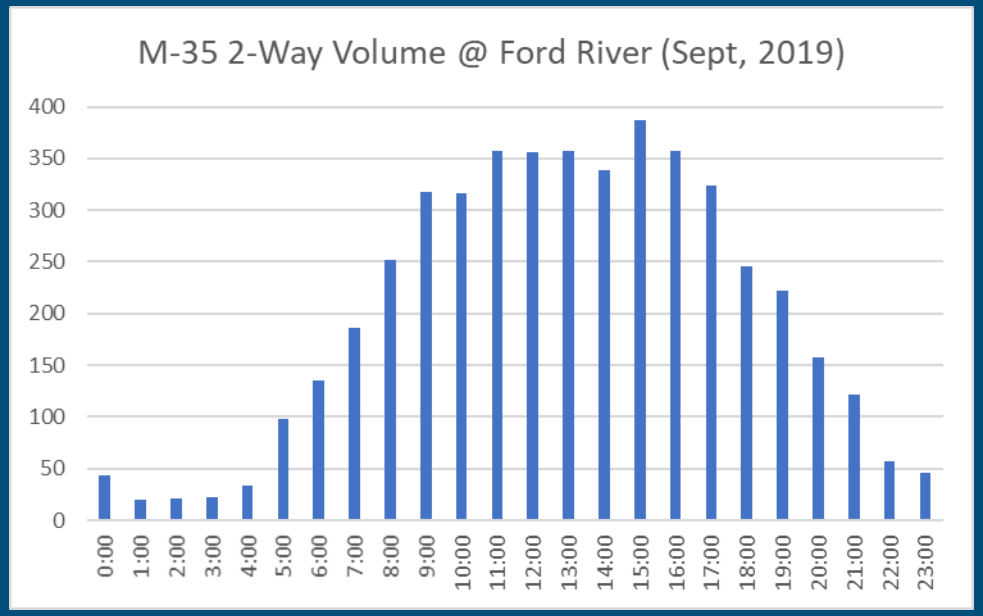
- Project Location Maps
- Traffic Count Data
- Right-of-Way (ROW) Maps
- Roadway Plans
- Crash Data
- Previous Studies

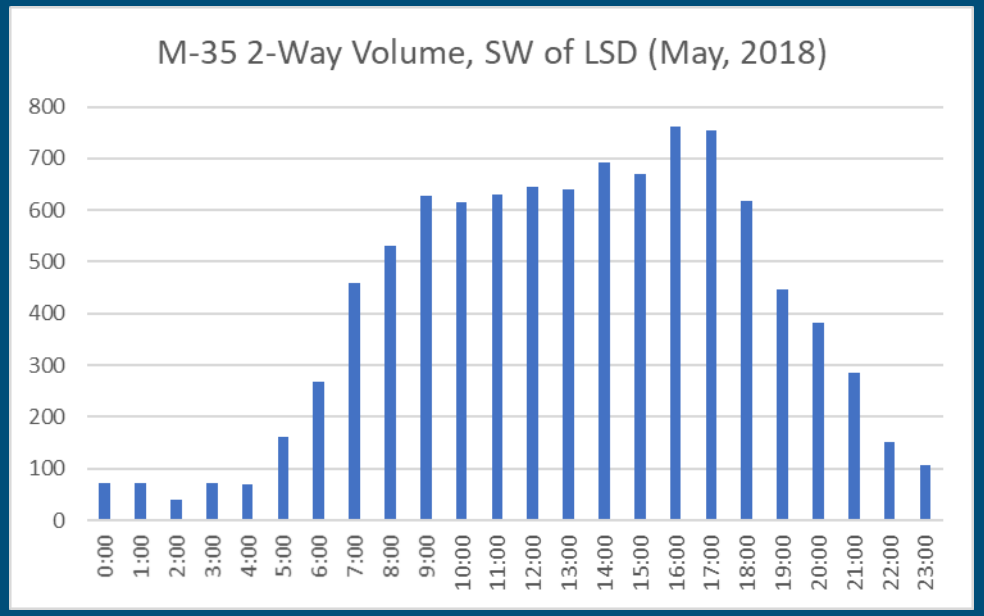


M-35 TRAFFIC VOLUME DATA

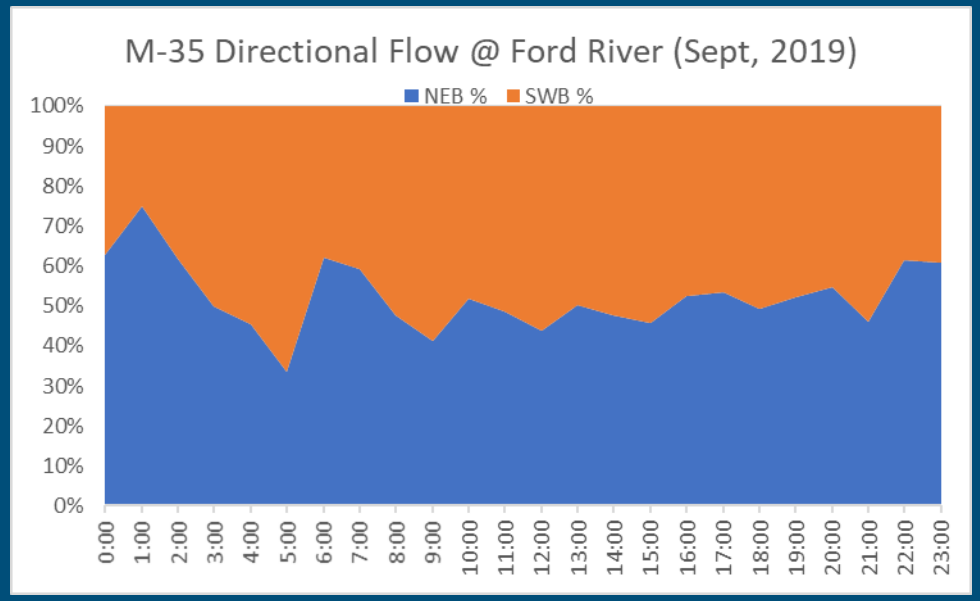
4,770
DAILY

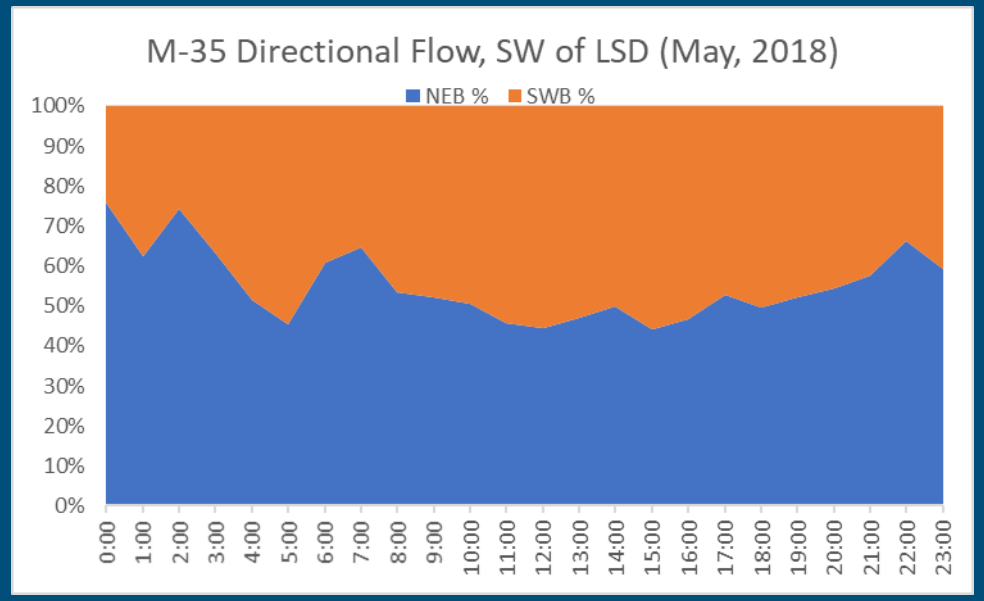
18%
HEAVY
VEHICLES



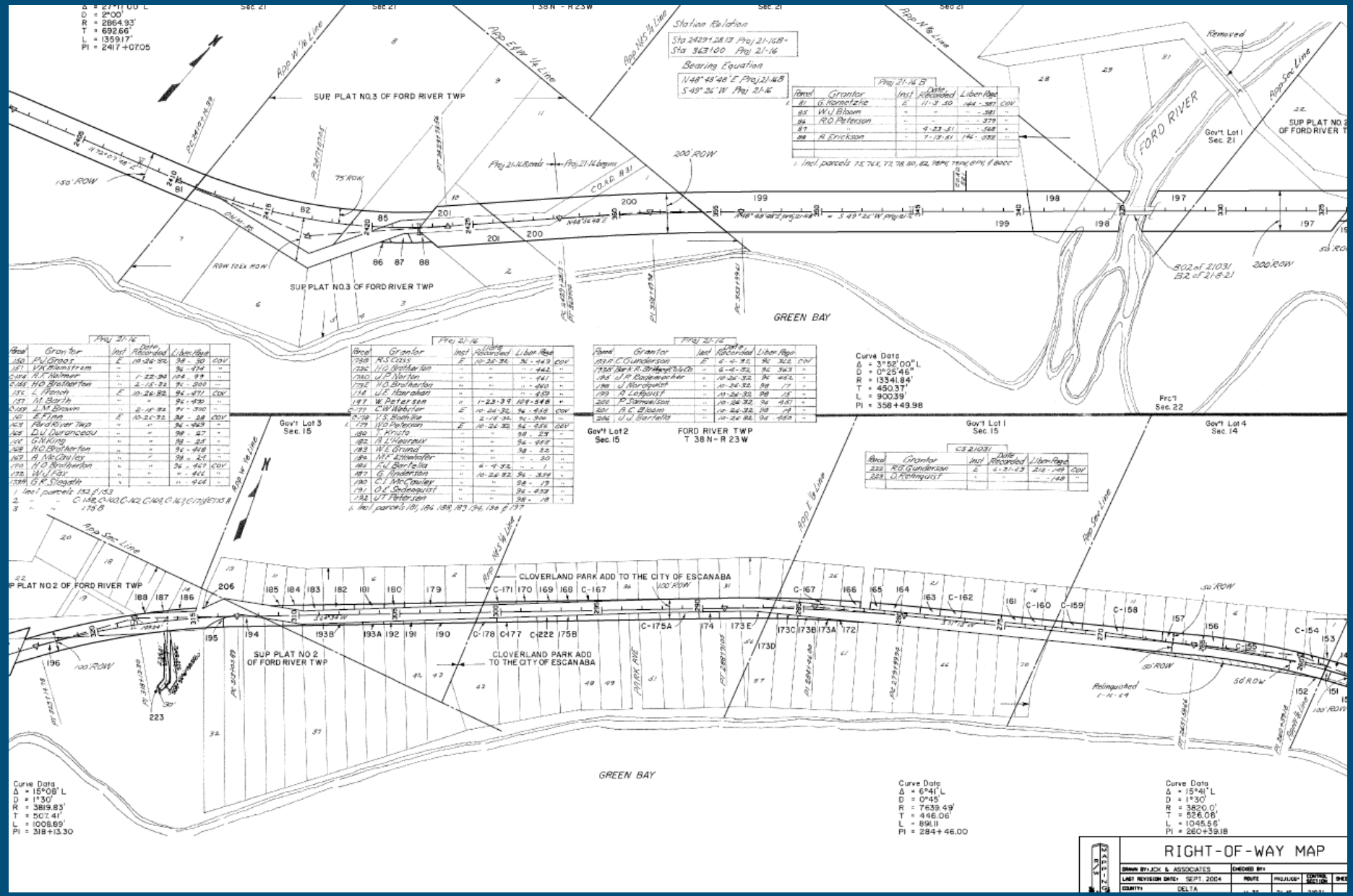


9,771
DAILY



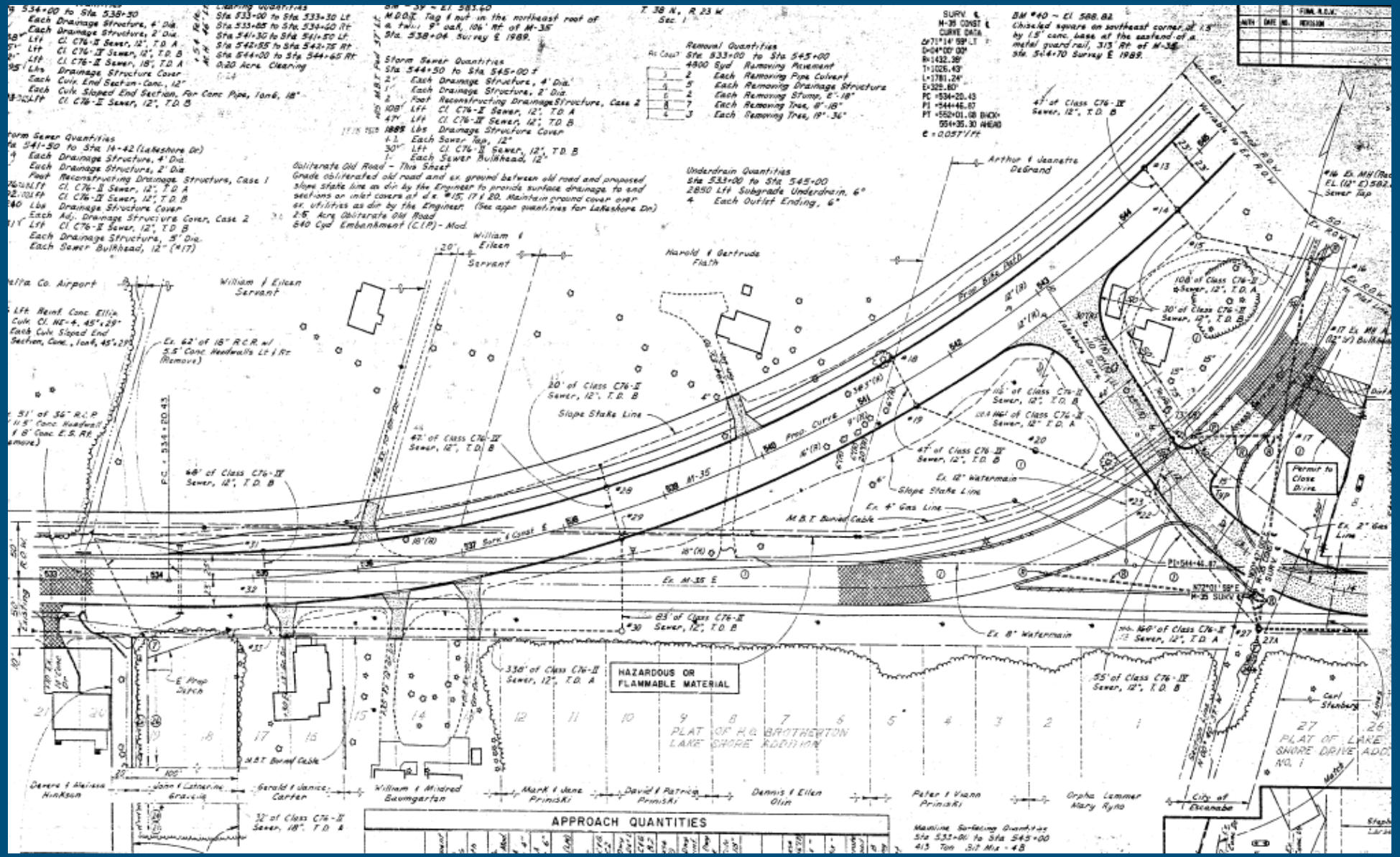


RIGHT-OF-WAY (R.O.W.) MAPS



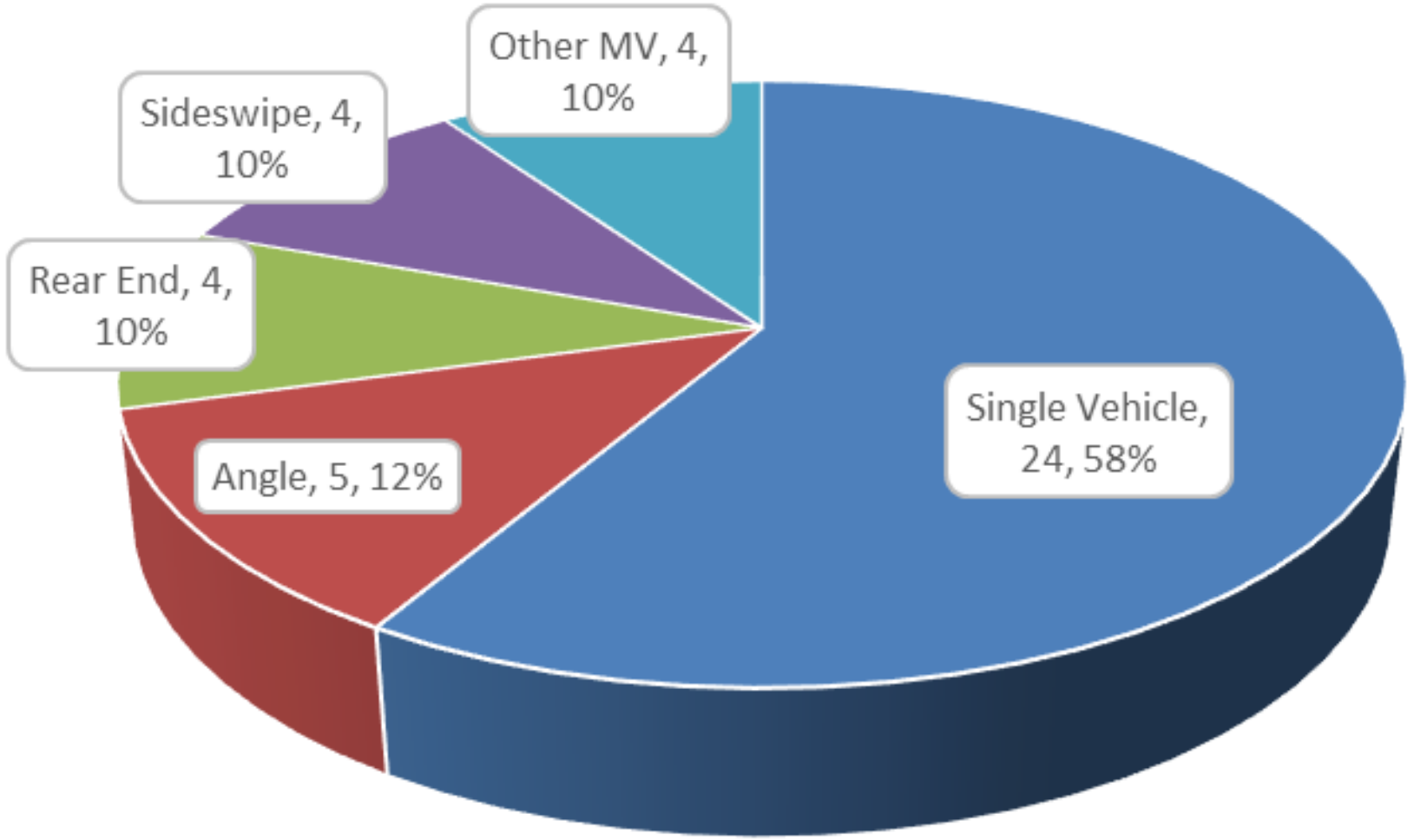
NATIONAL FIRM. STRONG LOCAL CONNECTIONS.

ROADWAY PLANS



NATIONAL FIRM. STRONG LOCAL CONNECTIONS.

M-35 CRASH TYPE BREAKDOWN: 1/1/2014 - 5/1/2019 (5.3 YRS.)



*EXCLUDES ANIMAL CRASHES

CRASH DATA – 1/1/2014 THROUGH 5/1/2019 (5.3 YRS.)

Crash Type	Number of Crashes by Severity					Number of Persons by Degree of Injury				
	Fatal	A Injury	B/C and Property Damage	Other	Total	Fatal	Type A	Type B	Type C	Not Injured
Angle Driveway	0	0	2	0	2	0	0	0	0	7
Percent			100							100.0
Angle Straight	0	0	3	0	3	0	0	0	1	4
Percent			100						20	80.0
Fixed Object	1	0	14	0	15	1	1	1	2	13
Percent	6.7		93.3			5.6	5.6	5.6	11.1	72.2
Head-On Left-Turn Not Associated with Driveway	0	0	1	0	1	0	0	0	1	1
Percent			100						50	50.0
Misc. Multiple Vehicle	0	0	2	0	2	0	0	0	0	4
Percent			100							100.0
Misc. Single Vehicle	0	0	1	0	1	0	0	0	0	1
Percent			100							100.0
Other Object	0	0	4	0	4	0	0	0	0	4
Percent			100							100.0
Overturn	0	2	2	0	4	0	2	1	1	0
Percent		50	50				50	25	25	0.0
Parking	0	0	1	0	1	0	0	0	1	0
Percent			100						100	0.0
Rear End Driveway	0	0	1	0	1	0	0	0	0	3
Percent			100							100.0
Rear End Straight	0	0	3	0	3	0	0	0	2	8
Percent			100						20	80.0
Side-Swipe Opposite	0	0	2	0	2	0	0	0	0	3
Percent			100							100.0
Side-Swipe Same	0	0	2	0	2	0	0	0	0	5
Percent			100							100.0
Totals	1	2	38	0	41	1	3	2	8	53
Percent	2.4	4.9	92.7			1.5	4.5	3	11.9	79.1

CRASH DATA – 1/1/2014 THROUGH 5/1/2019 (5.3 YRS.)

Pavement Condition

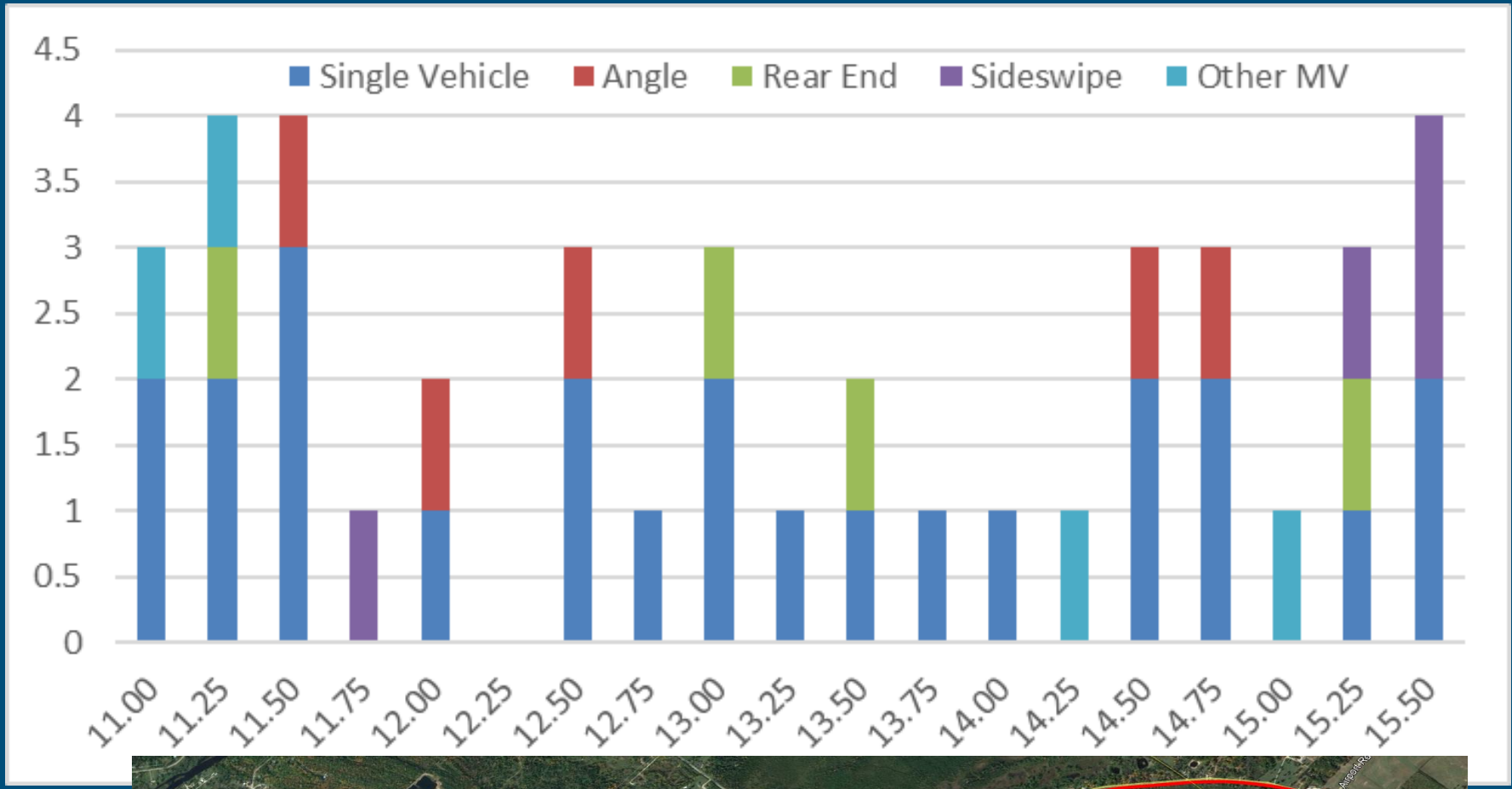
Year	Debris		Dry		Icy		Muddy		Slushy		Snowy		Wet		Others	
2014	0	0 %	4	31 %	2	15 %	0	0 %	0	0 %	5	38 %	2	15 %	0	0 %
2015	0	0 %	4	36 %	4	36 %	0	0 %	0	0 %	2	18 %	1	9 %	0	0 %
2016	0	0 %	3	100 %	0	0 %	0	0 %	0	0 %	0	0 %	0	0 %	0	0 %
2017	0	0 %	2	67 %	0	0 %	0	0 %	0	0 %	0	0 %	1	33 %	0	0 %
2018	0	0 %	6	86 %	0	0 %	0	0 %	0	0 %	0	0 %	1	14 %	0	0 %
2019	0	0 %	0	0 %	2	50 %	0	0 %	0	0 %	1	25 %	1	25 %	0	0 %
Total	0	0 %	19	46 %	8	20 %	0	0 %	0	0 %	8	20 %	6	15 %	0	0 %

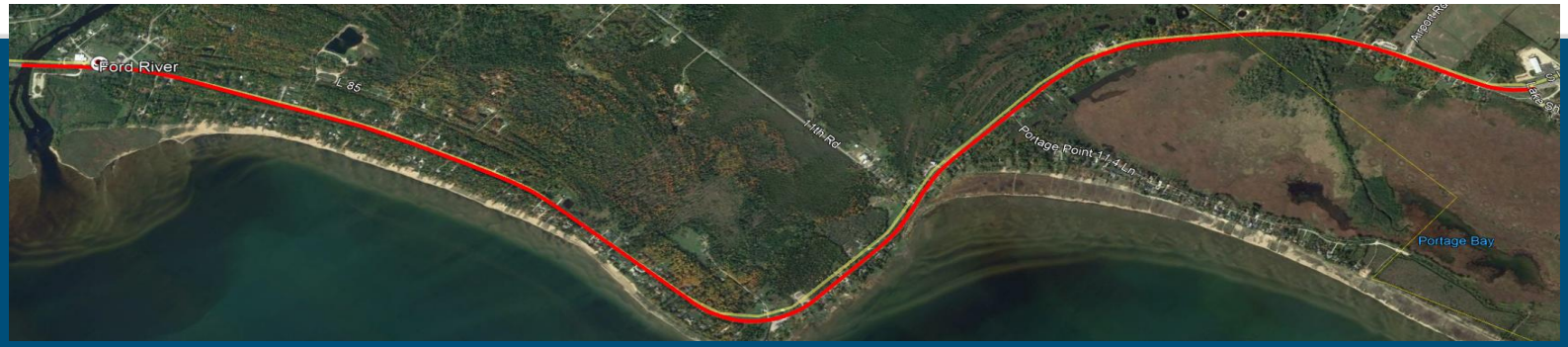
*1 K, 2A LEVEL SEVERITY, ALL OCCURRED IN DRY CONDITIONS

Light Condition

Year	Dark Lighted		Dark Unlighted		Dawn		Daylight		Dusk		Others	
2014	0	0 %	3	23 %	1	8 %	8	62 %	1	8 %	0	0 %
2015	0	0 %	3	27 %	0	0 %	8	73 %	0	0 %	0	0 %
2016	0	0 %	2	67 %	0	0 %	1	33 %	0	0 %	0	0 %
2017	0	0 %	0	0 %	0	0 %	3	100 %	0	0 %	0	0 %
2018	1	14 %	2	29 %	1	14 %	3	43 %	0	0 %	0	0 %
2019	1	25 %	1	25 %	0	0 %	2	50 %	0	0 %	0	0 %
Total	2	5 %	11	27 %	2	5 %	25	61 %	1	2 %	0	0 %

CRASH FREQUENCY BY LOCATION & TYPE (5.3 YRS.)





NORTH

M-35 - FORD RIVER BRIDGE TO LAKE SHORE DRIVE
ROAD SAFETY AUDIT - DAY 1
ATTENDANCE
WEDNESDAY, NOVEMBER 6, 2019

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	TODD M. TARDIFF	Delta County Sheriff	906-786-3633	Ttardiff@deltacountymi.org
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*	JASON EALY	MDOT - GEOMETRICS	517 335 2864	EALYJ@MICHIGAN.GOV
*	JASON COLE	MDOT - GRAND RAPIDS TSC	616-295-2132	colej@michigan.gov
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*	Dave Bradley	MDOT Crystal Falls	906-875-6644	Bradleyd5@michigan.gov
*	Jason DeGrand	MDOT - Region	906-786-1800	degrandj@michigan.gov
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*	Justin Junttila	MDOT - Region	906-786-1800	junttilaj@michigan.gov
*	MARK MALONEY	MDOT - SUPERIOR REGION	906-786-1800	MALONEYM@MICHIGAN.GOV
	Peter Van Steen	CUPPAD Regional Commission	906 786 9234	pvansteen@cuppad.org
	Kelly Smyth	Delta County Non Motorized Trails	906-280-8946	bikerkel3@gmail.com
	Jamie Dolan	MSP - Office of Highway Safety	517-331-6146	DolanJ@michigan.gov
	CHAD LARSEN	MSP CVED 8TH DISTRICT HQ	906-250-7064	LARSENC@MICHIGAN.GOV

*** MDOT / RSA Team members also present at Findings meeting on Thursday, Nov 7, 2019 (no other stakeholders)**

M-35 - FORD RIVER BRIDGE TO LAKE SHORE DRIVE
ROAD SAFETY AUDIT - DAY 1
ATTENDANCE
WEDNESDAY, NOVEMBER 6, 2019

*	Pete Wessel	MDOT - Superior Region Bridge	906-630-0547	wesselp@michigan.gov
*	Amanda Bink	MDOT - Superior Region	906-786-1800	binka1@michigan.gov
	Jody Norman	Delta County Rd Comm	906-786-3200	jody@deltacrc.org
*	TREVOR SHOLTEN	MDOT - SUPERIOR REGION	906-786-1800	SHOLTENT@MICHIGAN.GOV
	Additional present for Nov 7 findings meeting:			
	Benjamin Feldhausen	**MDOT Crystal Falls TSC**	**906-875-6644**	**FeldhausenB@michigan.gov**

Appendix B

HSM & Benefit-Cost Calculations

M-35 Road Safety Audit

Date: January, 2020
Agency: Bergmann
Analyst: Timothy J. Likens, PE, PTOE
Description: Ford River to Lake Shore Drive

Control Section(s): 21031
PR Number(s): 1349006
Job Number(s): 203002 EPE

Empirical Bayes Analysis (Project-Level)

	Predicted average crash frequency (crashes/year)			Observed Crashes (crashes/year)	Coefficients							Expected Crashes (crashes/year)		
	$N_{predicted}$ (TOTAL)	$N_{predicted}$ (FI)	$N_{predicted}$ (PDO)	$N_{observed}$	N_{w0}	N_{w1}	W_0	N_0	W_1	N_1	$N_{p/comb}$	$N_{expected}$ (TOTAL)	$N_{expected}$ (FI)	$N_{expected}$ (pdo)
Rural 2-Lane	15.724	1.714	14.010	19	13.921	2.895	0.530	17.262	0.845	16.233	16.748	16.7	1.8	14.9
Rural Multilane	0.662	0.404	0.258	1	0.274	0.643	0.708	0.761	0.507	0.828	0.795	0.8	0.5	0.3
Urban/ Suburban	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	*16.386*	*2.118*	*14.268*	*20*	--	--	--	--	--	--	--	*17.5*	*2.3*	*15.2*

Highest Predicted Total Crashes (crashes/year)

Rank					Predicted
1.	(SEG) M-35, MP 11.0 - 12.9	MDOT	Length = 1.9 mi	AADT: 5,000	7.64
2.	(SEG) M-35, MP 13.3 - 15.3	MDOT	Length = 2 mi	AADT: 6,500	6.15
3.	(SEG) M-35, MP 12.9 - 13.3	MDOT	Length = 0.4 mi	AADT: 5,000	1.94
4.	(SEG) M-35, MP 15.3 - 15.6	MDOT	Length = 0.3 mi	AADT: 8,000	0.66
5.	--	--	--	--	--
6.	--	--	--	--	--
7.	--	--	--	--	--
8.	--	--	--	--	--
9.	--	--	--	--	--
10.	--	--	--	--	--

Highest Predicted Fatal & Injury Crashes (crashes/year)

Rank					Predicted
1.	(SEG) M-35, MP 11.0 - 12.9	MDOT	Length = 1.9 mi	AADT: 5,000	0.83
2.	(SEG) M-35, MP 13.3 - 15.3	MDOT	Length = 2 mi	AADT: 6,500	0.67
3.	(SEG) M-35, MP 15.3 - 15.6	MDOT	Length = 0.3 mi	AADT: 8,000	0.40
4.	(SEG) M-35, MP 12.9 - 13.3	MDOT	Length = 0.4 mi	AADT: 5,000	0.21
5.	--	--	--	--	--
6.	--	--	--	--	--
7.	--	--	--	--	--
8.	--	--	--	--	--
9.	--	--	--	--	--
10.	--	--	--	--	--

M-35 RSA - Corrugation Treatment

Date: January, 2020
Agency: Bergmann
Analyst: Timothy J. Likens, PE, PTOE
Description: Ford River to Lake Shore Drive

Control Section(s): 21031
PR Number(s): 1349006
Job Number(s): 203002 EPE

Empirical Bayes Analysis (Project-Level)

	Predicted average crash frequency (crashes/year)			Observed Crashes (crashes/year)	Coefficients							Expected Crashes (crashes/year)		
	$N_{predicted}$ (TOTAL)	$N_{predicted}$ (FI)	$N_{predicted}$ (PDO)	$N_{observed}$	N_{w0}	N_{w1}	W_0	N_0	W_1	N_1	$N_{p/comb}$	$N_{expected}$ (TOTAL)	$N_{expected}$ (FI)	$N_{expected}$ (pdo)
Rural 2-Lane	12.416	1.353	11.062	19	8.679	2.572	0.589	15.125	0.828	13.546	14.335	14.3	1.6	12.8
Rural Multilane	0.662	0.404	0.258	1	0.274	0.643	0.708	0.761	0.507	0.828	0.795	0.8	0.5	0.3
Urban/ Suburban	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	*13.078*	*1.757*	*11.320*	*20*	--	--	--	--	--	--	--	*15.1*	*2.0*	*13.1*

Highest Predicted Total Crashes (crashes/year)

Rank					Predicted
1.	(SEG) M-35, MP 11.0 - 12.9	MDOT	Length = 1.9 mi	AADT: 5,000	6.03
2.	(SEG) M-35, MP 13.3 - 15.3	MDOT	Length = 2 mi	AADT: 6,500	4.86
3.	(SEG) M-35, MP 12.9 - 13.3	MDOT	Length = 0.4 mi	AADT: 5,000	1.53
4.	(SEG) M-35, MP 15.3 - 15.6	MDOT	Length = 0.3 mi	AADT: 8,000	0.66
5.	--	--	--	--	--
6.	--	--	--	--	--
7.	--	--	--	--	--
8.	--	--	--	--	--
9.	--	--	--	--	--
10.	--	--	--	--	--

Highest Predicted Fatal & Injury Crashes (crashes/year)

Rank					Predicted
1.	(SEG) M-35, MP 11.0 - 12.9	MDOT	Length = 1.9 mi	AADT: 5,000	0.66
2.	(SEG) M-35, MP 13.3 - 15.3	MDOT	Length = 2 mi	AADT: 6,500	0.53
3.	(SEG) M-35, MP 15.3 - 15.6	MDOT	Length = 0.3 mi	AADT: 8,000	0.40
4.	(SEG) M-35, MP 12.9 - 13.3	MDOT	Length = 0.4 mi	AADT: 5,000	0.17
5.	--	--	--	--	--
6.	--	--	--	--	--
7.	--	--	--	--	--
8.	--	--	--	--	--
9.	--	--	--	--	--
10.	--	--	--	--	--

M-35 RSA - Center Left Turn Lane

Date: January, 2020
Agency: Bergmann
Analyst: Timothy J. Likens, PE, PTOE
Description: Ford River to Lake Shore Drive

Control Section(s): 21031
PR Number(s): 1349006
Job Number(s): 203002 EPE

Empirical Bayes Analysis (Project-Level)

	Predicted average crash frequency (crashes/year)			Observed Crashes (crashes/year)	Coefficients							Expected Crashes (crashes/year)		
	$N_{predicted}$ (TOTAL)	$N_{predicted}$ (FI)	$N_{predicted}$ (PDO)	$N_{observed}$	N_{w0}	N_{w1}	W_0	N_0	W_1	N_1	$N_{p/comb}$	$N_{expected}$ (TOTAL)	$N_{expected}$ (FI)	$N_{expected}$ (pdo)
Rural 2-Lane	12.799	1.395	11.404	19	9.031	2.560	0.586	15.364	0.833	13.832	14.598	14.6	1.6	13.0
Rural Multilane	0.662	0.404	0.258	1	0.274	0.643	0.708	0.761	0.507	0.828	0.795	0.8	0.5	0.3
Urban/ Suburban	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	*13.461*	*1.799*	*11.662*	*20*	--	--	--	--	--	--	--	*15.4*	*2.1*	*13.3*

Highest Predicted Total Crashes (crashes/year)

Rank					Predicted
1.	(SEG) M-35, MP 13.3 - 15.3	MDOT	Length = 2 mi	AADT: 6,500	6.15
2.	(SEG) M-35, MP 11.0 - 12.9	MDOT	Length = 1.9 mi	AADT: 5,000	5.28
3.	(SEG) M-35, MP 12.9 - 13.3	MDOT	Length = 0.4 mi	AADT: 5,000	1.37
4.	(SEG) M-35, MP 15.3 - 15.6	MDOT	Length = 0.3 mi	AADT: 8,000	0.66
5.	--	--	--	--	--
6.	--	--	--	--	--
7.	--	--	--	--	--
8.	--	--	--	--	--
9.	--	--	--	--	--
10.	--	--	--	--	--

Highest Predicted Fatal & Injury Crashes (crashes/year)

Rank					Predicted
1.	(SEG) M-35, MP 13.3 - 15.3	MDOT	Length = 2 mi	AADT: 6,500	0.67
2.	(SEG) M-35, MP 11.0 - 12.9	MDOT	Length = 1.9 mi	AADT: 5,000	0.58
3.	(SEG) M-35, MP 15.3 - 15.6	MDOT	Length = 0.3 mi	AADT: 8,000	0.40
4.	(SEG) M-35, MP 12.9 - 13.3	MDOT	Length = 0.4 mi	AADT: 5,000	0.15
5.	--	--	--	--	--
6.	--	--	--	--	--
7.	--	--	--	--	--
8.	--	--	--	--	--
9.	--	--	--	--	--
10.	--	--	--	--	--

M-35 RSA - Corrugation & Center Left

Date: January, 2020
Agency: Bergmann
Analyst: Timothy J. Likens, PE, PTOE
Description: Ford River to Lake Shore Drive

Control Section(s): 21031
PR Number(s): 1349006
Job Number(s): 203002 EPE

Empirical Bayes Analysis (Project-Level)

	Predicted average crash frequency (crashes/year)			Observed Crashes (crashes/year)	Coefficients							Expected Crashes (crashes/year)		
	$N_{predicted}$ (TOTAL)	$N_{predicted}$ (FI)	$N_{predicted}$ (PDO)	$N_{observed}$	N_{w0}	N_{w1}	W_0	N_0	W_1	N_1	$N_{p/comb}$	$N_{expected}$ (TOTAL)	$N_{expected}$ (FI)	$N_{expected}$ (pdo)
Rural 2-Lane	10.441	1.138	9.303	19	6.006	2.323	0.635	13.566	0.818	11.999	12.782	12.8	1.4	11.4
Rural Multilane	0.662	0.404	0.258	1	0.274	0.643	0.708	0.761	0.507	0.828	0.795	0.8	0.5	0.3
Urban/ Suburban	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	*11.103*	*1.542*	*9.561*	*20*	--	--	--	--	--	--	--	*13.6*	*1.9*	*11.7*

Highest Predicted Total Crashes (crashes/year)

Rank					Predicted
1.	(SEG) M-35, MP 13.3 - 15.3	MDOT	Length = 2 mi	AADT: 6,500	4.86
2.	(SEG) M-35, MP 11.0 - 12.9	MDOT	Length = 1.9 mi	AADT: 5,000	4.44
3.	(SEG) M-35, MP 12.9 - 13.3	MDOT	Length = 0.4 mi	AADT: 5,000	1.15
4.	(SEG) M-35, MP 15.3 - 15.6	MDOT	Length = 0.3 mi	AADT: 8,000	0.66
5.	--	--	--	--	--
6.	--	--	--	--	--
7.	--	--	--	--	--
8.	--	--	--	--	--
9.	--	--	--	--	--
10.	--	--	--	--	--

Highest Predicted Fatal & Injury Crashes (crashes/year)

Rank					Predicted
1.	(SEG) M-35, MP 13.3 - 15.3	MDOT	Length = 2 mi	AADT: 6,500	0.53
2.	(SEG) M-35, MP 11.0 - 12.9	MDOT	Length = 1.9 mi	AADT: 5,000	0.48
3.	(SEG) M-35, MP 15.3 - 15.6	MDOT	Length = 0.3 mi	AADT: 8,000	0.40
4.	(SEG) M-35, MP 12.9 - 13.3	MDOT	Length = 0.4 mi	AADT: 5,000	0.13
5.	--	--	--	--	--
6.	--	--	--	--	--
7.	--	--	--	--	--
8.	--	--	--	--	--
9.	--	--	--	--	--
10.	--	--	--	--	--

M-35 RSA - Escanaba, MI

Safety Improvements

Crash Cost Calculations

UMTRI Crash Cost Data (2015 Dollars)					
Severity	**Crashes**	**Total Cost**	**$ per Crash (Total)**	**Monetary Cost**	**$ per Crash**
Fatal	27	$ 239,635,568	$ 8,875,391	$ 36,341,293	$ 1,345,974
A	134	$ 65,310,238	$ 487,390	$ 10,940,097	$ 81,643
B	430	$ 58,025,594	$ 134,943	$ 10,140,875	$ 23,583
C	1,305	$ 87,696,402	$ 67,200	$ 25,322,987	$ 19,405
PDO	12,906	$ 56,108,085	$ 4,347	$ 42,556,705	$ 3,297
Total	14,802	$ 506,775,887	$ 34,237	$ 125,301,957	$ 8,465
Avg. Cost per Crash		$ 34,237	-	$ 8,465	-

Crash Costs from HSM (2016 Dollars)			
Severity	**Economic $**	**QALY $**	**Comprehensive $**
Fatal	$ 1,688,100	$ 4,052,000	$ 5,740,100
A	$ 151,000	$ 153,400	$ 304,400
B	$ 56,800	$ 54,400	$ 111,200
C	$ 38,500	$ 24,200	$ 62,700
PDO	$ 8,700	$ 1,400	$ 10,100

AASHTO Safety Analyst Crash Costs (2015 Dollars)			
Severity	**Economic $**	**QALY $**	**Comprehensive $**
Fatal	$ 1,674,100	$ 4,048,200	$ 5,722,300
A	$ 149,700	$ 153,200	$ 302,900
B	$ 56,300	$ 54,400	$ 110,700
C	$ 38,200	$ 24,200	$ 62,400
PDO	$ 8,600	$ 1,500	$ 10,100

FHWA Reported Crash Costs (2016 Dollars)			
Severity	**Economic $**	**QALY $**	**Comprehensive $**
Fatal	$ 1,722,991	$ 9,572,411	$ 11,295,402
A	$ 130,068	$ 524,899	$ 654,967
B	$ 53,700	$ 144,792	$ 198,492
C	$ 42,536	$ 83,026	$ 125,562
PDO	$ 11,906	$ -	$ 11,906

M-35 RSA - Escanaba, MI

Safety Improvements

Crash Cost Calculations

Michigan Crash Costs (2014 Dollars)	
Severity	**Reported $**
Fatal	$ 1,512,000
A	$ 88,500
B	$ 25,600
C	$ 11,300
PDO	$ 11,300

* Appendix C of the FHWA Report

per Crash Monetary (only) Cost Comparisons					
Severity	**UMTRI**	**HSM**	**AASHTO**	**FHWA**	**Average**
Fatal	$ 1,345,974	$ 1,688,100	$ 1,674,100	$ 1,722,991	$ 1,607,791
A	$ 81,643	$ 151,000	$ 149,700	$ 130,068	$ 128,103
B	$ 23,583	$ 56,800	$ 56,300	$ 53,700	$ 47,596
C	$ 19,405	$ 38,500	$ 38,200	$ 42,536	$ 34,660
PDO	$ 3,297	$ 8,700	$ 8,600	$ 11,906	$ 8,126

per Crash Comprehensive (QALY) Cost Comparisons					
Severity	**UMTRI**	**HSM**	**AASHTO**	**FHWA**	**Average**
Fatal	$ 8,875,391	$ 5,740,100	$ 5,722,300	$ 11,295,402	$ 7,908,298
A	$ 487,390	$ 304,400	$ 302,900	$ 654,967	$ 437,414
B	$ 134,943	$ 111,200	$ 110,700	$ 198,492	$ 138,834
C	$ 67,200	$ 62,700	$ 62,400	$ 125,562	$ 79,466
PDO	$ 4,347	$ 10,100	$ 10,100	$ 11,906	$ 9,113

References:

UMTRI *Societal Costs of Traffic Crashes and Crime in Michigan: 2017 Update*

FHWA *Crash Costs for Highway Safety Analysis, 2018*

M-35 RSA - Escanaba, MI
Safety Improvements - Corridor
HSM Crash Reduction Expectancy

Observed Crash Severity 2014-2018			
Severity	**5-Year**	**per Year**	**%**
Fatal	1	0.2	1.0%
A	2	0.4	2.0%
B	2	0.4	2.0%
C	10	2.0	10.0%
Injury [subtotal]	15	3.0	15.0%
PDO	85	17.0	85.0%
Total	100	20.0	100%

M-35 RSA - Escanaba, MI
Safety Improvements - Corridor
HSM Crash Reduction Expectancy

HSM Expected Crashes (Existing Conditions)		
Severity	**per Year**	**%**
Fatal	0.2	1.1%
A	0.3	1.7%
B	0.3	1.7%
C	1.5	8.6%
Injury [subtotal]	2.3	13.1%
PDO	15.2	86.9%
Total	17.5	100%

HSM Crash Reduction Expectancy: CMF=0.84/0.94

HSM Expected Crashes (Corrugations)		
Severity	**per Year**	**%**
Fatal	0.2	1.3%
A	0.2	1.3%
B	0.2	1.3%
C	1.4	9.3%
Injury [subtotal]	2.0	13.2%
PDO	13.1	86.8%
Total	15.1	100%

HSM Crash Reduction (Corrugations)		
Severity	**per Year**	**%**
Fatal	0.0	0.0%
A	-0.1	4.2%
B	-0.1	4.2%
C	-0.1	4.2%
Injury [subtotal]	-0.3	12.5%
PDO	-2.1	87.5%
Total	-2.4	100%

M-35 RSA - Escanaba, MI

Safety Improvements - Install Corrugations

Benefit to Cost Calculations - HSM Crash Expectancy

Change in Crashes (Widen Inside Shoulder)		Cost Per Crash	Net Annual Benefit
Fatal	0.00	$ 7,908,298	$ -
A-Injury	-0.10	$ 437,414	$ 43,741
B-Injury	-0.10	$ 138,834	$ 13,883
C-Possible Injury	-0.10	$ 79,466	$ 7,947
PDO	-2.10	$ 9,113	$ 19,138
Total	**-2.40**		**$ 84,709**

Annual Cost of Improvement	
Construction Cost	$ 50,000
Discount Rate	5.00%
Service Life (year)	20
Annual Cost =	**$ 4,012**

Benefit Cost Ratio	
Net Annual Benefit	$ 84,709
Annual Cost of Improvement	$ 4,012
B/C Ratio =	**21.11**

* costs per crash include quality of life impacts

M-35 RSA - Escanaba, MI
Safety Improvements - Cottage Section
HSM Crash Reduction Expectancy

Observed Crash Severity 2014-2018			
Severity	**5-Year**	**per Year**	**%**
Fatal	1	0.2	1.0%
A	2	0.4	2.0%
B	2	0.4	2.0%
C	10	2.0	10.0%
Injury [subtotal]	15	3.0	15.0%
PDO	85	17.0	85.0%
Total	100	20.0	100%

M-35 RSA - Escanaba, MI
Safety Improvements - Cottage Section
HSM Crash Reduction Expectancy

HSM Expected Crashes (Existing Conditions)		
Severity	**per Year**	**%**
Fatal	0.2	1.1%
A	0.3	1.7%
B	0.3	1.7%
C	1.5	8.6%
Injury [subtotal]	2.3	13.1%
PDO	15.2	86.9%
Total	17.5	100%

HSM Crash Reduction Expectancy: CMF=0.70

HSM Expected Crashes (2-Way Left Turn Lane)		
Severity	**per Year**	**%**
Fatal	0.2	1.3%
A	0.2	1.3%
B	0.3	1.9%
C	1.4	9.1%
Injury [subtotal]	2.1	13.6%
PDO	13.3	86.4%
Total	15.4	100%

HSM Crash Reduction (2-Way Left Turn Lane)		
Severity	**per Year**	**%**
Fatal	0.0	0.0%
A	-0.1	4.8%
B	0.0	0.0%
C	-0.1	4.8%
Injury [subtotal]	-0.2	9.5%
PDO	-1.9	90.5%
Total	-2.1	100%

M-35 RSA - Escanaba, MI

Safety Improvements - Two-Way Left Turn Lane (Cottage Section)

Benefit to Cost Calculations - HSM Crash Expectancy

Change in Crashes (Widen Inside Shoulder)		Cost Per Crash	Net Annual Benefit
Fatal	0.00	$ 7,908,298	$ -
A-Injury	-0.10	$ 437,414	$ 43,741
B-Injury	0.00	$ 138,834	$ -
C-Possible Injury	-0.10	$ 79,466	$ 7,947
PDO	-1.90	$ 9,113	$ 17,315
Total	**-2.10**		**$ 69,003**

Annual Cost of Improvement	
Construction Cost	$ 2,500,000
Discount Rate	5.00%
Service Life (year)	20
Annual Cost =	**$ 200,606**

* costs per crash include quality of life impacts

Benefit Cost Ratio	
Net Annual Benefit	$ 69,003
Annual Cost of Improvement	$ 200,606
B/C Ratio =	**0.34**

M-35 RSA - Escanaba, MI
Safety Improvements - Corridor
HSM Crash Reduction Expectancy

Observed Crash Severity 2014-2018			
Severity	**5-Year**	**per Year**	**%**
Fatal	1	0.2	1.0%
A	2	0.4	2.0%
B	2	0.4	2.0%
C	10	2.0	10.0%
Injury [subtotal]	15	3.0	15.0%
PDO	85	17.0	85.0%
Total	100	20.0	100%

M-35 RSA - Escanaba, MI
Safety Improvements - Corridor
HSM Crash Reduction Expectancy

HSM Expected Crashes (Existing Conditions)		
Severity	**per Year**	**%**
Fatal	0.2	1.1%
A	0.3	1.7%
B	0.3	1.7%
C	1.5	8.6%
Injury [subtotal]	2.3	13.1%
PDO	15.2	86.9%
Total	17.5	100%

HSM Crash Reduction Expectancy: CMF=0.94&0.70

HSM Expected Crashes (Corrugation & TWLT)		
Severity	**per Year**	**%**
Fatal	0.2	1.5%
A	0.2	1.5%
B	0.2	1.5%
C	1.3	9.6%
Injury [subtotal]	1.9	14.1%
PDO	11.7	86.0%
Total	13.6	100%

HSM Crash Reduction (Corrugation & TWLT)		
Severity	**per Year**	**%**
Fatal	0.0	0.0%
A	-0.1	2.6%
B	-0.1	2.6%
C	-0.2	5.1%
Injury [subtotal]	-0.4	10.3%
PDO	-3.5	89.7%
Total	-3.9	100%

M-35 RSA - Escanaba, MI

Safety Improvements - Corridor Corrugation & Cottage Section 2-Way Left Turn

Benefit to Cost Calculations - HSM Crash Expectancy

Change in Crashes (Widen Inside Shoulder)		Cost Per Crash	Net Annual Benefit
Fatal	0.00	$ 7,908,298	$ -
A-Injury	-0.10	$ 437,414	$ 43,741
B-Injury	-0.10	$ 138,834	$ 13,883
C-Possible Injury	-0.20	$ 79,466	$ 15,893
PDO	-3.50	$ 9,113	$ 31,897
Total	**-3.90**		**$ 105,415**

Annual Cost of Improvement	
Construction Cost	$ 2,550,000
Discount Rate	5.00%
Service Life (year)	20
Annual Cost =	**$ 204,619**

Benefit Cost Ratio	
Net Annual Benefit	$ 105,415
Annual Cost of Improvement	$ 204,619
B/C Ratio =	**0.52**

* costs per crash include quality of life impacts

M-35 RSA - Escanaba, MI

Safety Improvements - Corridor Corrugation & Cottage Section 2-Way Left Turn

Benefit to Cost Calculations - HSM Crash Expectancy

Change in Crashes (Widen Inside Shoulder)		Cost Per Crash	Net Annual Benefit
Fatal	-0.10	$ 1,607,791	$ 160,779
A-Injury	0.00	$ 128,103	$ -
B-Injury	-0.10	$ 47,596	$ 4,760
C-Possible Injury	-0.20	$ 34,660	$ 6,932
PDO	-3.50	$ 8,126	$ 28,441
Total	**-3.90**		**$ 200,911**

Annual Cost of Improvement	
Construction Cost	$ 2,550,000
Discount Rate	5.00%
Service Life (year)	20
Annual Cost =	**$ 204,619**

Benefit Cost Ratio	
Net Annual Benefit	$ 200,911
Annual Cost of Improvement	$ 204,619
B/C Ratio =	**0.98**

* costs per crash include monetary considerations only (no QALY)

M-35 RSA - Escanaba, MI

Safety Improvements - Corridor Corrugation & Cottage Section 2-Way Left Turn

Benefit to Cost Calculations - HSM Crash Expectancy

Change in Crashes (Widen Inside Shoulder)		Cost Per Crash	Net Annual Benefit
Fatal	-0.10	$ 7,908,298	$ 790,830
A-Injury	0.00	$ 437,414	$ -
B-Injury	-0.10	$ 138,834	$ 13,883
C-Possible Injury	-0.20	$ 79,466	$ 15,893
PDO	-3.50	$ 9,113	$ 31,897
Total	**-3.90**		**$ 852,503**

Annual Cost of Improvement	
Construction Cost	$ 2,550,000
Discount Rate	5.00%
Service Life (year)	20
Annual Cost =	**$ 204,619**

Benefit Cost Ratio	
Net Annual Benefit	$ 852,503
Annual Cost of Improvement	$ 204,619
B/C Ratio =	**4.17**

* costs per crash include quality of life impacts

Appendix C

MDOT Crash Summary & A/K UD-10 Crash Reports

Michigan Department of Transportation
Crash Severity Report

State of Michigan

Report Module: Safety Management Analysis

Today's Date: Friday, May 31, 2019

Dates: 1/1/2014 to 5/1/2019

Animal Crashes: Excluded

Criteria: Start Date >= 1/1/2014
End Date <= 5/1/2019
CS Number = 21031
BMP = 11.11
EMP = 15.57

Michigan Department of Transportation
Crash Severity Report

Crash Type	Number of Crashes by Severity						Number of Persons by Degree of Injury				
	Fatal	A Injury	B/C and Property Damage	Other	Total		Fatal	Type A	Type B	Type C	Not Injured
Angle Driveway	0	0	2	0	2		0	0	0	0	7
Percent			100								100.0
Angle Straight	0	0	3	0	3		0	0	0	1	4
Percent			100							20	80.0
Fixed Object	1	0	14	0	15		1	1	1	2	13
Percent	6.7		93.3				5.6	5.6	5.6	11.1	72.2
Head-On Left-Turn Not Associated with Driveway	0	0	1	0	1		0	0	0	1	1
Percent			100							50	50.0
Misc. Multiple Vehicle	0	0	2	0	2		0	0	0	0	4
Percent			100								100.0
Misc. Single Vehicle	0	0	1	0	1		0	0	0	0	1
Percent			100								100.0
Other Object	0	0	4	0	4		0	0	0	0	4
Percent			100								100.0
Overturn	0	2	2	0	4		0	2	1	1	0
Percent		50	50					50	25	25	0.0
Parking	0	0	1	0	1		0	0	0	1	0
Percent			100							100	0.0
Rear End Driveway	0	0	1	0	1		0	0	0	0	3
Percent			100								100.0
Rear End Straight	0	0	3	0	3		0	0	0	2	8
Percent			100							20	80.0
Side-Swipe Opposite	0	0	2	0	2		0	0	0	0	3
Percent			100								100.0
Side-Swipe Same	0	0	2	0	2		0	0	0	0	5
Percent			100								100.0
Totals	1	2	38	0	41		1	3	2	8	53
Percent	2.4	4.9	92.7				1.5	4.5	3	11.9	79.1

TYPE A: Incapacitating
TYPE B: Non-Incapacitating
TYPE C: Possible, Not Evident

Michigan Department of Transportation
Summary of Crash Characteristics Report

Type of Crash

Year	Rear-End Left Turn		Head-On Left Turn		Rear-End		Angle		Sideswipe		Pedestrian		Head-On		Drive Related		Fixed Object		Others	
2014	0	0 %	0	0 %	1	8 %	1	8 %	0	0 %	0	0 %	0	0 %	1	8 %	5	38 %	5	38 %
2015	0	0 %	0	0 %	1	9 %	0	0 %	3	27 %	0	0 %	0	0 %	1	9 %	5	45 %	1	9 %
2016	0	0 %	0	0 %	0	0 %	0	0 %	0	0 %	0	0 %	0	0 %	0	0 %	1	33 %	2	67 %
2017	0	0 %	0	0 %	0	0 %	1	33 %	0	0 %	0	0 %	0	0 %	1	33 %	0	0 %	1	33 %
2018	0	0 %	1	14 %	1	14 %	1	14 %	0	0 %	0	0 %	0	0 %	0	0 %	2	29 %	2	29 %
2019	0	0 %	0	0 %	0	0 %	0	0 %	1	25 %	0	0 %	0	0 %	0	0 %	2	50 %	1	25 %
Total	0	0 %	1	2 %	3	7 %	3	7 %	4	10 %	0	0 %	0	0 %	3	7 %	15	37 %	12	29 %

Pavement Condition

Year	Debris		Dry		Icy		Muddy		Slushy		Snowy		Wet		Others	
2014	0	0 %	4	31 %	2	15 %	0	0 %	0	0 %	5	38 %	2	15 %	0	0 %
2015	0	0 %	4	36 %	4	36 %	0	0 %	0	0 %	2	18 %	1	9 %	0	0 %
2016	0	0 %	3	100 %	0	0 %	0	0 %	0	0 %	0	0 %	0	0 %	0	0 %
2017	0	0 %	2	67 %	0	0 %	0	0 %	0	0 %	0	0 %	1	33 %	0	0 %
2018	0	0 %	6	86 %	0	0 %	0	0 %	0	0 %	0	0 %	1	14 %	0	0 %
2019	0	0 %	0	0 %	2	50 %	0	0 %	0	0 %	1	25 %	1	25 %	0	0 %
Total	0	0 %	19	46 %	8	20 %	0	0 %	0	0 %	8	20 %	6	15 %	0	0 %

Light Condition

Year	Dark Lighted		Dark Unlighted		Dawn		Daylight		Dusk		Others	
2014	0	0 %	3	23 %	1	8 %	8	62 %	1	8 %	0	0 %
2015	0	0 %	3	27 %	0	0 %	8	73 %	0	0 %	0	0 %
2016	0	0 %	2	67 %	0	0 %	1	33 %	0	0 %	0	0 %
2017	0	0 %	0	0 %	0	0 %	3	100 %	0	0 %	0	0 %
2018	1	14 %	2	29 %	1	14 %	3	43 %	0	0 %	0	0 %
2019	1	25 %	1	25 %	0	0 %	2	50 %	0	0 %	0	0 %
Total	2	5 %	11	27 %	2	5 %	25	61 %	1	2 %	0	0 %

Crash Severity

Year	Fatal Crashes		Number Killed	Injury Crashes		Number Injured	Property Damage		Total Crashes	Total Injuries
2014	0	0 %	0	2	15 %	2	11	85 %	13	2
2015	0	0 %	0	2	18 %	2	9	82 %	11	2
2016	1	33 %	1	1	33 %	1	1	33 %	3	2
2017	0	0 %	0	1	33 %	1	2	67 %	3	1
2018	0	0 %	0	4	57 %	5	3	43 %	7	5
2019	0	0 %	0	1	25 %	1	3	75 %	4	1
Total	1		1	11		12	29		41	13

Michigan Department of Transportation
Crash Summary Report

Approach Direction	Total	Number of Crashes by Type									
		Head On	Head On Lt	Angle Str	Angle Turn	Rear End	Rear Turn	Ped	Park	Drive	Other
E	3	0	0	1	0	1	0	0	0	0	1
N	12	0	0	2	0	1	0	0	1	1	7
S	17	0	0	0	0	1	0	0	0	2	14
W	3	0	0	0	0	0	0	0	0	0	3
Other	6	0	1	0	0	0	0	0	0	0	5
Total	**41**	**0**	**1**	**3**	**0**	**3**	**0**	**0**	**1**	**3**	**30**
Average Per Year	6.8	0.0	0.2	0.5	0.0	0.5	0.0	0.0	0.2	0.5	5.0
Percent of Total	100.0	0.0	2.4	7.3	0.0	7.3	0.0	0.0	2.4	7.3	73.2
2014	13	0	0	1	0	1	0	0	0	1	10
2015	11	0	0	0	0	1	0	0	0	1	9
2016	3	0	0	0	0	0	0	0	0	0	3
2017	3	0	0	1	0	0	0	0	1	1	0
2018	7	0	1	1	0	1	0	0	0	0	4
2019	4	0	0	0	0	0	0	0	0	0	4

Michigan Department of Transportation
Summary of Crash Statistics

Dates: 1/1/2014 to 5/1/2019

TOTAL NUMBER OF CRASHES: 41

CRASHES BY DAY OF WEEK		F	A	B/C and PDO	Total	% of Crashes
Sunday	=	0	0	7	7	17.1%
Monday	=	1	0	6	7	17.1%
Tuesday	=	0	0	2	2	4.9%
Wednesday	=	0	0	6	6	14.6%
Thursday	=	0	2	3	5	12.2%
Friday	=	0	0	8	8	19.5%
Saturday	=	0	0	6	6	14.6%

CRASHES BY SURFACE CONDITION						
Dry	=	1	2	16	19	46.3%
Wet	=	0	0	6	6	14.6%
Icy	=	0	0	8	8	19.5%
Snowy	=	0	0	8	8	19.5%
Muddy	=	0	0	0	0	0.0%
Slushy	=	0	0	0	0	0.0%
Debris	=	0	0	0	0	0.0%
Water	=	0	0	0	0	0.0%
Sand	=	0	0	0	0	0.0%
Oily	=	0	0	0	0	0.0%
Other	=	0	0	0	0	0.0%
Unknown	=	0	0	0	0	0.0%
Uncoded & Errors	=	0	0	0	0	0.0%

CRASHES BY TIME OF DAY						
MDNT-01AM	=	0	0	0	0	0.0%
01AM-02AM	=	0	0	2	2	4.9%
02AM-03AM	=	0	1	0	1	2.4%
03AM-04AM	=	0	0	1	1	2.4%
04AM-05AM	=	0	0	0	0	0.0%
05AM-06AM	=	0	0	1	1	2.4%
06AM-07AM	=	0	0	2	2	4.9%
07AM-08AM	=	0	0	2	2	4.9%
08AM-09AM	=	0	0	1	1	2.4%
09AM-10AM	=	0	0	5	5	12.2%
10AM-11AM	=	0	0	3	3	7.3%
11AM-NOON	=	0	0	3	3	7.3%
NOON-01PM	=	0	0	1	1	2.4%
01PM-02PM	=	0	0	2	2	4.9%
02PM-03PM	=	0	0	3	3	7.3%
03PM-04PM	=	0	0	4	4	9.8%
04PM-05PM	=	0	0	4	4	9.8%
05PM-06PM	=	0	0	0	0	0.0%
06PM-07PM	=	0	0	1	1	2.4%
07PM-08PM	=	0	0	1	1	2.4%
08PM-09PM	=	1	0	1	2	4.9%
09PM-10PM	=	0	0	0	0	0.0%
10PM-11PM	=	0	1	0	1	2.4%
11PM-MDNT	=	0	0	1	1	2.4%
Uncoded & Errors	=	0	0	0	0	0.0%

CRASHES BY TYPE		F	A	B/C and PDO	Total	% of Crashes
Angle Driveway	=	0	0	2	2	4.9%
Angle Straight	=	0	0	3	3	7.3%
Angle Turn	=	0	0	0	0	0.0%
Animal	=	0	0	0	0	0.0%
Backing	=	0	0	0	0	0.0%
Bicycle	=	0	0	0	0	0.0%
Fixed Object	=	1	0	14	15	36.6%
Head-on	=	0	0	0	0	0.0%
Head-on Left-Turn Driveway	=	0	0	0	0	0.0%
Head-on L-Turn Not Driveway	=	0	0	1	1	2.4%
Hit Train	=	0	0	0	0	0.0%
Misc. Multiple Vehicle	=	0	0	2	2	4.9%
Misc. Single Vehicle	=	0	0	1	1	2.4%
Other Driveway	=	0	0	0	0	0.0%
Other Object	=	0	0	4	4	9.8%
Overturn	=	0	2	2	4	9.8%
Parking	=	0	0	1	1	2.4%
Pedestrian	=	0	0	0	0	0.0%
Rear End Driveway	=	0	0	1	1	2.4%
Rear End Left Turn	=	0	0	0	0	0.0%
Rear End Right Turn	=	0	0	0	0	0.0%
Rear End Straight	=	0	0	3	3	7.3%
Side Swipe Opposite	=	0	0	2	2	4.9%
Side Swipe Same	=	0	0	2	2	4.9%

CRASHES BY MONTH						
January	=	0	0	5	5	12.2%
February	=	0	0	8	8	19.5%
March	=	0	0	2	2	4.9%
April	=	0	0	3	3	7.3%
May	=	0	0	3	3	7.3%
June	=	0	1	3	4	9.8%
July	=	0	0	1	1	2.4%
August	=	1	0	1	2	4.9%
September	=	0	0	1	1	2.4%
October	=	0	1	2	3	7.3%
November	=	0	0	2	2	4.9%
December	=	0	0	7	7	17.1%
Uncoded & Errors	=	0	0	0	0	0.0%

CRASHES BY WEATHER CONDITION						
Clear	=	1	2	20	23	56.1%
Cloudy	=	0	0	7	7	17.1%
Fog	=	0	0	2	2	4.9%
Rain	=	0	0	2	2	4.9%
Sleet/Hail	=	0	0	0	0	0.0%
Snow	=	0	0	7	7	17.1%
Wind	=	0	0	0	0	0.0%
Blowing Snow	=	0	0	0	0	0.0%
Blowing Dirt	=	0	0	0	0	0.0%
Smoke	=	0	0	0	0	0.0%
Unknown	=	0	0	0	0	0.0%
Uncoded & Errors	=	0	0	0	0	0.0%

Michigan Department of Transportation
Summary of Crash Statistics

Dates: 1/1/2014 to 5/1/2019

CRASHES BY LIGHT

		F	A	B/C and PDO	Total	% of Crashes
Daylight	=	1	0	24	25	61.0%
Dawn	=	0	0	2	2	4.9%
Dusk	=	0	1	0	1	2.4%
Dark, Lighted	=	0	1	10	2	4.9%
Dark, Unlighted	=	0	0	2	11	26.8%
Other	=	0	0	0	0	0.0%
Unknown	=	0	0	0	0	0.0%
Uncoded & Errors	=	0	0	0	0	0.0%

CRASHES BY SEVERITY

Fatal	=	1	2.4%
A-Incapacitating	=	2	4.9%
B-Non-Incapacitating	=	2	4.9%
C-Possible Injury	=	7	17.1%
Uninjured	=	29	70.7%
Uncoded & Errors	=	0	0.0%

CRASHES BY INVOLVEMENT

Drinking	=	2	4.9%
Drugs	=	5	12.2%
Truck/Bus	=	3	7.3%
Snowmobile	=	0	0.0%
Emergency Vehicle	=	0	0.0%
Off Road Vehicle	=	0	0.0%
Pedestrian	=	0	0.0%
Bicyclist	=	0	0.0%
Farm Equipment	=	0	0.0%
Animal	=	0	0.0%
School Bus	=	0	0.0%
Motorcycle	=	1	2.4%
Train	=	0	0.0%
Hit and Run	=	4	9.8%
Fleeing Situation	=	1	2.4%

CRASHES BY DRIVER VIOLATION

Careless or Negligent	=	8	19.5%
Fatal + A-Type	=	1	12.5%
Disobeyed TCD	=	0	0.0%
Fatal + A-Type	=	0	0.0%
Drove Left of Center	=	0	0.0%
Fatal + A-Type	=	0	0.0%
Drove Wrong Way	=	0	0.0%
Fatal + A-Type	=	0	0.0%
Fail to Stop ACD	=	3	7.3%
Fatal + A-Type	=	0	0.0%
Failed to Yield	=	4	9.8%
Fatal + A-Type	=	0	0.0%
Improper Backing	=	0	0.0%
Fatal + A-Type	=	0	0.0%
Improper Lane Use	=	2	4.9%
Fatal + A-Type	=	0	0.0%
Improper Pass	=	0	0.0%
Fatal + A-Type	=	0	0.0%
Improper Signal	=	0	0.0%
Fatal + A-Type	=	0	0.0%
Improper Turn	=	1	2.4%
Fatal + A-Type	=	0	0.0%
Other	=	4	9.8%
Fatal + A-Type	=	1	25.0%
Reckless Driving	=	2	4.9%
Fatal + A-Type	=	1	50.0%
Speed Too Fast	=	8	19.5%
Fatal + A-Type	=	0	0.0%
Speed Too Slow	=	0	0.0%
Fatal + A-Type	=	0	0.0%
Ran Red Light	=	0	0.0%
Fatal + A-Type	=	0	0.0%

Authority: 1949 PA 300, Sec.257.622
Compliance: Required MSP UD-10E
Penalty: $100 and/or 90 days (Rev 01/2016)

External # 0145469 Crash ID 9771542

File Class 93001

STATE OF MICHIGAN TRAFFIC CRASH REPORT

Incident # 16001338

ORI: MI 2112100
Department Name: Delta Co Sheriff's Office
Reviewer: Todd Tardiff

Crash Date	Crash Time	No. of Units	Crash Type	Special Circumstances	Special Checks
08/08/2016	20:30	01	Single Motor Vehicle	● None ○ Fleeing Police ○ Hit and Run ○ Unknown ○ School Bus ○ Animal	● Fatal ○ Non-Traffic Area ○ ORV/Snowmobile

County	Traffic Control	Relation to Roadway	Weather	Area
21 - Delta	None	Outside of Shoulder/Curb	Clear	NON-FRWY Straight Roadway

City/Twsp	Contributing Circumstances 1st	2nd	Light	Road Surface Condition	Total Lanes	Speed Limit	Posted
09 - Ford River Twp	None		Daylight	Dry	02	50	Yes

Work Zone (if applicable): Type | Workers Present | Activity | Location

LOCATION

Prefix	Primary Road Name	Road Type	Suffix	Divided Roadway
	M-35	HWY		

Distance / Direction: 528 Feet NE
Trafficway: Not Physically Divided

Prefix	Intersecting Road Name	Road Type	Suffix	Divided Roadway
	L.15	LN		

UNIT / DRIVER

Unit Number	Unit Known	State	Driver License Number	Date of Birth (Age)	License Type	Endorsements	Sex	Total Occupants	Hazardous Action
01	Yes	MI	##########	##/##/#### (37)	● Operator ○ Chauffeur ○ Moped	○ Cycle ○ Farm ○ Recreation	F	02	Other

Unit Type	Driver Information	Driver is Owner	Injury	Position	Restraint
MV	########## ########## WOLVERINE, MI 49799 (###) ###-####	Yes	K	Front - Left	Shoulder and Lap Belt

Driver Condition at Time of Crash 1st	2nd	Driver Distracted By	Ejected	Trapped	Airbag Deployed
Fatigued or Asleep		Unknown		Yes	Deployed - Front

Hospital: DLP MARQUETTE GENERAL HOSPITAL, LLC
Ambulance: AIRLIFT FLIGHT SERVICE

Alcohol Suspected	Contributing Factor	Alcohol Test Type	Alcohol Test Results	Interlock Device
No	No	○ Breath ○ Blood ○ Urine ○ Field ○ PBT ○ Refused ● Not Offered	○ Pending Test Results:	No

Drug Suspected	Contributing Factor	Drug Test Type	Drug Test Results	Citation Issued
Yes	No	● Blood ○ Urine ○ Field ○ Refused ○ Not Offered	● Pending Test Results:	○ Hazardous ○ Other

Vehicle Registration	State	Vehicle Description	Year	Make	Model	Color
##########	MI		2006	GMC	YUKON	BLK

VIN	Vehicle Type	Special Vehicles	Private Trailer Type	Vehicle Defect
##################	Passenger Car, SUV, Van	Not Applicable		

Insurance Company	Insurance Policy #	Towed By	Towed To
##########	##########	GENE'S	GENE'S

Location of Greatest Damage	First Impact	Extent of Damage (Power Unit and/or Trailers)	Vehicle Direction	Vehicle Use	Action Prior
10	08	Disabling Damage	NE	Private	Going Straight Ahead

Sequence of Events (● indicates MOST harmful event)	First	Second	Third	Fourth
	02 - Cross Centerline	03 - Ran Off Roadway-Left	● 39 - Tree	06 - Overturn

PASSENGERS

Passenger Information: ##########
##########
WOLVERINE, MI 49799 (###) ###-####

Date of Birth (Age)	Sex	Position	Restraint
##/##/#### (41)	M	Front - Right	Shoulder and Lap Belt

Injury	Ejected	Trapped	Airbag Deployed
A			Deployed - Front

Hospital: OSF ST FRANCIS HOSPITAL
Ambulance: RAMPART EMS INC

Passenger Information | Date of Birth (Age) | Sex | Position | Restraint
Injury | Ejected | Trapped | Airbag Deployed
Hospital | Ambulance

Passenger Information | Date of Birth (Age) | Sex | Position | Restraint
Injury | Ejected | Trapped | Airbag Deployed
Hospital | Ambulance

TRUCK / BUS

Carrier Information | USDOT | MC | MPSC
Driver's CDL Type | Endorsements ○ H ○ P ○ T ○ N ○ S ○ X | CDL Exempt ○ Farm ○ Other

GVWR/GCWR	Vehicle Configuration	Cargo Body Type	Medical Card	Hazardous Material	ID #	Class #
○ 10,000 lbs. or Less ○ 10,001 - 26,000 lbs. ○ Greater than 26,000 lbs.				○ Placard ○ Cargo Spill		

OWNERS

Owner Information | Owner Information

Damaged Property | Public | Owner & Phone

UNIT / DRIVER

Unit Number	Unit Known	State	Driver License Number	Date of Birth (Age)	License Type ○ Operator ○ Chauffeur ○ Moped	Endorsements ○ Cycle ○ Farm ○ Recreation	Sex	Total Occupants	Hazardous Action

Unit Type	Driver Information	Driver is Owner	Injury	Position	Restraint

Driver Condition at Time of Crash 1st	2nd	Driver Distracted By	Ejected	Trapped	Airbag Deployed

Hospital	Ambulance

Alcohol Suspected	Contributing Factor	Alcohol Test Type ○ Breath ○ Blood ○ Urine ○ Field ○ PBT ○ Refused ○ Not Offered	Alcohol Test Results ○ Pending Test Results:	Interlock Device

Drug Suspected	Contributing Factor	Drug Test Type ○ Blood ○ Urine ○ Field ○ Refused ○ Not Offered	Drug Test Results ○ Pending Test Results:	Citation Issued ○ Hazardous ○ Other

Vehicle Registration	State	Vehicle Description	Year	Make	Model	Color

VIN	Vehicle Type	Special Vehicles	Private Trailer Type	Vehicle Defect

Insurance Company	Insurance Policy #	Towed By	Towed To

Location of Greatest Damage	First Impact	Extent of Damage (Power Unit and/or Trailers)	Vehicle Direction	Vehicle Use	Action Prior

Sequence of Events (● indicates MOST harmful event)	First	Second	Third	Fourth

PASSENGERS

Passenger Information	Date of Birth (Age)	Sex	Position	Restraint
	Injury / Ejected / Trapped		Airbag Deployed	
Hospital	Ambulance			
Passenger Information	Date of Birth (Age)	Sex	Position	Restraint
	Injury / Ejected / Trapped		Airbag Deployed	
Hospital	Ambulance			
Passenger Information	Date of Birth (Age)	Sex	Position	Restraint
	Injury / Ejected / Trapped		Airbag Deployed	
Hospital	Ambulance			

TRUCK/BUS

Carrier Information	USDOT	MC	MPSC
	Driver's CDL Type	Endorsements ○ H ○ P ○ T ○ N ○ S ○ X	CDL Exempt ○ Farm ○ Other

GVWR/GCWR ○ 10,000 lbs. or Less ○ 10,001 - 26,000 lbs. ○ Greater than 26,000 lbs.	Vehicle Configuration	Cargo Body Type	Medical Card	Hazardous Material ○ Placard ○ Cargo Spill	ID #	Class #

OWNERS

Owner Information	Owner Information

WITNESS

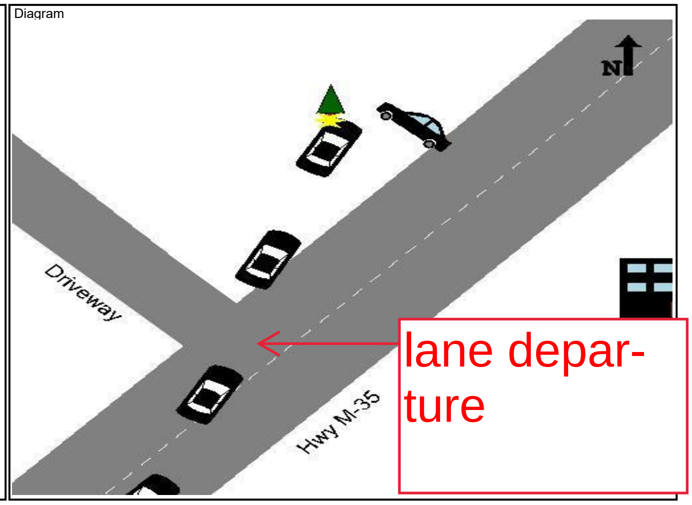
Witness Information	Witness Information
############################## ############################## ##################################, ## #####-#### (###) ###-####	

Investigated at Scene	Reported Date (Time)	1st Investigator Name (Badge)	2nd Investigator Name (Badge)	Photos
Yes	08/08/2016 (20:33)	KURT WILSON (168)		Yes

Narrative

Unit 1 was traveling N/E on M-35 just north of L.15 Lane. The driver drifted over the centerline, off the road and struck a tree. There was no brake fade or skid marks found on the road. There were no scraps or gouges found in the road. The passenger stated they were traveling from MN where they had been working a lot. He advised they were both very tired and told the driver they should sleep before traveling, but the driver wanted to make the drive to Wolverine. The passenger thinks he was sleeping at the time of the crash. When looking for ID, a marijuana pipe was located in the driver's purse.

Diagram



Authority: 1949 PA 300, Sec.257.622 Compliance: Required MSP UD-10E Penalty: $100 and/or 90 days (Rev 01/2016)	External #: 0145473 Crash ID: 9819177	Page 01 of 01 File Class 93001

STATE OF MICHIGAN TRAFFIC CRASH REPORT

Incident #	ORI	Department Name	Reviewer
16001740	MI 2112100	Delta Co Sheriff's Office	Todd Tardiff

Crash Date	Crash Time	No. of Units	Crash Type	Special Circumstances	Special Checks
10/06/2016	02:52	01	Single Motor Vehicle	● None ○ Fleeing Police ○ Hit and Run ○ Unknown ○ School Bus ○ Animal	○ Fatal ○ Non-Traffic Area ○ ORV/Snowmobile

County	Traffic Control	Relation to Roadway	Weather	Area
21 - Delta	None	On the Road	Clear	FRWY Curved Roadway

City/Twsp	Contributing Circumstances 1st	2nd	Light	Road Surface Condition	Total Lanes	Speed Limit	Posted
09 - Ford River Twp	None		Dark-Unlighted	Dry	02	50	Yes

Work Zone (if applicable): Type | Workers Present | Activity | Location

LOCATION

Prefix	Primary Road Name	Road Type	Suffix	Divided Roadway
	M-35	HWY		

Distance / Direction	Trafficway
3,696 Feet S	Not Physically Divided

Prefix	Intersecting Road Name	Road Type	Suffix	Divided Roadway
	11TH	RD		

UNIT / DRIVER

Unit Number	Unit Known	State	Driver License Number	Date of Birth (Age)	License Type	Endorsements	Sex	Total Occupants	Hazardous Action
01	Yes	WI	############	##/##/#### (51)	○ Operator ● Chauffeur ○ Moped	○ Cycle ○ Farm ○ Recreation	M	01	Careless Driving

Unit Type	Driver Information	Driver is Owner	Injury	Position	Restraint
MV	############################## ############################## MILWAUKEE, WI 53204 (###) ###-####	No	A	Front - Left	Restraint Use Unknown

Driver Condition at Time of Crash 1st	2nd	Driver Distracted By	Ejected	Trapped	Airbag Deployed
Fatigued or Asleep		Unknown			Not Equipped

Hospital	Ambulance
OSF ST FRANCIS HOSPITAL	RAMPART EMS INC

Alcohol Suspected	Contributing Factor	Alcohol Test Type	Alcohol Test Results	Interlock Device
No	No	○ Breath ○ Blood ○ Urine ○ Field ○ PBT ○ Refused ● Not Offered	○ Pending Test Results:	No

Drug Suspected	Contributing Factor	Drug Test Type	Drug Test Results	Citation Issued
No	No	○ Blood ○ Urine ○ Field ○ Refused ● Not Offered	○ Pending Test Results:	● Hazardous CARELESS DRIVING 257.626B ○ Other

Vehicle Registration	State	Vehicle Description Year	Make	Model	Color
###########	WI	1999	FRHT		WHI

VIN	Vehicle Type	Special Vehicles	Private Trailer Type	Vehicle Defect
#################	Truck / Bus	Not Applicable	Other	

Insurance Company	Insurance Policy #	Towed By	Towed To
##############################	##############################	GENE'S	GENE'S

Location of Greatest Damage	First Impact	Extent of Damage (Power Unit and/or Trailers)	Vehicle Direction	Vehicle Use	Action Prior
03	04	Functional Damage	N	Commercial (Business)	Going Straight Ahead

Sequence of Events (● indicates MOST harmful event)	First	Second	Third	Fourth
	04 - Ran Off Roadway-Right	01 - Loss of Control	● 06 - Overturn	49 - Cargo Fall/Shift or SIM

PASSENGERS

Passenger Information	Date of Birth (Age)	Sex	Position	Restraint

Injury	Ejected	Trapped	Airbag Deployed

Hospital	Ambulance

Passenger Information	Date of Birth (Age)	Sex	Position	Restraint

Injury	Ejected	Trapped	Airbag Deployed

Hospital	Ambulance

Passenger Information	Date of Birth (Age)	Sex	Position	Restraint

Injury	Ejected	Trapped	Airbag Deployed

Hospital	Ambulance

TRUCK/BUS

Carrier Information	USDOT	MC	MPSC
TIRES EXPRESS 2836 N 32ND ST 16629 MILWAUKEE, WI 53210	000002442355		

Driver's CDL Type	Endorsements	CDL Exempt
Group A	○ H ○ P ○ T ○ N ○ S ○ X	○ Farm ○ Other

GVWR/GCWR	Vehicle Configuration	Cargo Body Type	Medical Card	Hazardous Material	ID #	Class #
○ 10,000 lbs. or Less ○ 10,001 - 26,000 lbs. ● Greater than 26,000 lbs.	Tractor / Semi-Trailer	1	Yes	○ Placard ○ Cargo Spill		

OWNERS

Owner Information	Owner Information

Damaged Property	Public	Owner & Phone
MAILBOX E5225 HWY M-35	No	############################## (###) ###-####

UNIT / DRIVER

Unit Number | Unit Known | State | Driver License Number | Date of Birth (Age) | License Type: ○ Operator ○ Chauffeur ○ Moped | Endorsements: ○ Cycle ○ Farm ○ Recreation | Sex | Total Occupants | Hazardous Action

Unit Type | Driver Information | Driver is Owner | Injury | Position | Restraint

Driver Condition at Time of Crash: 1st | 2nd | Driver Distracted By | Ejected | Trapped | Airbag Deployed

Hospital | Ambulance

Alcohol Suspected | Contributing Factor | Alcohol Test Type: ○ Breath ○ Blood ○ Urine ○ Field ○ PBT ○ Refused ○ Not Offered | Alcohol Test Results: ○ Pending Test Results: | Interlock Device

Drug Suspected | Contributing Factor | Drug Test Type: ○ Blood ○ Urine ○ Field ○ Refused ○ Not Offered | Drug Test Results: ○ Pending Test Results: | Citation Issued: ○ Hazardous ○ Other

Vehicle Registration | State | Vehicle Description: Year | Make | Model | Color

VIN | Vehicle Type | Special Vehicles | Private Trailer Type | Vehicle Defect

Insurance Company | Insurance Policy # | Towed By | Towed To

Location of Greatest Damage | First Impact | Extent of Damage (Power Unit and/or Trailers) | Vehicle Direction | Vehicle Use | Action Prior

Sequence of Events (● indicates MOST harmful event): First | Second | Third | Fourth

PASSENGERS

Passenger Information | Date of Birth (Age) | Sex | Position | Restraint | Injury | Ejected | Trapped | Airbag Deployed

Hospital | Ambulance

Passenger Information | Date of Birth (Age) | Sex | Position | Restraint | Injury | Ejected | Trapped | Airbag Deployed

Hospital | Ambulance

Passenger Information | Date of Birth (Age) | Sex | Position | Restraint | Injury | Ejected | Trapped | Airbag Deployed

Hospital | Ambulance

TRUCK/BUS

Carrier Information | USDOT | MC | MPSC

Driver's CDL Type | Endorsements: ○ H ○ P ○ T ○ N ○ S ○ X | CDL Exempt: ○ Farm ○ Other

GVWR/GCWR: ○ 10,000 lbs. or Less ○ 10,001 - 26,000 lbs. ○ Greater than 26,000 lbs. | Vehicle Configuration | Cargo Body Type | Medical Card | Hazardous Material: ○ Placard ○ Cargo Spill | ID # | Class #

OWNERS

Owner Information | Owner Information

WITNESS

Witness Information
##############################
##############################
##################################, ## #####-#### (###) ###-####

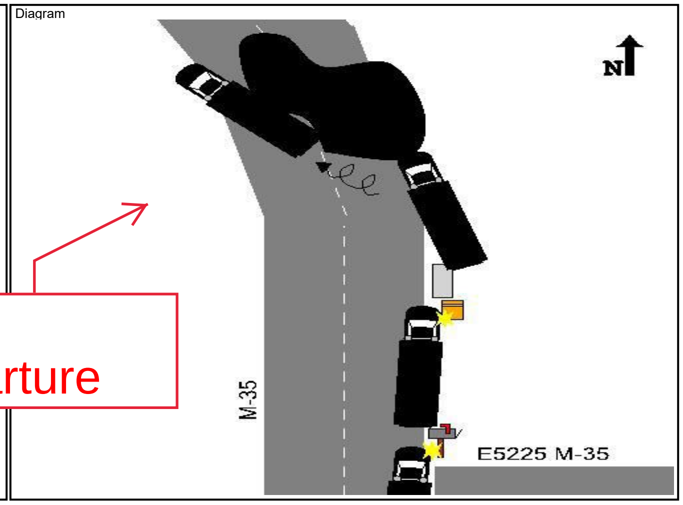
Witness Information
##############################
##############################
##################################, ## #####-#### (###) ###-####

Investigated at Scene	Reported Date (Time)	1st Investigator Name (Badge)	2nd Investigator Name (Badge)	Photos
Yes	10/06/2016 (03:58)	KURT WILSON (168)		Yes

Narrative

Unit 1 was traveling N/B on M-35 near the Breezy Point Bar. Unit 1 went off the road to the right and struck a mailbox. It then struck a large hole, lost control, and overturned. Unit 1 was hauling a full load of shredded tires which spilled on the highway and into the east ditch. The driver of Unit 1 stated he fell asleep. The driver had a large cut on his forehead. The trailer was a 1977 FRUEHAUF, WI trailer plate 673374, , VIN: 100000000010512WI

Diagram



Authority: 1949 PA 300, Sec.257.622
Compliance: Required MSP UD-10E
Penalty: $100 and/or 90 days (Rev 11/2006)

External # 0143170 Crash ID 8987044

Incident # 84111214 File Class 93001

STATE OF MICHIGAN TRAFFIC CRASH REPORT

Incident Disposition: Closed

ORI: MI 2108500
Department Name: MSP Gladstone
Reviewer: Sue CATO

Crash Date	Crash Time	No. of Units	Crash Type	Special Circumstances	Special Checks
06/26/2014	22:17	01	Single Motor Vehicle	○ School Bus ○ None ○ Hit and Run ○ Deer ● Fleeing Police	○ Fatal ○ Non-Traffic Area ○ ORV/Snowmobile

County	Traffic Control	Relation to Roadway	Special Study	Weather	Area
21 - Delta	None	Shoulder		Clear	11 - NON-FRWY Curved roadway

City/Twsp	Construction Zone (if applicable) Type	Lane Closed	Activity	Light	Road Condition	Total Lanes	Speed Limit	Posted
66 - Escanaba				Dusk	Dry	03	50	Yes

LOCATION

Prefix	Road Name	Road Type	Suffix	Divided Roadway
S	LINCOLN	RD		

Distance	Traffic Way	Access Control
200 Feet S	01 - Not physically divided	01 - No access control

Prefix	Intersecting Road	Road Type	Suffix	Divided Roadway
	LAKE SHORE	DR		

UNIT / DRIVER

Unit Number	Unit Known	State	Driver License Number	Date of Birth (Age)	License Type	Endorsements	Sex	Total Occupants	Hazardous Action
01	Yes	MI	##########	##/##/#### (28)	● Operator ○ Chauffer ○ Moped	○ Cycle ○ Farm ○ Recreation	M	01	15 - Reckless driving

Unit Type	Driver Information	Injury	Position	Restraint	Hospital
MV	########## ########## CARNEY, MI 49812 (###) ###-####	A	01	11	OSF ST FRANCIS HOSPITAL

Driver Condition	Interlock	Ejected	Trapped	Airbag Deployed	Ambulance
○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ● 99	No	Yes		Not Equipped	RAMPART EMS INC

Alcohol	Test Results	Drugs	Test Results	Citation Issued
○ Yes ● No ○ Refused ○ Not offered Test Type ○ Field ○ PBT ○ Breath ○ Blood ○ Urine		○ Yes ● No Test Type ○ Blood ○ Urine		○ Hazardous ○ Other

Vehicle Registration	State	Insurance / Policy #	Towed To/By	Special Vehicles	Private Trailer Type	Vehicle Defect
##########	MI	##########	GENE'S TOWING	0		

VIN	Vehicle Description	Make	Model	Color	Year	Vehicle Type
##########		HONDA		BLK	1999	Cycle

Location of Greatest Damage	First Impact	Extent of Damage	Driveable	Vehicle Direction	Vehicle Use	Action Prior
10	10	5	No	N	01 - Private	01 - Going Straight Ahead

Sequence of Events (● indicates MOST harmful event)	First	Second	Third	Fourth
	04 - Ran off roadway-right	● 06 - Overturn	13 - Individual fell from veh	

PASSENGERS

Passenger Information	Date of Birth (Age)	Sex	Position	Restraint	Hospital	Injury	Airbag Deployed	Ejected	Trapped	Ambulance

TRUCK/BUS

Carrier Information	Carrier Source	GVWR	ICCMC	USDOT	MPSC

Driver's CDL Type	Endorsements	CDL Exempt	CDL Restrictions
	○ H ○ P ○ T ○ N ○ S ○ X	○ Farm ○ Other	○ 28 ○ 29 ○ 30 ○ 35 ○ 36

Interstate/Intrastate	Vehicle Type	Type & Axle Per Unit First Second Third Fourth	Cargo Body Type	Medical Card	Hazardous Material	ID #	Class #
					○ Placard ○ Cargo Spill		

OWNERS

Owner Information	Owner Information

Person Advised of Damaged Traffic Control	Damaged Property	Public
Contact Name: Contact Date: Contact Time:	Owner & Phone	

UNIT / DRIVER

Unit Number	Unit Known	State	Driver License Number	Date of Birth (Age)	License Type	Endorsements	Sex	Total Occupants	Hazardous Action
					○ Operator ○ Chauffer ○ Moped	○ Cycle ○ Farm ○ Recreation			

Unit Type	Driver Information	Injury	Position	Restraint	Hospital

Driver Condition	Interlock	Ejected	Trapped	Airbag Deployed	Ambulance
○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 99					

Alcohol	Test Results	Drugs	Test Results	Citation Issued
○ Yes ○ No ○ Refused ○ Not offered Test Type ○ Field ○ PBT ○ Breath ○ Blood ○ Urine		○ Yes ○ No Test Type ○ Blood ○ Urine		○ Hazardous ○ Other

Vehicle Registration	State	Insurance / Policy #	Towed To/By	Special Vehicles	Private Trailer Type	Vehicle Defect

VIN	Vehicle Description	Make	Model	Color	Year	Vehicle Type

Location of Greatest Damage	First Impact	Extent of Damage	Driveable	Vehicle Direction	Vehicle Use	Action Prior

Sequence of Events (● indicates MOST harmful event)	First	Second	Third	Fourth

PASSENGERS

Passenger Information	Date of Birth (Age)	Sex	Position	Restraint	Hospital
	Injury	Airbag Deployed	Ejected	Trapped	Ambulance
Passenger Information	Date of Birth (Age)	Sex	Position	Restraint	Hospital
	Injury	Airbag Deployed	Ejected	Trapped	Ambulance
Passenger Information	Date of Birth (Age)	Sex	Position	Restraint	Hospital
	Injury	Airbag Deployed	Ejected	Trapped	Ambulance
Passenger Information	Date of Birth (Age)	Sex	Position	Restraint	Hospital
	Injury	Airbag Deployed	Ejected	Trapped	Ambulance
Passenger Information	Date of Birth (Age)	Sex	Position	Restraint	Hospital
	Injury	Airbag Deployed	Ejected	Trapped	Ambulance
Passenger Information	Date of Birth (Age)	Sex	Position	Restraint	Hospital
	Injury	Airbag Deployed	Ejected	Trapped	Ambulance

TRUCK / BUS

Carrier Information	Carrier Source	GVWR	ICCMC	USDOT	MPSC
	Driver's CDL Type	Endorsements ○ H ○ P ○ T ○ N ○ S ○ X	CDL Exempt ○ Farm ○ Other	CDL Restrictions ○ 28 ○ 29 ○ 30 ○ 35 ○ 36	

Interstate/Intrastate	Vehicle Type	Type & Axle Per Unit First Second Third Fourth	Cargo Body Type	Medical Card	Hazardous Material ○ Placard ○ Cargo Spill	ID #	Class #

OWNERS

Owner Information	Owner Information

WITNESS

Witness Information	Witness Information

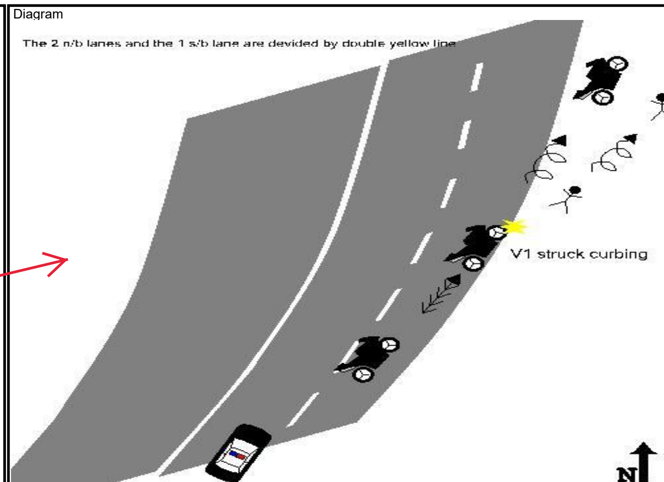
Investigated at Scene	Reported Date (Time)	1st Investigator Name (Badge)	2nd Investigator Name (Badge)	Photos By
Yes	06/26/2014 (22:17)	JAMES MAKI (335)		TPR. REYNOLDS

Narrative

V1 was fleeing police and was unable to negotiate curve in roadway. V1 hit curbing on outside of lane and crashed. V1 overturned multiple times throwing rider from the vehicle. Both came to rest in grassy area off of roadway.

lane departure

Diagram



Authority: 1949 PA 300, Sec.257.622
Compliance: Required MSP UD-10E
Penalty: $100 and/or 90 days (Rev 01/2016)

External # 0149505 Crash ID 1671150

File Class 93001

STATE OF MICHIGAN TRAFFIC CRASH REPORT

Incident # 19000549

ORI	Department Name	Reviewer
MI 2112100	Delta Co Sheriff's Office	Kurt Wilson

Crash Date	Crash Time	No. of Units	Crash Type	Special Circumstances	Special Checks
03/28/2019	09:53	02	Head On	● None ○ Hit and Run ○ School Bus ○ Fleeing Police ○ Unknown ○ Animal	● Fatal ○ Non-Traffic Area ○ ORV/Snowmobile

County	Traffic Control	Relation to Roadway	Weather	Area
21 - Delta	None	On the Road	Clear	NON-FRWY Curved Roadway

City/Twsp	Contributing Circumstances 1st	2nd	Light	Road Surface Condition	Total Lanes	Speed Limit	Posted
09 - Ford River Twp	None		Daylight	Dry	02	50	Yes

Work Zone (if applicable) — Type | Workers Present | Activity | Location

LOCATION

Prefix	Primary Road Name	Road Type	Suffix	Divided Roadway
	M 35	HWY		

Distance / Direction: 1.09 Mile E
Trafficway: Not Physically Divided

Prefix	Intersecting Road Name	Road Type	Suffix	Divided Roadway
	A 36	ROAD		

UNIT / DRIVER

Unit Number	Unit Known	State	Driver License Number	Date of Birth (Age)	License Type	Endorsements	Sex	Total Occupants	Hazardous Action
01	Yes	MI	##########	##/##/#### (35)	● Operator ○ Chauffeur ○ Moped	○ Cycle ○ Farm ○ Recreation	M	01	Drove Left of Center

Unit Type	Driver Information	Driver is Owner	Injury	Position	Restraint
MV	########## ########## ESCANABA, MI 49829 (###) ###-####	Yes	K	Front - Left	Shoulder and Lap Belt

Driver Condition at Time of Crash 1st	2nd	Driver Distracted By	Ejected	Trapped	Airbag Deployed
Unknown		Unknown		Yes	Not Equipped

Hospital	Ambulance
NONE	NONE

Alcohol Suspected	Contributing Factor	Alcohol Test Type	Alcohol Test Results	Interlock Device
No	No	○ Breath ● Blood ○ Urine ○ Field ○ PBT ○ Refused ○ Not Offered	● Pending Test Results:	No

Drug Suspected	Contributing Factor	Drug Test Type	Drug Test Results	Citation Issued
No	No	● Blood ○ Urine ○ Field ○ Refused ○ Not Offered	● Pending Test Results:	○ Hazardous ○ Other

Vehicle Registration	State	Vehicle Description	Year	Make	Model	Color
Y727964	IL		1990	OLDSMOBILE	98	TAN

VIN	Vehicle Type	Special Vehicles	Private Trailer Type	Vehicle Defect
1G3CW54C3L4321136	Passenger Car, SUV, Van	Not Applicable		

Automation System(s) in Vehicle	Automation System Level in Vehicle	Automation System Level Engaged at Time of Crash
Yes	No Automation	No Automation

Insurance Company	Insurance Policy #	Towed By	Towed To
##########	##########	GENE'S	GENE'S

Location of Greatest Damage	First Impact	Extent of Damage (Power Unit and/or Trailers)	Vehicle Direction	Vehicle Use	Action Prior
08	08	Disabling Damage	N	Private	Changing Lanes

Sequence of Events (● indicates MOST harmful event)

First	Second	Third	Fourth
● 17 - Motor Veh in Transport			

PASSENGERS

Passenger Information	Date of Birth (Age)	Sex	Position	Restraint

Injury	Ejected	Trapped	Airbag Deployed

Hospital	Ambulance

Passenger Information	Date of Birth (Age)	Sex	Position	Restraint

Injury	Ejected	Trapped	Airbag Deployed

Hospital	Ambulance

TRUCK/BUS

Carrier Information	USDOT	MC	MPSC

Driver's CDL Type	Endorsements	CDL Exempt
	○ H ○ P ○ T ○ N ○ S ○ X	○ Farm ○ Other

GVWR/GCWR	Vehicle Configuration	Cargo Body Type	Medical Card	Hazardous Material	ID #	Class #
○ 10,000 lbs. or Less ○ 10,001 - 26,000 lbs. ○ Greater than 26,000 lbs.				○ Placard ○ Cargo Spill		

OWNERS

Owner Information	Owner Information

Damaged Property	Public	Owner & Phone

UNIT/DRIVER

Unit Number	Unit Known	State Driver License Number	Date of Birth (Age)	License Type	Endorsements	Sex	Total Occupants	Hazardous Action
02	Yes	WI ##########	##/##/#### (52)	● Operator ○ Chauffeur ○ Moped	○ Cycle ○ Farm ○ Recreation	M	02	None

Unit Type	Driver Information	Driver is Owner	Injury	Position	Restraint
MV	########## ########## WAUSAU, WI 54403 (###) ###-####	No	O	Front - Left	Shoulder and Lap Belt

Driver Condition at Time of Crash 1st / 2nd	Driver Distracted By	Ejected	Trapped	Airbag Deployed
Appeared Normal	Not Distracted			Not Deployed

Hospital	Ambulance
NONE	NONE

Alcohol Suspected	Contributing Factor	Alcohol Test Type	Alcohol Test Results	Interlock Device
No	No	○ Breath ● Blood ○ Urine ○ Field ○ PBT ○ Refused ○ Not Offered	● Pending Test Results:	No

Drug Suspected	Contributing Factor	Drug Test Type	Drug Test Results	Citation Issued
No	No	● Blood ○ Urine ○ Field ○ Refused ○ Not Offered	● Pending Test Results:	○ Hazardous ○ Other

Vehicle Registration	State	Vehicle Description	Year	Make	Model	Color
57422X	WI		2017	KENNWORTH		WHI

VIN	Vehicle Type	Special Vehicles	Private Trailer Type	Vehicle Defect
1XKYD49X3HJ177571	Truck / Bus	Not Applicable	Other	

Automation System(s) in Vehicle	Automation System Level in Vehicle	Automation System Level Engaged at Time of Crash
Yes	No Automation	No Automation

Insurance Company	Insurance Policy #	Towed By	Towed To
##########	##########	GENE'S	GENE'S

Location of Greatest Damage	First Impact	Extent of Damage (Power Unit and/or Trailers)	Vehicle Direction	Vehicle Use	Action Prior
08	08	Disabling Damage	S	Commercial (Business)	Going Straight Ahead

Sequence of Events (● indicates MOST harmful event)	First	Second	Third	Fourth
	● 17 - Motor Veh in Transport			

PASSENGERS

Passenger Information	Date of Birth (Age)	Sex	Position	Restraint

Injury	Ejected	Trapped	Airbag Deployed

Hospital	Ambulance

Passenger Information	Date of Birth (Age)	Sex	Position	Restraint

Injury	Ejected	Trapped	Airbag Deployed

Hospital	Ambulance

TRUCK/BUS

Carrier Information	USDOT	MC	MPSC
WSC TRUCKING INC 7102 COMMERCE DR SCHOFIELD, WI 54476	000000906138		

Driver's CDL Type	Endorsements	CDL Exempt
Group A	○ H ○ P ○ T ○ N ○ S ○ X	○ Farm ○ Other

GVWR/GCWR	Vehicle Configuration	Cargo Body Type	Medical Card	Hazardous Material	ID #	Class #
○ 10,000 lbs. or Less ○ 10,001 - 26,000 lbs. ● Greater than 26,000 lbs.	Tractor / Semi-Trailer	1	Yes	○ Placard ○ Cargo Spill		

OWNERS

Owner Information	Owner Information

WITNESS

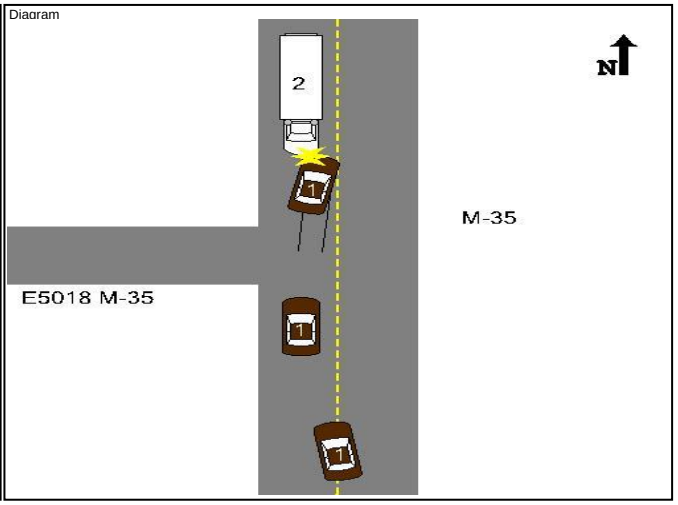
Witness Information	Witness Information
########## ########## ##########, ## #####-#### (###) ###-####	

Investigated at Scene	Reported Date (Time)	1st Investigator Name (Badge)	2nd Investigator Name (Badge)	Photos
Yes	04/02/2019 (08:13)	KURT WILSON (168)		Yes

Narrative

Unit 1 was traveling N/B on M-35. Unit 1 crossed the center line into the S/B lane. It appears Unit 1 then started back towards the N/B lane and the brakes were applied. Unit 1 was struck by Unit 2. The driver of Unit 2 saw Unit 1 come into the S/B lane, but there was nothing he could do. A witness behind Unit 2 saw Unit 1 cross the center line and into the S/B lane. The witness thought maybe Unit 1 was going to turn into a driveway, but didn't think he would be able to. The witness saw Unit 2 strike Unit 1.

Diagram



Appendix D

RSA Findings Meeting Presentation

M-35 FROM FORD RIVER TO LAKE SHORE DRIVE

BERGMANN

ROAD SAFETY AUDIT FINDINGS

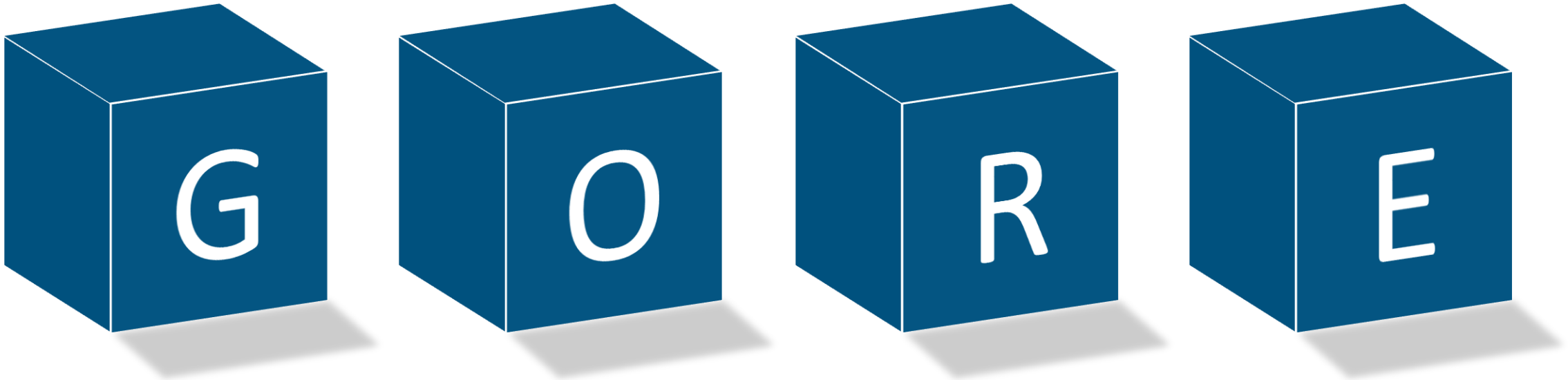
Prepared for:

MDOT
Michigan Department of Transportation

NATIONAL FIRM. STRONG LOCAL CONNECTIONS.

Wednesday, November 6	
9:00 - 10:30 am	Kick-Off Meeting
10:30 - 12:00 pm	Data Review / Drive Site
12:00 - 1:00 pm	Break for Lunch
1:00 - 3:30 pm	Field Reviews
3:30 - 5:00 pm	PM Peak Review / Compile Notes
7:00 - 8:00 pm	Nighttime Field Review
Thursday, November 7	
8:00 - 9:00 am	Morning Field Review (If Necessary)
9:00 am - 2:00 pm	RSA Team Prioritization Workshop
2:00 - 3:30 pm	Preliminary Findings Meeting

RSA OBSERVATIONS



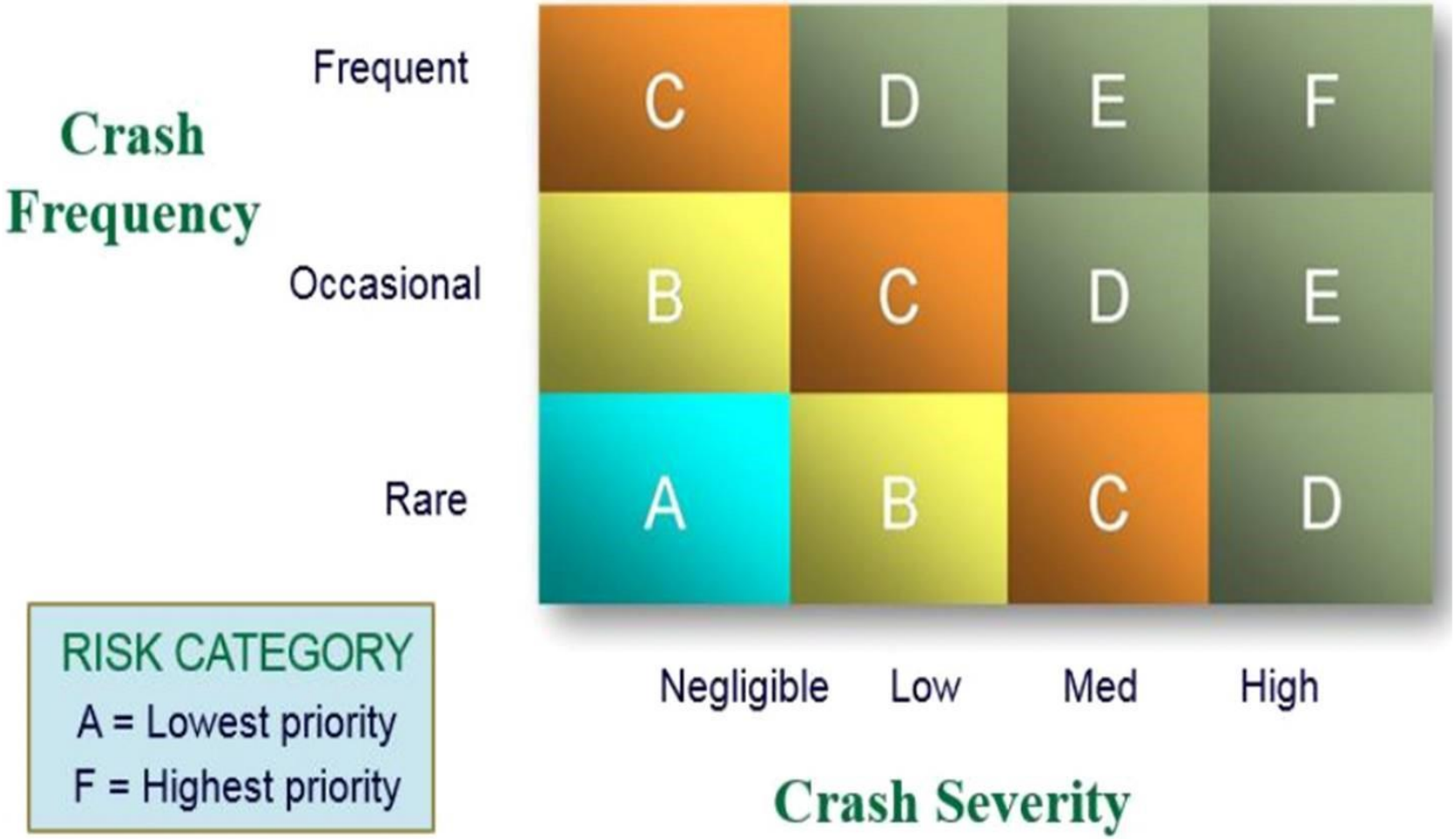
- Curve
- Gradient
- Cross section
- Clearance
- Sight distance
- Clear zone

- Congestion
- Signal operation
- Speed management
- Queuing
- Turning movements

- Motorists
- Bicyclists
- Pedestrians
- Other users

- Weather
- Lighting
- Road conditions

USING RELATIVE RISK TO PRIORITIZE SAFETY ISSUES



GENERAL OBSERVATIONS - M-35 CORRIDOR

- Many Positive Attributes:
  - Signs / markings generally appropriate and visible
  - Reflectors, chevrons delineate horizontal curves well
  - Fixed objects (trees, signs) do line the corridor; however generally roadsides are recoverable, wide shoulders help
  - Vertical reflective panels on STOP and chevron / warning sign posts improve visibility
  - Lighting - corridor regularly spaced cobra lighting north end, intersections lit overhead
  - Horizontal curves have been upgraded to design standards for posted speed
  - Guardrail appropriate at bridge structures

1. M-35 CORRIDOR

Observations

- Few spots where roadside slopes are not recoverable
- Noted two locations (Ford River and Son of a Beach) with tree hits
- Project segment is absent of corrugations (center or shoulder)

Safety Concern

- Severe outcomes have resulted from roadway departure (fixed object and overturn)
- Crash history indicates several drivers fell asleep

Mitigation

- Install shoulder / centerline corrugations

Frequency	Severity	Grade
Occasional	High	E

2. M-35 CORRIDOR

Observations

- Utility poles generally in the clear zone, obscure sight distance
- Brush growth complicates sight distance limitations

Safety Concern

- Fixed object crashes
- Angle crashes at intersections

Mitigation

- Clear overgrown brush, particularly at intersections
- Install shoulder / centerline corrugations

Frequency	Severity	Grade
Occasional	Medium	D

3. M-35 CORRIDOR

Observations

- Minor (county road) approaches (typ) no stop bar or W1-7 sign opposing the approach
- Intersections not typically signed in advance, street name signs small / aged

Safety Concern

- Failure to stop resulting in roadway departure
- Angle crashes at high speed related to intersection conspicuity
- Rear-end / sideswipe related to slowing / turning

Mitigation

- Install improvements on minor approaches
- Replace aged street signs
- Advanced guide / warning signs

Frequency	Severity	Grade
Infrequent	High	D

4. FORD RIVER BRIDGE

Observations

- Bridge has pedestrian access on S side, but no connections to anything
- Some worn path behind guardrail or use shoulder in front of guardrail
- Wooden stairs leading down to marina are overgrown and path is flooded

Safety Concern

- Pedestrians exposed near bridge trying to reach ped area (likely fishing spots)

Mitigation

- Improve pedestrian connection directly to marina area
- Would likely require some fill and a cross culvert

Frequency	Severity	Grade
Rare	High	C

5. BOAT RAMP ACCESS

Observations

- Sight distance to the SW appeared limited past bridge (we were slightly elevated in a large van)
- More vertical profile issue than brush or obstruction
- Calculated sight distance / design appears appropriate

Safety Concern

- Angle crashes trying to pull out onto M-35
- Boat trailers slower and exposed for a longer period

Mitigation

- If road is reconstructed, revisit the vertical profile / sight distance
- Move boat access to the east and head-up with Ford River Grill access & 9.9 Lane

Frequency	Severity	Grade
Infrequent	High	D

6. FORD RIVER GRILL ACCESS

Observations

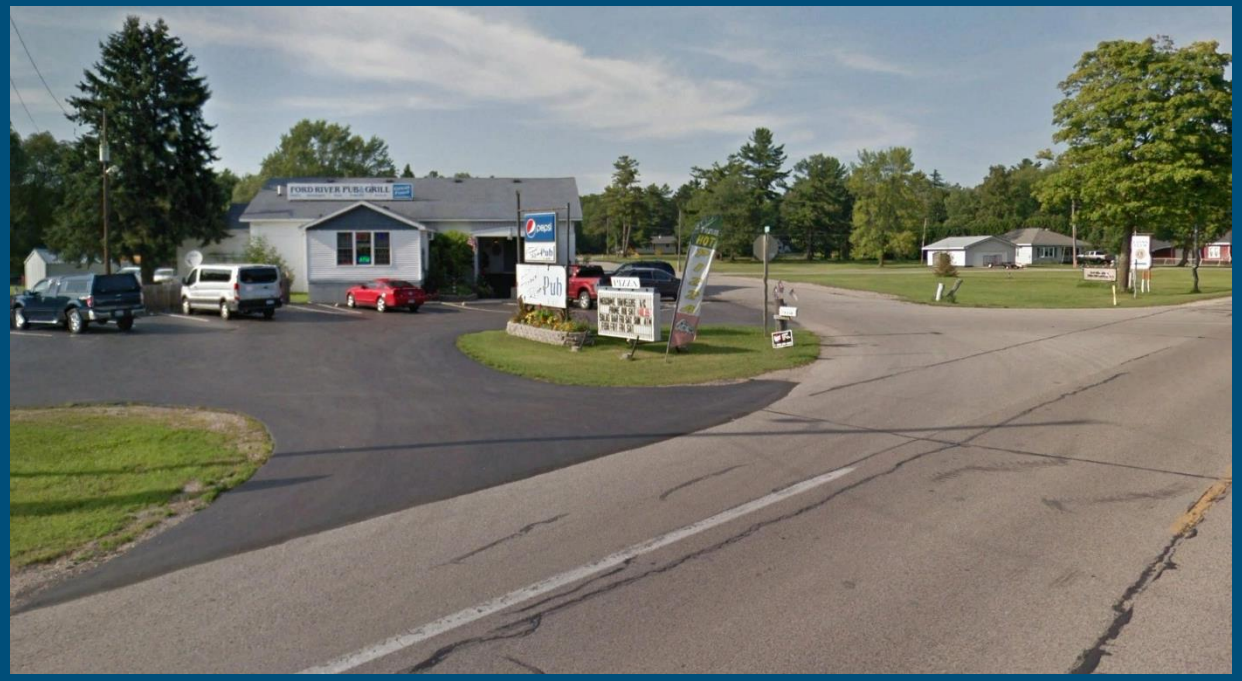
- Triangular access on county road approaches seemed redundant
- Sight distance appeared reasonable; however south access (L15) and north (Co Rd a 26) sightline is skewed to alignment of M-35

Safety Concern

- Angle crashes trying to pull out onto M-35

Mitigation

- Close northern access, cul-de-sac to maintain residential access
- Align south access perpendicular to M-35
- Reallocate parking / internal access on L15, close private drive direct to M-35



Frequency	Severity	Grade
Occasional	High	E

7. MEISTER'S PARTY STORE ACCESS

Observations

- Open access, multiple areas of ingress / egress
- Island delineation set back on very wide shoulder area

Safety Concern

- Uncontrolled access leading to rear-end / sideswipe
- Possible angle crashes

Mitigation

- Close one access point, leave two for circulation
- Link the two islands together for continuous access control

Frequency	Severity	Grade
Occasional	Medium	D

8. COTTAGE (RESIDENTIAL) SECTION

Observations

- Many driveways, cottage signs, residential properties
- Anecdotal information indicates frequent "near misses" related to left turns on this segment and vehicles passing on the shoulder w/ ped/bike
- RSA Team believes pedestrian activity may be localized to residences / restaurant / store
- Discussed the various +/- of wide shoulders for pedestrian mobility versus widening the roadway to 3 lanes for a center left turn lane (10 FT center)
- With a center lane the road would feel even faster, to which traffic appears to be already moving above posted 50 mph (speed control has also been noted as a local concern)
- Discussed merits on project of passing flare / turn lane at key intersections; however, on this segment there are no key intersections / points of access
- [postal, parking, lawn care on shoulder anecdotal concern - may be a counter consideration for wide 8FT shoulders] install gang boxes / bump-out

8. COTTAGE (RESIDENTIAL) SECTION (CONTINUED)

<u>Safety Concern</u>

- Sideswipe crashes between vehicles
- Vehicle - ped / bike crash on shoulder

Frequency	Severity	Grade
Occasional	High	E

<u>Mitigation</u>

- Further study / observe locations of pedestrian activity (RSA limited observation due to season)
- Reconstruct / widen to provide a continuous center lane for left turns
- Consider narrower shoulders, replace pedestrian accommodation via separate shared use path.
- [discussion of left turn conflicts in center left, low frequency, but potential]

9. BREEZY POINT - HORIZONTAL ALIGNMENT

Observations

- Drives well at posted speed, even in large van
- Road is on super, seems appropriate, trucks drive at or above posted
- Curve radius and e are exact on R107 = 50, straight line = 60 mph

Safety Concern

- Lane departure (head on / single vehicle)

Mitigation

- No advisory speed plaques (curve warning signs are already posted)

Frequency	Severity	Grade
Rare	Medium	B

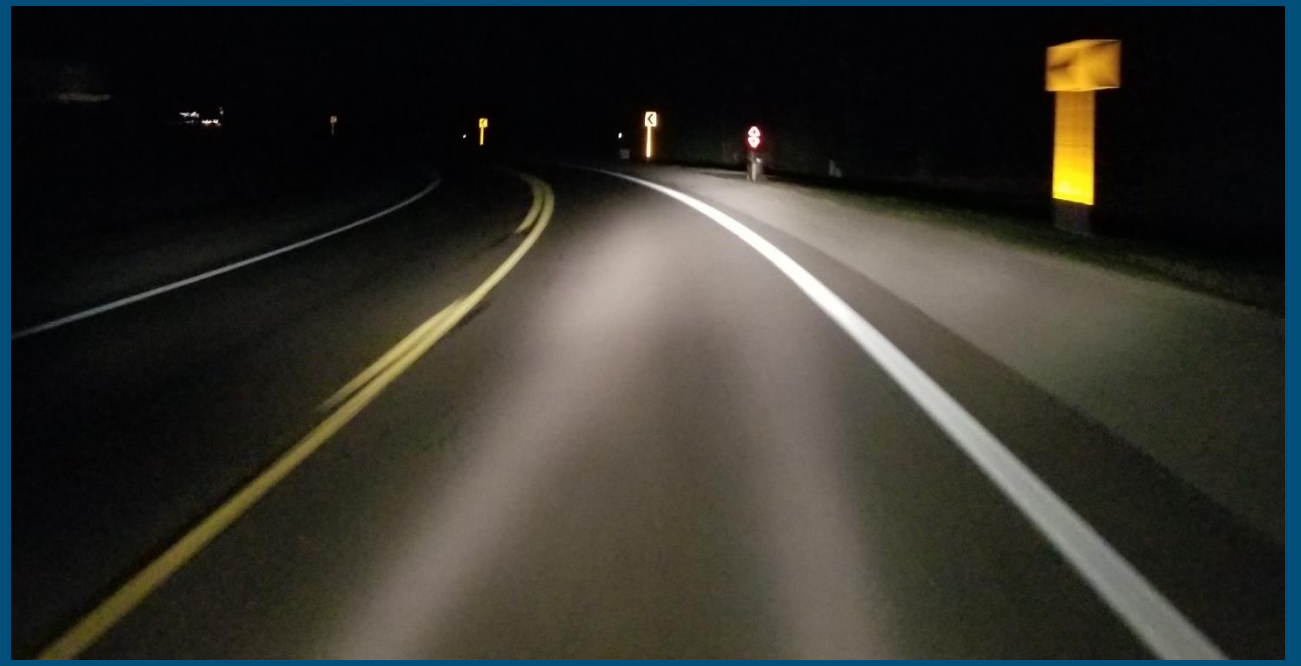
10. BREEZY POINT - HORIZONTAL ALIGNMENT

Observations

- Chevrons posted with vertical reflective panels, seems at north side of curve (both bounds) chevrons end prematurely

Safety Concern

- Leaving roadway to outside of curve, particularly at night / poor weather conditions



Mitigation

- Install 1-2 additional chevrons on both bounds at north PC/PT

Frequency	Severity	Grade
Infrequent	Medium	C

11. BREEZY POINT - BAR ACCESS

Observations

- Sight distance more restricted at south drive than north
- Pavement / gravel evidence of parking overflow on north side of N drive
- Wide driveways and generally uncontrolled access

Safety Concern

- Uncontrolled access leading to rear-end / sideswipe, possible angle crashes

Mitigation

- Depending on truck circulation, narrow access points and curb areas to better control access and parking

Frequency	Severity	Grade
Occasional	Medium	D

11. 11TH ROAD 'T' INTERSECTION

Observations

- Minor approach looks out into bay, potential infinity effect, no background at night

Safety Concern

- Minor approach driver may fail to stop

Mitigation

- Install T-intersection arrow sign (W1-7) on bay side facing minor approach

Frequency	Severity	Grade
Rare	High	C

12. 11TH ROAD 'T' INTERSECTION

Observations

- SW quad culvert, unrecoverable slopes both sides
- Slope restoration seemed recent on bayside erosion

Safety Concern

- Driver leaving roadway unlikely to recover, likely to strike fixed object (or water)

Mitigation

- Enclose drainage on SW quad
- Guard rail on bay side (would also discourage photo parking where roadside is eroding into bay)

Frequency	Severity	Grade
Rare	Medium	B

13. PORTAGE POINT LANE

Observations

- To the south (SE quad) sight distance was partially obstructed by brush and utility poles

Safety Concern

- Angle crashes trying to pull out onto M-35

Mitigation

- Brush clearing
- [left turn passing flare, not likely to meet warrants]

Frequency	Severity	Grade
Occasional	High	E

14. 12TH ROAD

Observations

- SW quad trees significantly blocked sightline to south

Safety Concern

- Angle crashes trying to pull out onto M-35

Mitigation

- Clear trees for corner sight distance, based on ROW and parcel ownership (private vs Township)

Frequency	Severity	Grade
Occasional	High	E

15. 12TH ROAD

Observations

- Minor approach is turned in perpendicular
- W1-6 directional arrow is blocked by the left side supplemental STOP

Safety Concern

- Driver not seeing the arrow sign may cross centerline or leave roadway at approach

Mitigation

- Relocate W1-6 directional arrow in a more visible location
- Or, curve ahead warning sign

Frequency	Severity	Grade
Infrequent	Medium	C

16. AIRPORT ROAD

Observations

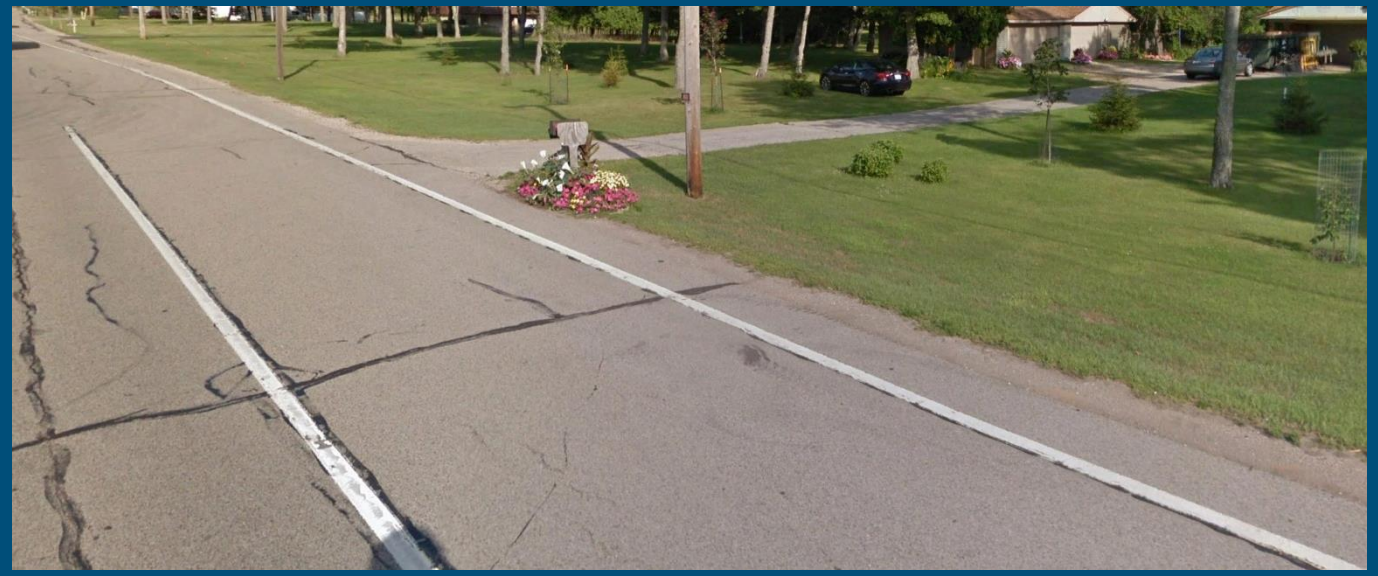
- RT lane is narrow (10 FT) and occupies the wide shoulder
- Flare occupies wide shoulder
- Discussion of connecting Airport passing flare with additional lane add to the north - RSA Team agreed this does not provide a direct benefit

Safety Concern

- Sideswipe crashes between vehicles
- Vehicle - ped / bike crash on shoulder

Mitigation

- Install off-road pedestrian facility
- (extend existing sidewalk / path beyond Airport Road)



Frequency	Severity	Grade
Rare	High	C

17. LAKE SHORE DRIVE

Observations

- Path stub on north / west side does not align with sidewalk connections on south / east side; in fact, the stub falls into the middle of the LSD approach
- May have to relocate intersection lighting to provide correct alignment / connection

Safety Concern

- No clear crossing location
- Confusing alignment, drivers have no expectation of pedestrian crossing

Mitigation

- Relocate pathway stub on north / west side
- Install marked pedestrian/bike crosswalk (high visibility markings)

Frequency	Severity	Grade
Infrequent	High	D

18. LAKE SHORE DRIVE

Observations

- Width of LSD approach seems wide, no apparent demand for large truck traffic
- Radii seemed large (south may need to be large due to angle vs curve)
- Aerial images show separate paths for left and right turn movements

Safety Concern

- Sideswipe crashes
- 2-lanes- possible blocking of sightlines

Mitigation

- Narrow approach or modify curb radii
- Mark approach to have 2-lanes

Frequency	Severity	Grade
Rare	Low	A

19. LAKE SHORE DRIVE

Observations

- Curb section not to standard for 50 mph design / posted speed
- 45 mph is maximum without shoulder

Safety Concern

- At higher speed curb may offset drivers towards center lane
- No shoulder for breakdowns
- Curb may disrupt vehicle that departs lane rather than allow for recovery

Mitigation

- Rehab / reconstruct may require design exception
- Monitor speeds in this section w/r/t posted limit

Frequency	Severity	Grade
Infrequent	Low	B

20. LAKE SHORE DRIVE

Observations

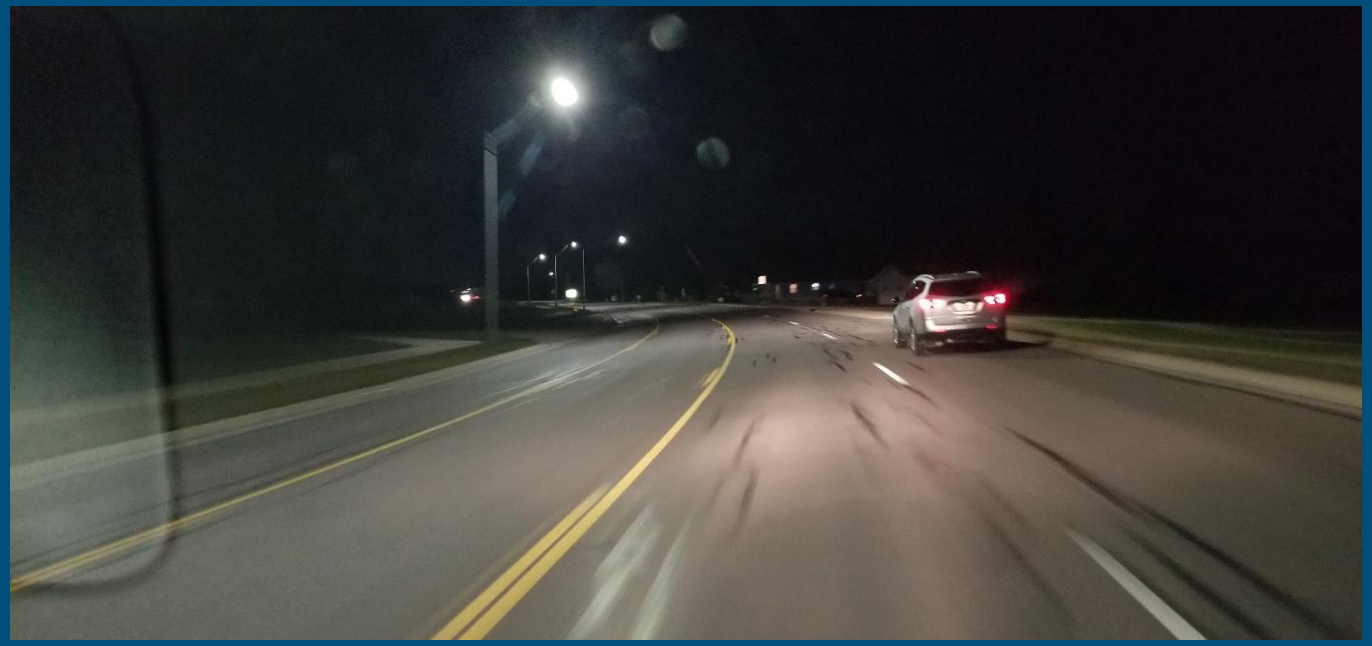
- Cobra light at intersection not functional
- Low retro reflectivity on LSD approach STOP sign

Safety Concern

- Failure to stop for minor approach
- Lack of conspicuity of intersection on M-35
- May result in angle crashes

Mitigation

- Replace STOP sign, vertical reflective panel
- Maintenance call for lighting



Frequency	Severity	Grade
Rare	High	C

21. OUTSIDE RSA LIMITS

Observations

- White lane markings still on pavement in transition area between 5-lane and unbalanced 4 lane w/ TWLT

Safety Concern

- Sideswipe, lane departure

Mitigation

- Clean up / remove white lane markings

Frequency	Severity	Grade
Infrequent	Low	B

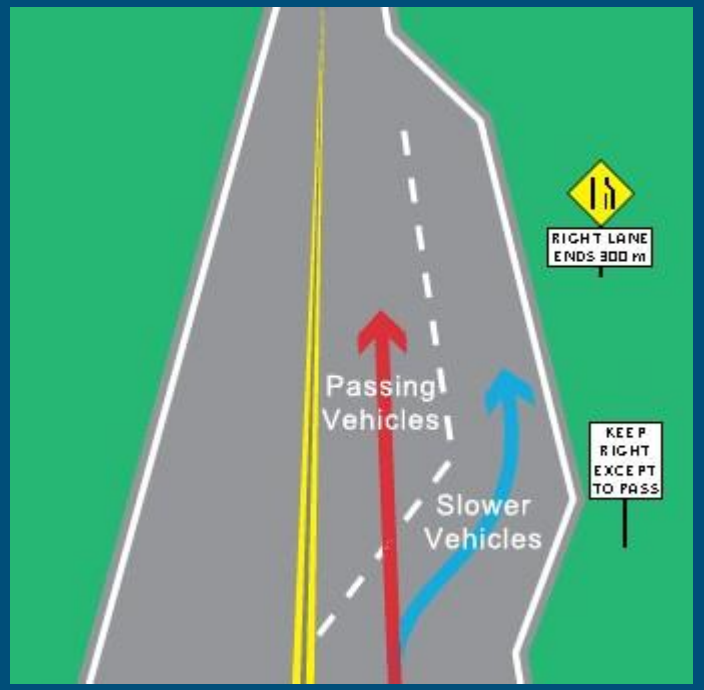
22. OUTSIDE RSA LIMITS

Observations

- Noted no passing relief lane in the vicinity to the south
- Speeds leaving town indicate that overtaking on 2 lanes may be frequent, particularly w/r/t trucks slowly gaining speed leaving town after lane drop

Safety Concern

- Overtaking on 2-lane exposure to head on collisions



Mitigation

- Evaluate passing relief lane criteria to the south of the study area
- [passing relief lane in X miles]

Frequency	Severity	Grade
Occasional	High	E

DISCUSSION?

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