ROAD SAFETY AUDIT

JACKSON AVENUE

ANN ARBOR, MI

PROJECT OWNERS: CITY OF ANN ARBOR

DATE: OCTOBER 2025

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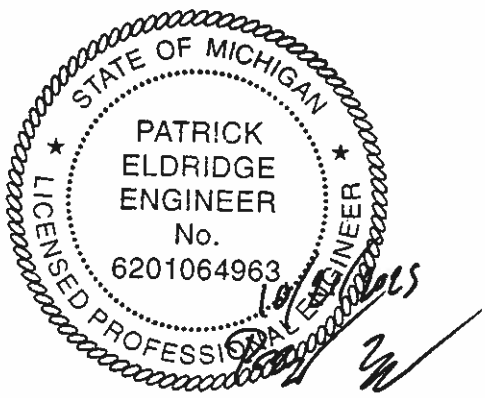

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1 INTRODUCTION

The City of Ann Arbor retained WSP to facilitate an Operational Service Road Safety Audit (RSA) along the Jackson Avenue corridor between Maple Road and Wagner Road in the city of Ann Arbor, Michigan. The objective of this study was to conduct a formal safety performance examination of the intersection with an independent, multi-disciplinary team. RSAs are a proactive approach to addressing the safety of all road users and involve identifying both safety issues and developing potential mitigation measures.

The RSA followed the Federal Highway Administration's (FHWA) eight-step process which is detailed in Figure 1 below.

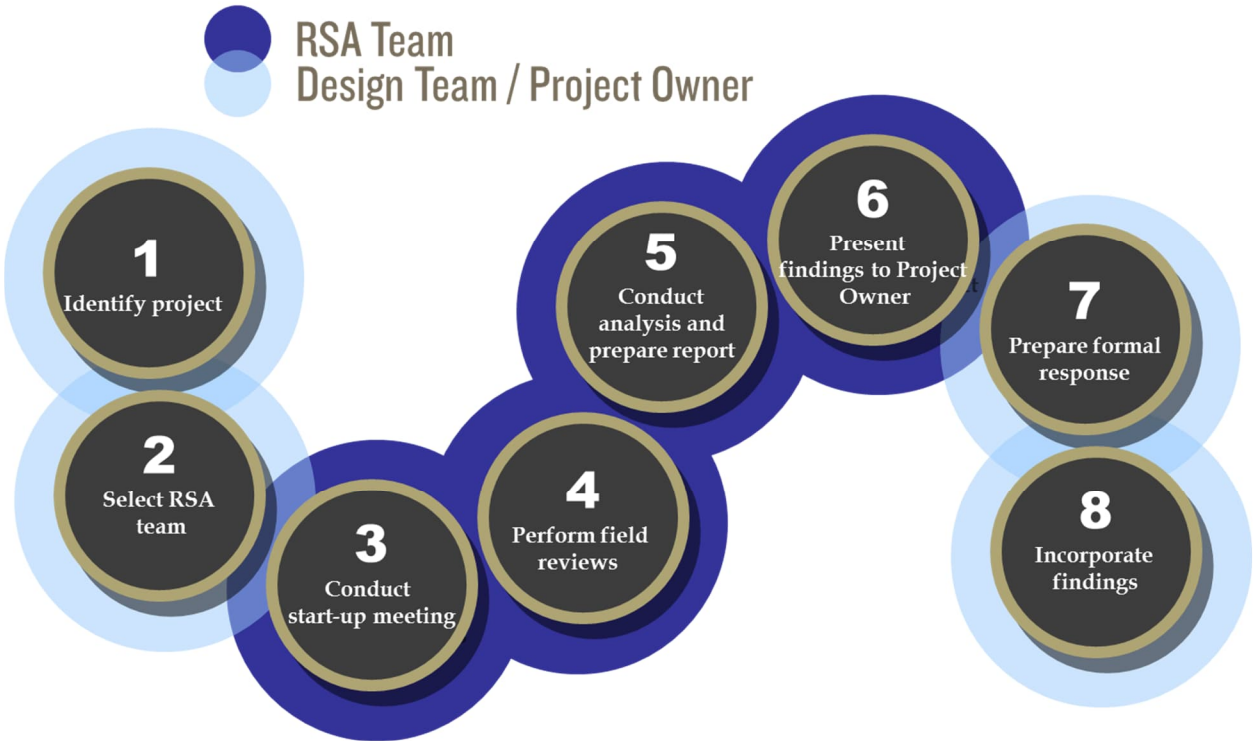


Figure 1 - RSA Eight-Step Process

The objectives of the RSA are to:

- Review road safety within the study area;
- Identify physical and operational issues that may affect road safety, and;
- Develop and provide potential countermeasures to reduce the frequency and severity of collisions.

The following sections will detail the RSA process, the methodology for this analysis, and data obtained throughout the study. The report will also present all significant findings and safety issues as well as provide recommended mitigation strategies.

1.1 BACKGROUND

The City of Ann Arbor initiated this RSA to investigate issues along the Jackson Avenue corridor between Wagner Road and Maple Road to improve vulnerable road user safety and motor vehicle safety. Additionally, the unique geometrics of the corridor as well as the surrounding land use and limited right-of-way (ROW) has created challenges in connecting the sidewalks on the northern side of the corridor. This limited connectivity poses a safety concern for vulnerable road users (VRU) who end up crossing outside the designated pedestrian and bicycle crosswalks as they travel to and from the different pedestrian and bicyclist generators in the area.

The study area along the Jackson corridor begins at the signalized intersection of Jackson Avenue and Maple Road as the eastern limit and the signalized intersection of Jackson Avenue with Wagner Road and the western limit stretching approximately 1.62 miles. Jackson Avenue splits into a boulevard consisting of two one-way roadways approximately 415 feet west of the Lakeview Drive intersection. Jackson Avenue is classified by MDOT as other principal arterial[1] and runs east-west through Washtenaw County and connects various cities, neighborhoods, and shopping centers, and is used as a local connector route for traffic entering and exiting from eastbound and westbound I-94 freeway. There is an eastbound I-94 exit ramp which merges with eastbound Jackson Avenue just east of Parklake Avenue. There are three crossovers within the study area, these are all located between Gralake Avenue and Wagner Road. An aerial view of the study area is shown in Figure 2.

Figure 2 – RSA Study Area

[1] https://mdot.maps.arcgis.com/apps/webappviewer/index.html?id=3eafa64de17049989b6968f0faa8e191

2 ROAD SAFETY AUDIT

An RSA is a formal safety performance examination of an existing or future road or intersection by an independent multi-disciplinary audit team. RSAs help promote road safety by identifying safety issues during the planning, design, and implementation stages, promoting awareness of safe design practices, integrating multimodal safety concerns, and considering human factors.

2.1 ROAD SAFETY AUDIT TEAM

Location:	Jackson Ave from Wagner to Maple Ann Arbor, Michigan	
Audit Team Members:	Patrick Eldridge	WSP
	Blessing Tayisepi	WSP
	Ashlynn Caviness	WSP
	Adam McArthur	WSP
Project Owners:	City of Ann Arbor	
Review Date:	July 1 - 2, 2025	
Audit Stage:	Operational	
Start-up Meeting:	June 10, 2025	
Preliminary Findings Meeting:	September 12, 2025	
Attended By:	City of Ann Arbor Engineering, Planning & Development TheRide Michigan Department of Transportation University of Michigan WSP	

The RSA team members conducted this audit to the best of their professional abilities within the on-site time available and by referring to provided information. While every attempt has been made to identify significant safety issues, the project owners are reminded that responsibility for the design, construction, and performance of the roadways remains with the agency with jurisdictional authority.

2.2 ROAD SAFETY AUDIT MATERIALS

The RSA was based on the following data and analysis:

Site Review: Site visits were conducted by the WSP team on July 1, 2025, for the nighttime conditions and July 2, 2025, to facilitate a road safety audit during daytime and PM peak conditions. This time was spent driving and walking the corridor to observe traffic operations, conflicts, and surrounding land uses. The information collected was supplemented with comments and concerns received from stakeholders and the crash data. This effort helped to provide location specific context around area concerns and potential treatment considerations.

Traffic Counts: Annual Average Daily Traffic (AADT) counts were obtained from 2020 through 2024 from MDOTs Transportation Data Management System (TDMS) and provided in Table 1 – Local Roadway Average Annual Daily Traffic (AADT) by Year below.

Table 1 – Local Roadway Average Annual Daily Traffic (AADT) by Year

	2020 AADT	2024 AADT	Difference
Jackson Avenue west of Maple Road	*20,917*	*26,241*	+25.4%
Jackson Avenue east of Highlake Street	*17,575*	*20,849*	+18.6%
Jackson Avenue west of Highlake Street	*16,887*	*20,032*	+18.6%
Hilltop Drive at Highlake Street	*161*	*183*	+13.7%
Highlake Street south of Jackson Avenue	*1,282*	*1,454*	+13.4%
EB Jackson Avenue west of Gralake Avenue	*15,692*	*19,280*	+22.9%
WB Jackson Avenue east of Wagner Road	*15,676*	*17,305*	+10.4%

Crash Data: Five years of crash data (2020-2024) were obtained by the RSA team from Numetric. UD-10 reports were also obtained from Numetric for the 2020-24 period with 2025 crash UD-10s provided by the City of Ann Arbor.

Identification of Countermeasures: Based on the above tasks, road safety concerns and potential contributing factors were identified. Countermeasures were identified to help mitigate the safety issues and possible crash causes, along with the crash reduction factors that are anticipated to result from their implementation.

Supporting Documentation (all documents were provided to the project team prior to or during the RSA process):

- Road exhibit detailing project limits
- Traffic volume counts[2]
- Numetric & City of Ann Arbor crash data
- Video footage and photographs of the site
- Aerial imagery

[2] MDOTs Transportation Data Management System (TDMS) MS2 Portal

2.3 ROAD SAFETY AUDIT PROCESS

A road safety audit framework was applied for both the analysis and presentation of findings. The expected frequency and severity of crashes caused by each safety issue were identified and rated according to categories shown in Table 2 and Table 3. A qualitative approach, as detailed in the FHWA eight-step process and adopted by MDOT, is used to assess the expected frequency and severity of crashes by utilizing crash history, first responder experience, and the RSA team's experience. These two elements were then combined to obtain an assessment based on the matrix shown in Table 4. Consequently, each safety issue was assessed based on a ranking between F (highest concern and priority) and A (lowest concern and priority). For each safety issue identified, possible mitigation measures have been suggested.

Table 2 - Crash Frequency

Estimated Exposure	Estimated Probability	Frequency Rating
Medium - High	High	*Frequent*
Low - High	Medium - High	*Occasional*
Low - Medium	Low	*Rare*

Table 3 - Crash Severity

Typical Collisions Expected (per audit item)	Expected Collision Severity	Severity Rating
Collisions involving high speeds[1] or heavy vehicles, pedestrians, or bicycles	Probable fatality or incapacitating injury	*High*
Collisions involving medium to high speed; head-on, crossing, or off-road collisions	Moderate to severe injury	*Moderate*
Collisions involving medium to low speeds; left-turn and right-turn collisions	Minor to moderate injury	*Low*
Collisions involving low to medium speeds; rear-end or sideswipe collisions	Property damage only	*Negligible*

[1]Since the study location is located in an urban area near downtown Ann Arbor, a speed above 35 MPH was considered to be high, 25-35 MPH to be medium, and under 25 MPH to be low.

Table 4 - Crash Concern Assessment

Frequency Rating	Severity Rating			
	Negligible	*Low*	*Moderate*	*High*
Frequent	C	D	E	F
Occasional	B	C	D	E
Rare	A	B	C	D
Concern Rankings -	*A: Lowest priority*		*F: Highest priority*	

3 SITE CHARACTERISTICS

3.1 STUDY CORRIDOR

The Jackson Avenue corridor in Ann Arbor, Michigan consists of signalized intersections at Maple Road, westbound I-94 exit ramp, Lakeview Drive, and Wagner Road. The rest of the corridor consists of minor road stop-controlled intersections and driveways. The corridor has a posted speed limit of 35mph between Maple Road and the I-94 freeway overpass and increases to 45mph after the overpass in the westbound direction and continues to Wagner Road. In the eastbound direction, Jackson Avenue has a posted speed limit of 45mph between Wagner Road and I-94 freeway overpass and this speed limit continues to Maple Road. MDOT controls the segment of Jackson Ave that overlaps with the I-94 Business Route (approximately from Parklake Rd to the east) with the City of Ann Arbor controlling the remaining segments. Additionally, Jackson Ave has been designated as a Bus Rapid Transit corridor per the City's long-range plans. Figure 3 shows some characteristics of the Maple Road intersection.

The main characteristics along the corridor starting at the Maple intersection and moving from east to west are described below:

Jackson, west of Maple: The eastbound Jackson approach at Maple, consists of two through lanes, two left-turn lanes and a right-turn lane. Some notable features in the section between Maple and just east of the I-94 interchange include:

(1) There are 8 driveways within an 800-foot stretch, where 4 provide access to the Westgate Shopping Mall south of Jackson Avenue, and 4 provide access into the mixed-use development north of Jackson, which includes a bank, retail, gym and gas station.

(2) There are two bus stops in this section with one on each side of Jackson Avenue, where they are both located approximately 390 feet west of Maple; the eastbound stop has a shelter where the westbound stop only has a sign.

(3) While the RSA was focused on the Jackson corridor specifically, there were crossings along every leg of Jackson Avenue and Maple Road to provide connectivity with sidewalks on Jackson. The northern sidewalk ends right before the intersection of Jackson Avenue and the westbound I-94 ramps, where the sidewalk south of Jackson continues through the interchange, crossing the westbound I-94 exit ramp.

Eastbound Jackson Ave Bus Stop, South ofMaple

Jackson Ave Eastbound Approach to Maple

Jackson Ave and Maple Rd Intersection

Figure 3 – Maple Intersection Characteristics

Westbound I-94 Exit/Entrance Ramps: The signalized intersection of the westbound I-94 exit ramp with Jackson consists of two lanes emerging from the ramp with one being exclusively for left-turning traffic and the other being for right-turning traffic. The right westbound lane is a shared lane between through traffic and vehicles turning onto the westbound I-94 on-ramp. The left lane along eastbound Jackson Avenue is a shared through and left-turning lane with the left-turn leading to the westbound I-94 on-ramp. The two lanes leading to the ramp are separated by a triangular median. There is a sidewalk along the southern side of Jackson Avenue at this intersection with a crosswalk along the southern leg of the intersection. Figure 4 provides examples of some main characteristics of the Jackson Avenue and Westbound I-94 ramp intersection. It should be noted that MDOT owns the portion of the stud corridor from Parklake Ave eastward.

Eastbound/Westbound I-94 Ramps and Jackson Ave Aerial

Westbound I-94 Exit Ramp and Jackson Ave Intersection

Figure 4 - Westbound I-94 Ramp Overview

Jackson near Lakeview: The signalized intersection of Jackson Avenue and Lakeview Drive consists of two through lanes and a single left-turn lane in the eastbound and westbound directions. The westbound direction has a right-turn lane leading to the eastbound I-94 on-ramp. There are crosswalks across every leg of this intersection except for the east leg. Hilltop Drive, which connects to the residential neighborhood, runs parallel to the west leg of Jackson Avenue and connects to Lakeview Drive at the intersection while the sidewalk follows along to the south of Hilltop Drive. Figure 5 provides examples of some main characteristics of the Jackson Avenue and Lakeview Drive intersection.

Westbound Jackson Avenue Approach at Lakeview Drive

Hilltop Drive Approach

Jackson Avenue at Lakeview Drive Aerial

Figure 5 - Lakeview Drive Intersection Characteristics

Jackson Split (eastbound and westbound diverge into separate alignments): Jackson Avenue splits into a boulevard consisting of two one-way roadways with two lanes in either direction beginning approximately 415 feet west of the Lakeview Drive intersection. The westbound direction becomes a curved roadway. There is an eastbound I-94 exit ramp which merges with eastbound Jackson Avenue just east of Parklake Avenue. There are three crossovers within the study area, these are all located between Gralake Avenue

and Wagner Road. The crossover at Gralake Road allows vehicles to make left turns in both directions. There is an eastbound-westbound crossover approximately 858 feet east of Wagner Road and a westbound-eastbound crossover approximately 105 feet east of Wagner Road. There is a sidewalk in the eastbound and westbound directions between the splitting point of Jackson Avenue and Wagner Road with the westbound sidewalk terminating just west of the Hampton Inn and Suites hotel driveway. There are signs for bicyclists to utilize the westbound Jackson Avenue shoulder beginning at the splitting point following along the curve. Figure 6 provides examples of some main characteristics along eastbound and westbound Jackson Avenue.

Eastbound Jackson Ave Bus Stop and Eastbound I-94 Off-Ramp

Westbound Jackson Ave Flashing Speed Beacon

Aerial View of Jackson Avenue, east of Wagner Road

Figure 6 - Eastbound and Westbound Jackson Ave Characteristics

Pedestrian Crossing (Westbound I-94 Exit Ramp)

Speed Limit Sign and Freeway Signs along Westbound Jackson Avenue

Foliage and Branches Along Sidewalk

Worn Bike Lane Pavement Marking

Bicyclist along Hilltop Dr

Maple Road Intersection Traffic and Pedestrian Signals and Crosswalk

Vehicle Turning Left from Westgate Plaza

Nighttime Lighting along Westbound Jackson Ave Curve

Figure 7 – Field Review Observations along Jackson Ave

SITE OBSERVATIONS

Site observations were facilitated through an in-person field review by driving and walking through the study intersection in each direction during daytime and nighttime. Figure 7 provides examples of some corridor characteristics and activities, including those of vulnerable road users.

FIELD REVIEW OBSERVATIONS

The following provides an overview of observations collected during field review that are described in more detail in Section 4 with potential countermeasures highlighted in Section 5.

- Signal Operations
  - Accessible pedestrian signals
  - Leading pedestrian intervals (LPI) at Maple Road intersection
  - There are no pedestrian signals at the westbound I-94 Off-ramp to Jackson Avenue
- Nighttime
  - Lighting present east of the interchange
  - No lighting on westbound Jackson Avenue, west of the interchange with a lack of ambient sources
  - Vegetation obscured large portions of the guardrail reflectors at nighttime
  - Stop bar at westbound I-94 on ramp was very difficult to see during the day and was almost invisible at night
  - Pedestrians observed walking in roadway / near miss with vehicle in outer lane along westbound Jackson Ave curve at nighttime
  - Signs generally had good retroreflectivity at nighttime
  - Pavement markings were generally visible at night; the team was not sure how well they would perform under inclement weather
  - Crosswalk markings were less visible compared to the other markings
  - Street lighting appeared to be functional throughout where provided
- Nonmotorized Facilities
  - Shared use path west of interchange (approx. 1,500’ gap between Varsity Ford Dealership and Hampton Inn & Suites) and south of Jackson Avenue (continuous)
  - Guardrail west of interchange on south side near the cemetery
  - Most crosswalks are well marked and visible
  - ADA compliant ramps at intersections
  - Positive pedestrian guidance to direct them to use facilities on the south side of Jackson.
  - Several discontinuous sections of sidewalk on the north side of Jackson Avenue, with limited available ROW to travel though the interchange.
  - Several minor street and driveway crossings did not have ADA compliant ramps
  - Vegetation was observed to be encroaching onto the sidewalk on the south side of Jackson Avenue
- Roadway Geometrics and Signing
  - Missing guidance sign for eastbound to westbound crossover, east of Wagner

- Lack of consistent signage and markings for shoulder bike lane for WESTBOUND Jackson, west of the interchange. There is also no formal entryway for the bikes to enter the bike lane from the sidewalk. The bike lane sign is also blocked by an informational sign.
- Multiple shopping complex and local business driveways near the intersection with Maple Road exiting onto Jackson Avenue increase complexity and conflict points
- There is no left-turn pocket for vehicles trying to turn from eastbound Jackson Avenue to westbound I-94 on ramp
- The short right-turn pocket for vehicles turning from westbound Jackson Avenue to the westbound I-94 On-ramp resulted in backups along westbound Jackson Avenue going as far back as Maple Road during the evening peak
- Limited sight distance for vehicles coming from the ramps

– Road User Behavior
  - Vehicles observed to be waiting several turns before being able to make left turns out of the shopping complex and the two-way left turn lane
  - Vehicles making left-turns from the shopping complex, near misses were observed
  - Vehicles were not looking for pedestrians for the eastbound right-turning movement from Jackson Avenue to Stadium Road
  - Buses were observed causing extensive queues on eastbound Jackson Avenue, extending back to the westbound I-94 off ramp
  - Speeding vehicles through the curve along the westbound Jackson Avenue curve approaching Wagner Road resulting in over tracking through the turn and possibly endangering bicyclists or pedestrians in the shoulder.
  - Bicyclists were observed utilizing sidewalks in areas where there are no dedicated bicycle facilities (primarily to traverse interchange along south side of Jackson).

3.2 ROAD USER CHARACTERISTICS

The team observed the multimodal nature of traffic and the riders along the Jackson Avenue study corridor, some of the main observations included:

- Commercial Vehicles
    - The study corridor experiences commercial vehicle traffic due to its proximity to the I-94 freeway ramps as well as local businesses in the area such as the Westgate shopping plaza. Approximately 2.7 percent of the vehicles travelling within the study area are buses and heavier commercial vehicles according to the latest MDOT vehicular counts for the corridor.
- Transit
    - Buses utilize the Jackson Avenue corridor with the main stops being at Wagner Road and Maple Road according to TheRide's[3] website for route schedules. Riders were observed getting on and off the buses on both sides of Jackson Avenue at the Maple Road bus stops. According to the bus schedule there are thirty-two eastbound trips and thirty-one westbound trips along Jackson Avenue each day.
- Pedestrians and Bicyclists
    - Pedestrians and bicyclists were observed utilizing the sidewalks and the bike facilities on either side of Jackson Avenue along the corridor with the main usage occurring on the south side of Jackson Avenue where the sidewalks are more continuous, some additional data on pedestrian and bicyclist usage of the available facilities was obtained from Strava. The Strava Global Heatmap is a tool that allows us to visualize aggregated, anonymized GPS activity data from public user uploads, where the brighter and thicker lines indicate higher concentrations of activity. Figure 8 highlights popular routes and activity zones, including the south side of Jackson between Maple and Wagner, where there are common pathways for various human-powered movements (e.g., bicycling, walking, scooters, etc.). The intensity of the "heat" corresponds directly to the frequency and volume of recorded activities, providing insights into local movement patterns.

[3] www.theride.org/maps-schedules

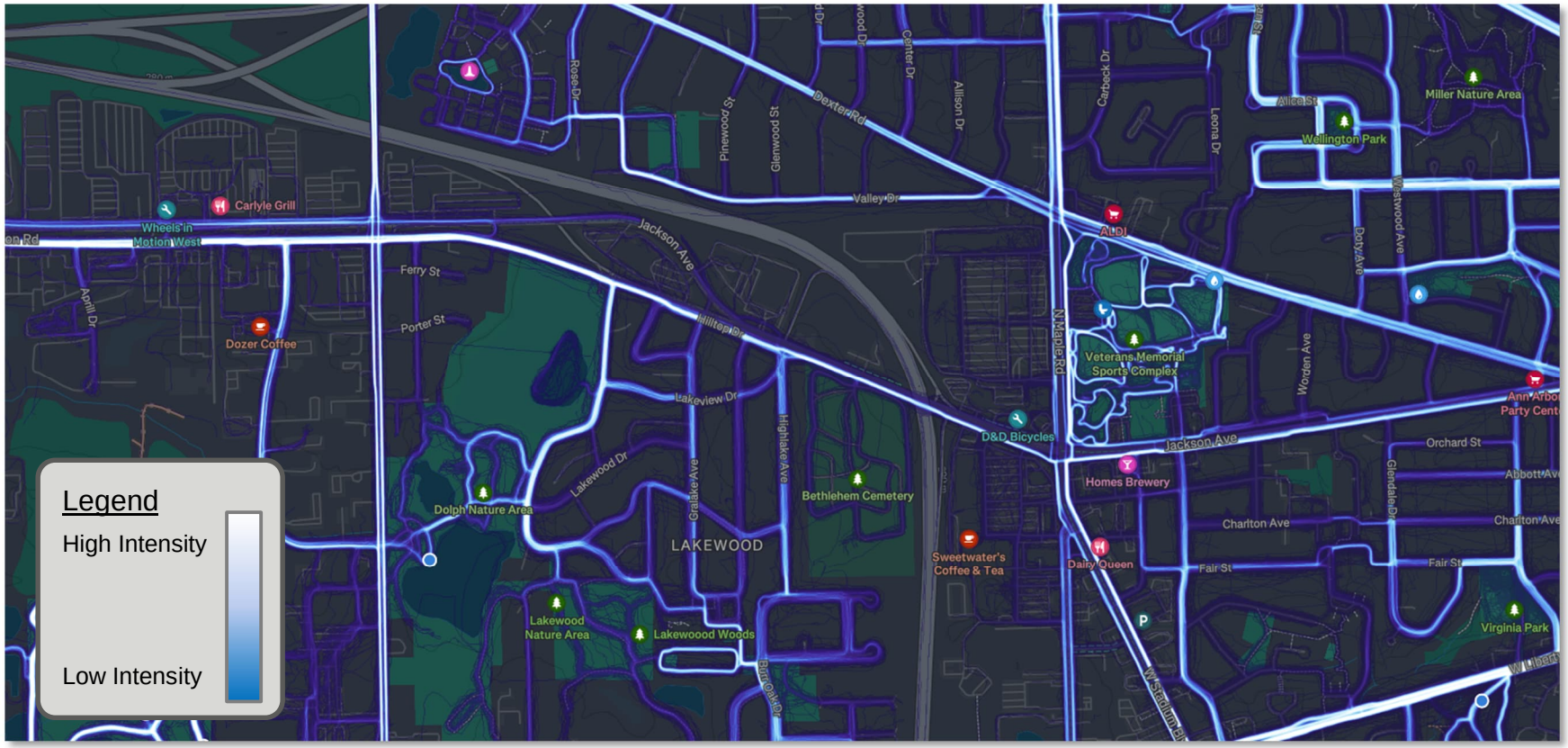


Figure 8 - Strava Public Active Transportation Heat Map

3.3 CRASH ANALYSIS

The most recent five years of crash data (2020 – 2024) were obtained from Numetric and MichiganTrafficCrashFacts.org (MTCF) for the study area. During the five-year study period, a total of 240 reported crashes occurred with 37 (15%) resulting in an injury crash. Figure 9 provides a spatial distribution of crashes and Figure 10 provides the overall distribution of crashes by severity. Additionally, crash reports for January through May of 2025 were provided by the City of Ann Arbor and the crash details are included at the end of this crash analysis.

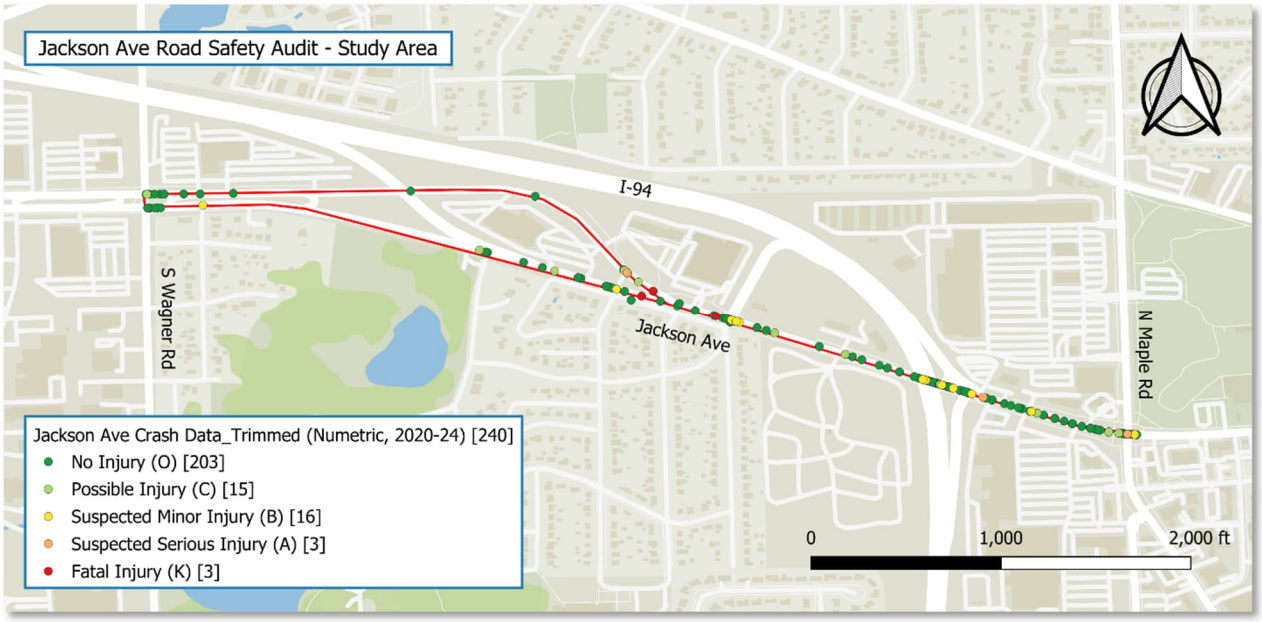


Figure 9 - Spatial Distribution of Crashes (2020-2024)

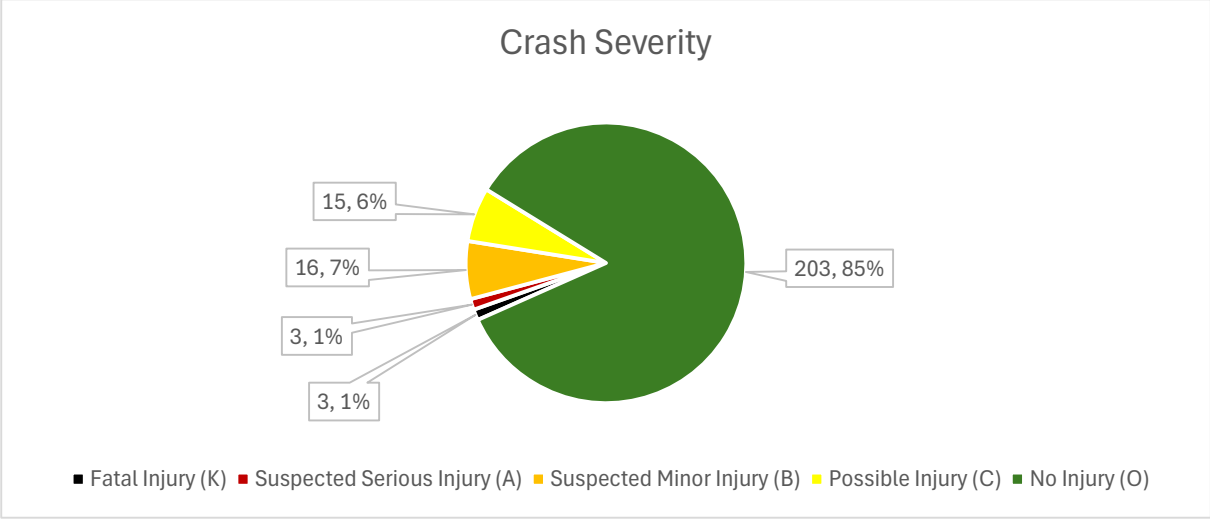


Figure 10 - Crash Severity (2020-2024)

The following summarizes Fatal Injury (K) and Suspected Serious Injury (A) crashes which occurred from 2020 through 2024 are organized by crash severity.

- A single motor vehicle crash occurred when a westbound travelling vehicle lost control while entering the curve just east of Gralake Road along westbound Jackson Avenue during dark-lighted and dry road conditions. The UD-10 report mentions that distracted driving might have contributed to the Suspected Serious Injury (A) crash.
- A head on-left turn crash occurred at a private driveway approximately 200 feet west of Highlake Road when a vehicle attempting to make an eastbound left-turn onto a driveway struck a westbound travelling motorcycle resulting in a fatal injury (K) crash. The crash occurred during daylight and dry road conditions and the UD-10 states that the motorcyclist was travelling at a high rate of speed.
- A single motor vehicle crash occurred when a westbound travelling vehicle lost control while entering the curve approximately 200 feet east of Gralake Road along westbound Jackson Avenue during dark-lighted and wet road conditions. The result was a fatal injury (K) crash.
- A head-on crash occurred when a vehicle exiting I-94 on eastbound Jackson Avenue was suspected to have experienced brake failure and struck a westbound facing vehicle which was stopped at the traffic light during daylight and dry road conditions. The incident resulted in a Suspected Serious Injury (A) crash.

The City of Ann Arbor provided crash reports for the five crashes that occurred along the study corridor in 2025. The crash descriptions are provided below in order of injury severity and include:

- A single vehicle crash occurred along the westbound Jackson Avenue curve approximately 150 feet west of Gralake Avenue as the vehicle lost control and entered the median striking a tree. This resulted in a fatal injury (K) crash during dark-unlighted and wet road conditions. The report also seemed to indicate to intoxication being a factor.
- An angle crash occurred along westbound Jackson Avenue approximately 500 feet west of Highlake Avenue as a vehicle turning right from a private driveway failed to yield to a through vehicle. The report also mentioned that the through vehicle may have been speeding at the time of the crash. This resulted in a suspected minor injury (B) crash and occurred during daylight and dry road conditions.
- A rear-end crash occurred along westbound Jackson Avenue approaching Wagner Avenue as the trailing vehicle failed to slow down in time at a red light. This resulted in a no injury (O) crash and occurred during daylight and dry road conditions.
- A rear-end crash occurred along eastbound Jackson Avenue approaching Highlake Avenue as the trailing vehicle failed to slow down in time at a red light. This resulted in a no injury (O) crash and occurred during daylight and dry road conditions.
- A sideswipe-same direction crash occurred along eastbound Jackson Avenue approximately 100 feet east of Wagner Road as a distracted driver who was attempting to avoid the bus which was stopped at a bus stop sideswiped a vehicle travelling in the left lane. This resulted in a no injury (O) crash and occurred during daylight and dry road conditions.

CRASH CHARACTERISTICS

In addition to the spatial distribution of crashes, UD-10s were reviewed for all the crashes reported during the study period. This information helped to ascertain some of the contributing factors to the types of crashes. Figure 11 provides the overall distribution of crashes by crash type. As shown, more than 87% of the crashes resulted in a rear-end, angle, sideswipe-same or single motor vehicle crash type.

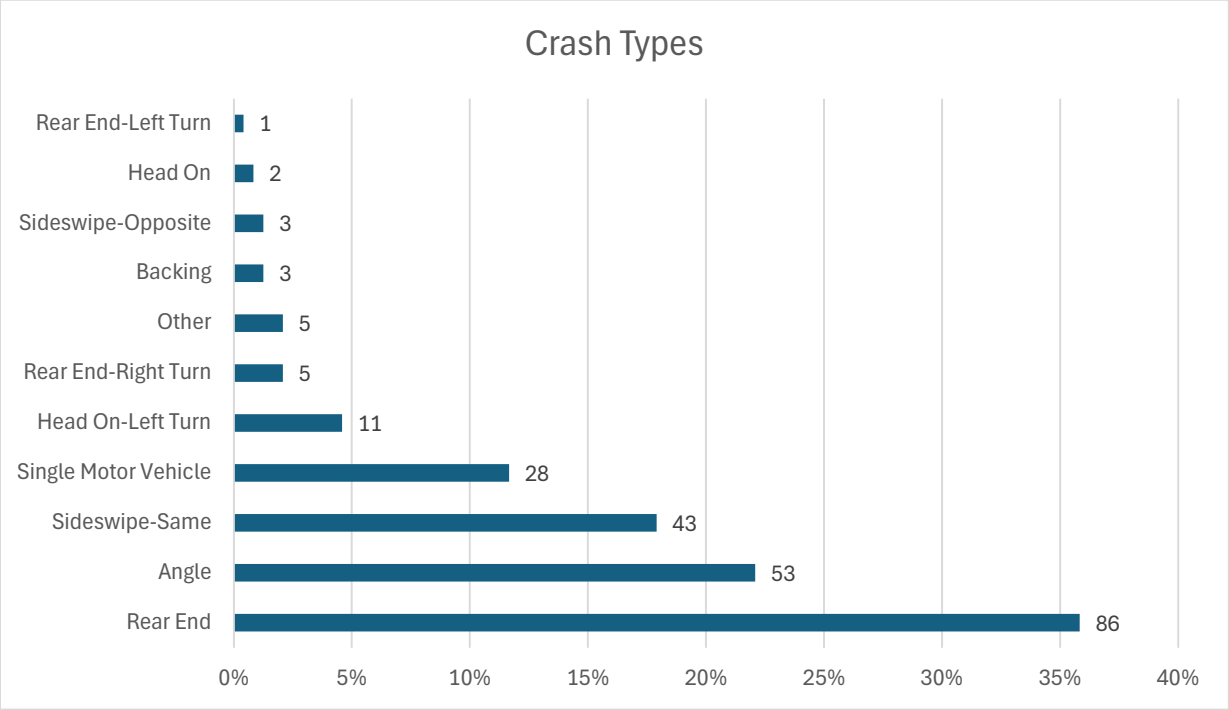


Figure 11 - Crash Type (2020-2024)

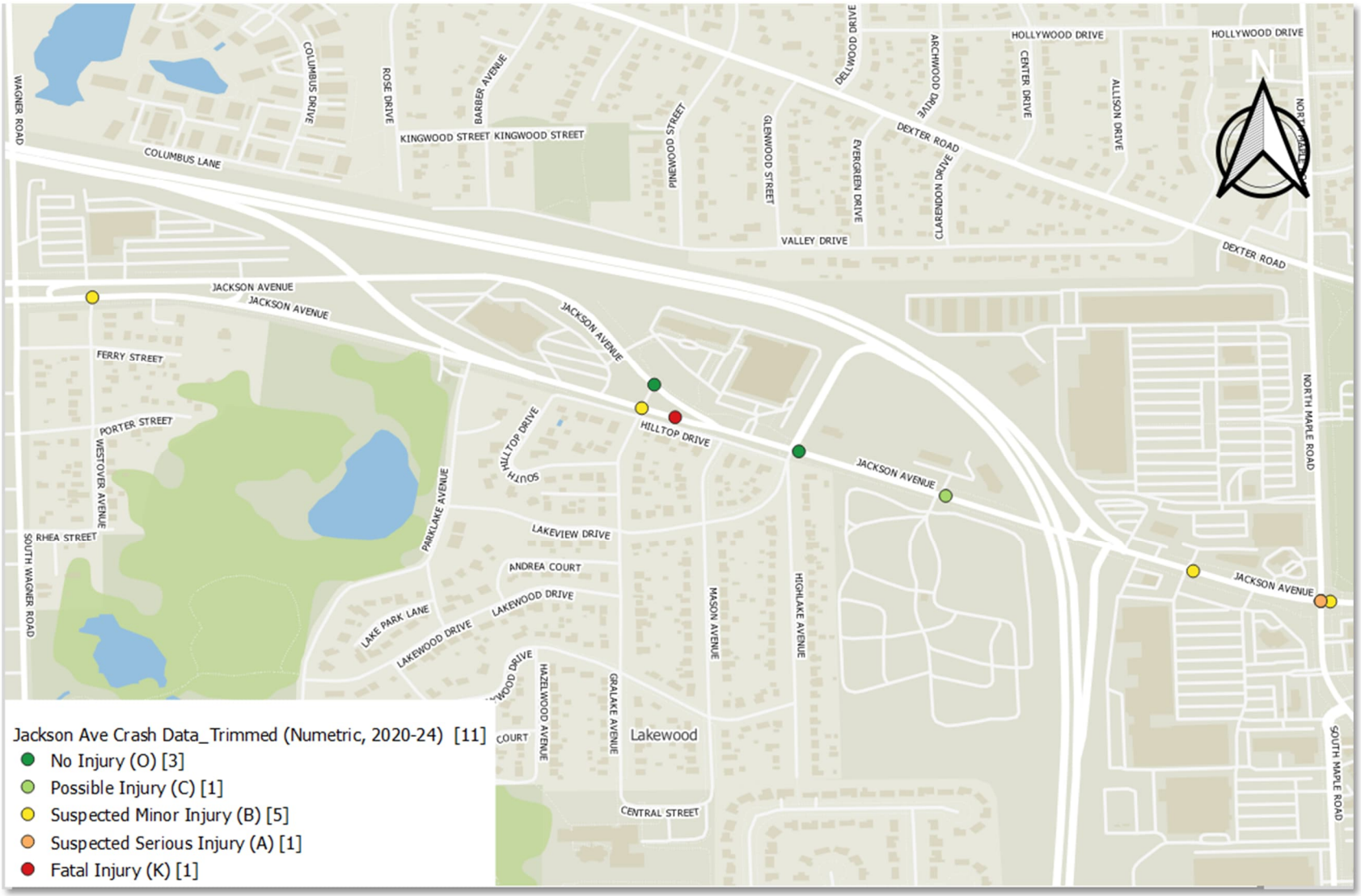


Figure 12 - Pedestrian and Bicycle Crash Locations

Crash Descriptions

The following summarizes the three pedestrian and eight bicyclist crashes which occurred from 2020 through 2024, with their locations shown in Figure 12. It should be noted that due to proximity and scale, some crash icons overlap on the map. The crashes organized by severity are as follows:

- A pedestrian who was crossing the roadway outside of a designated pedestrian crosswalk was fatally struck by an eastbound vehicle during dark-lighted and wet road conditions. The fatal injury (K) incident occurred approximately 500 feet west of Highlake Road nearby where Jackson Avenue diverges.
- A pedestrian who was crossing the west leg of the intersection within the pedestrian crosswalk at the Maple Road intersection was struck by a westbound vehicle during daylight and wet road conditions. The eastbound vehicles had a green light, and the pedestrian ran across despite having the Don't Walk indication resulting in a Suspected Serious Injury (A) crash.
- A southbound pedestrian who was crossing Jackson Ave outside of the crosswalk at the Maple Road intersection was struck by a westbound vehicle during dark-lighted and dry road conditions. The incident resulted in a suspected minor injury (B) crash.
- A westbound cyclist who was crossing Maple Road within the crosswalk was struck by a westbound right-turning vehicle which failed to yield during daylight and dry road conditions. The incident resulted in a suspected minor injury (B) crash.
- An eastbound bicyclist who was crossing Gralake Avenue was struck by a southbound vehicle during dusk and dry road conditions. The incident resulted in a suspected minor injury (B) crash and the driver reported they had low visibility due to sun glare.
- A bicyclist who was going westbound along the Jackson Avenue sidewalk was struck by a vehicle attempting to turn onto Jackson Avenue from a private driveway located east of the I-94 exit ramp during daylight and dry road conditions. The incident resulted in a suspected minor injury (B) crash.
- A bicyclist who was going westbound along the Jackson Avenue sidewalk was struck by a vehicle which failed to yield while attempting to turn onto Jackson Avenue from a private driveway located at the cemetery east of I-94 during daylight and dry road conditions. The incident resulted in a suspected minor injury (B) crash.
- A bicyclist who was going westbound along the Jackson Avenue shoulder was struck by a vehicle attempting to make a northbound right-turn onto eastbound Jackson Avenue from Westover Street during daylight and dry road conditions. The incident resulted in a possible injury (C) crash.
- A bicyclist who was going westbound in the left lane along Jackson Avenue just east of Highlake Avenue was struck by a vehicle which failed to yield while attempting to make a westbound left-turn onto eastbound Jackson Avenue from Westover Street during daylight and dry road conditions. The incident resulted in a possible injury (C) crash.
- A bicyclist who was crossing the road within the pedestrian crosswalk at Maple Road in an unspecified direction was struck by a right-turning vehicle during daylight and unknown road conditions. The incident resulted in a property damage only (O) crash.
- An eastbound bicyclist who was crossing Gralake Avenue was struck by an eastbound right-turning vehicle during daylight and unknown road conditions. The injury status of the bicyclist is unknown since they did not remain at the scene of the crash.

TEMPORAL TRENDS

The following figures provide a high-level summary of the various temporal trends for crashes of all severities. As shown in Figure 13, the highest number of crashes occurred in the hour between noon to 1PM and from 2PM to 6PM which includes the PM peak. There was an average of 48 crashes per year with 2023 accounting for the highest number of crashes. Figure 13 also highlights that Thursdays had the highest number of crash incidents while weekend days, Saturdays and Sundays had the lowest.

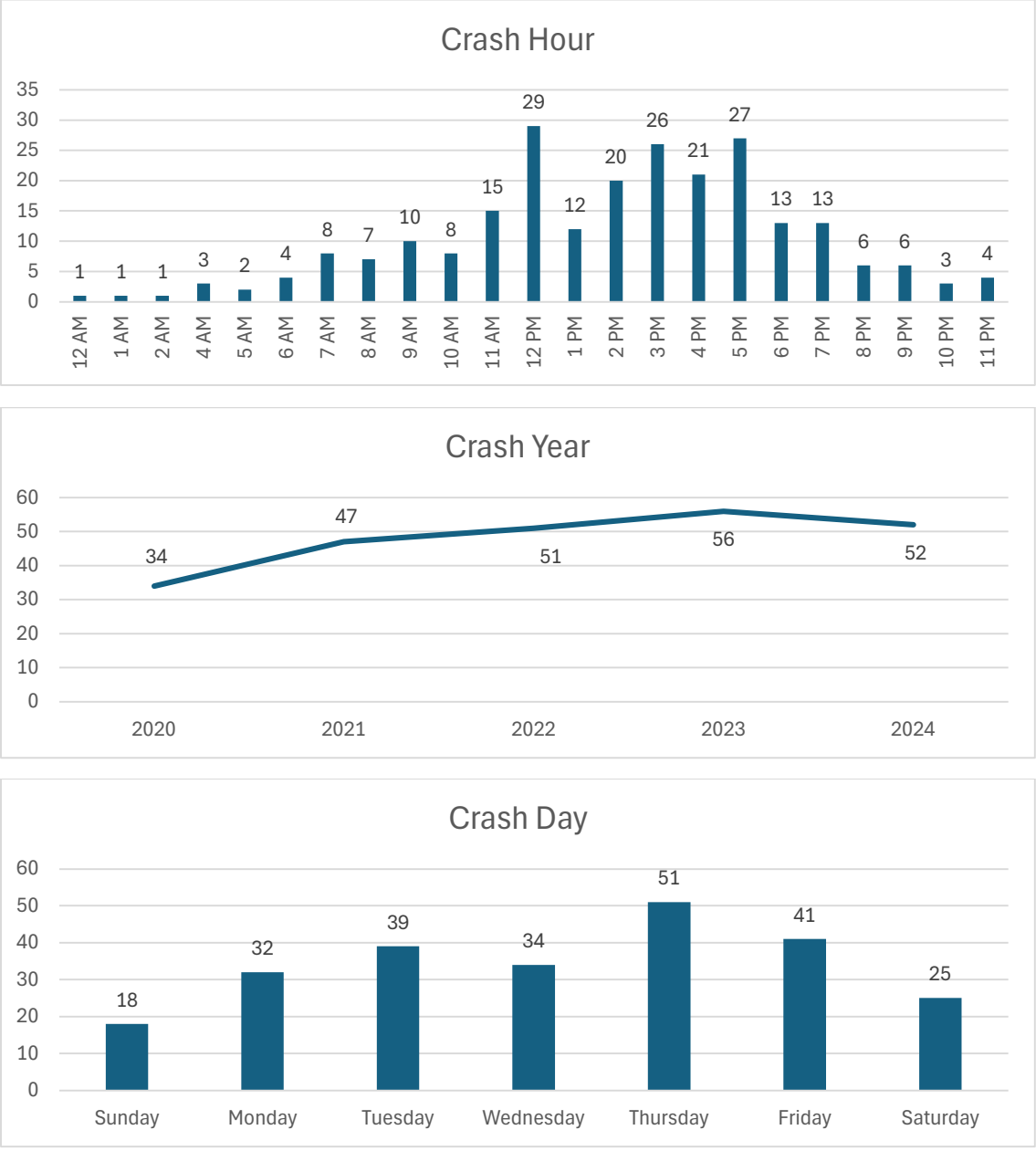


Figure 13 - Temporal Crash Distributions

ENVIRONMENTAL CONDITIONS

While environmental conditions are more difficult, if not impossible to control, they are important to consider as mitigating steps can still be taken to try to reduce their impact on roadway users. Figure 14 provides the distribution of crashes by the lighting conditions present at the time of the crash, as reported by the responding officer. Based on historic crash data, almost a quarter of all crashes occurred during non-daylight conditions. A similar trend occurred for crashes due to wet/snow/ice and other unfavorable road conditions with almost a quarter of crashes happening during unfavorable road conditions.

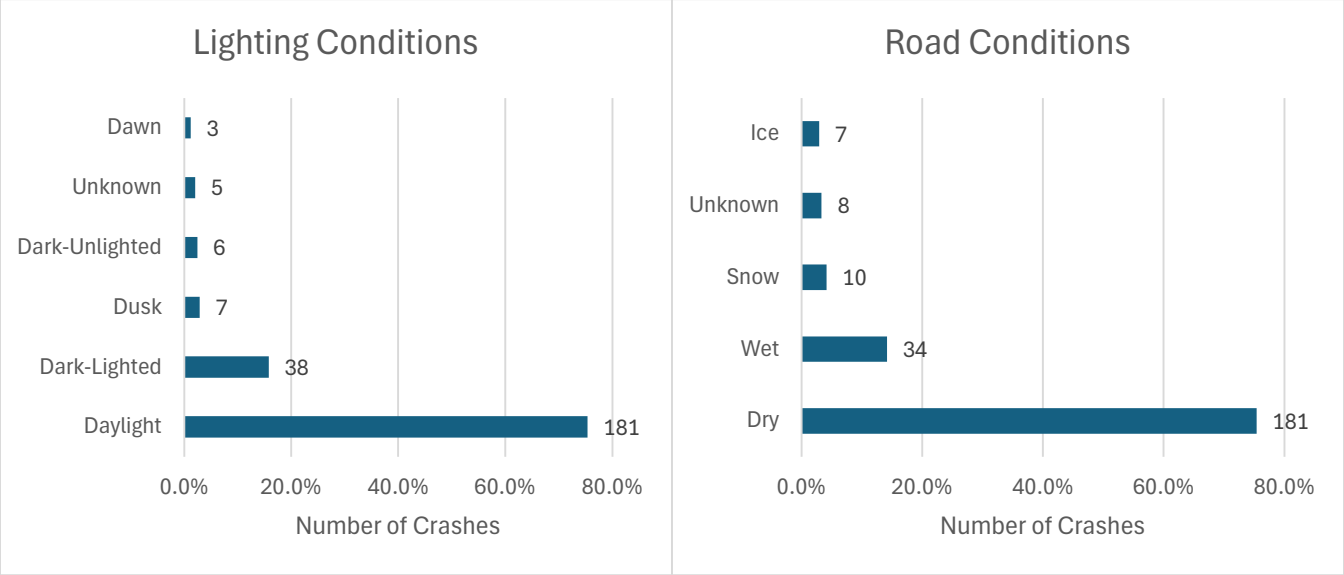
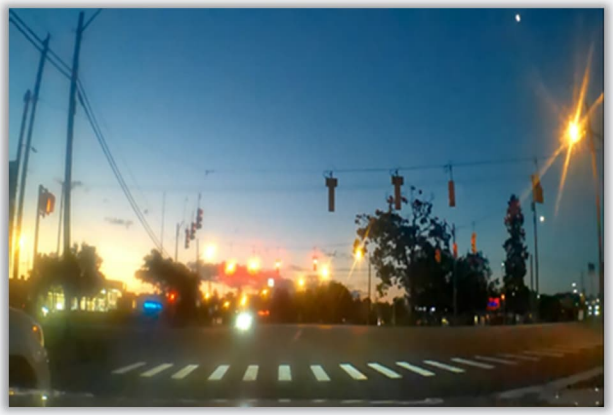


Figure 14 - Lighting Conditions and Road Conditions

4 EXISTING SAFETY MEASURES

The characteristics in the following table have been identified as having a presence or positive impact on safety in the study area.

Existing Safety Measures	
Accessible Pedestrian Signals and ADA Ramps There are several positive pedestrian features at intersections, including accessible pedestrian signals and ADA compliant ramps at Jackson/Maple, Jackson/Lakeview/Eastbound I-94 On Ramp (pictured), and Jackson/Wagner.	
Lighting Lighting is present east of the interchange, providing sufficient nighttime visibility for motorists. Overhead lighting is present at the intersections along the corridor.	
Shared Use Path south of Jackson Avenue There is a two-way bike path west of the interchange on the south side of Jackson, extending from S Hilltop to Parklake that provides enough space for pedestrians and cyclists to traverse without conflict.	

Presence of Guardrail

Guardrail west of interchange on the south side of Jackson near the cemetery provides additional protection for pedestrians and cyclists who were observed traversing the sidewalk in this section. It also helps to reduce the likelihood of pedestrians crossing mid-block by positively guiding them along the sidewalk.

Advanced Flashing Sign

There is an advanced signal flasher indicating the presence of a signal west of the interchange which provides advanced warning to motorists of the presence of a signal is ahead.

Bus Shelter/Transit Facilities

There is a bus shelter provided on the south side of Jackson, approximately 400 feet west of Maple which provides protection during inclement weather and includes a concrete pad to facilitate an accessible path to the bus. This is the only shelter on the corridor.

5 SAFETY CONCERNS AND RECOMMENDATIONS

The following sections detail safety concerns identified during the RSA, along with targeted treatment recommendations for each. Seven primary safety concerns have been identified based on existing conditions, with specific issues detailed under each category. The safety concerns, ratings, and recommendations are summarized below.

#	Safety Concern	Rating	Recommendations
1	Vulnerable Road Users ▪ Discontinuous Sidewalks ▪ Pedestrian and bicyclist obstacles from overgrown branches along sidewalks ▪ Bus riders crossing mid-block after getting off the bus. ▪ ADA compliance concerns along sidewalks ▪ Vehicles not yielding to pedestrians in crosswalk ▪ Lack of Pedestrian Signal at westbound I-94 Off-Ramp ▪ Lack of consistent bike signage	**E**	▪ Complete Gaps in Sidewalk Network and / or Provide Advance Route Guidance ▪ Enhance existing pedestrian facilities o Positive Guidance Signage o High Visibility Mid-Block Crossings o Construct a shared path east of interchange o Consider pedestrian level lighting ▪ Stripe a cycle track on the north side of Hilltop drive to provide continuity with shared use path. ▪ Refresh Special and Crosswalk Pavement Markings ▪ Review Pedestrian Crossings / Ramps for ADA Compliance ▪ Prohibiting right turn on red movements ▪ Addition of Pedestrian signals at the crossing ▪ Formalizing the entryway for the bike lane on the north side of westbound Jackson ▪ Relocate the bike lane sign which is currently obstructed ▪ Replace the road signage to increase visibility
2	Access Management near Westgate Plaza ▪ Turning across multiple lanes from driveways ▪ Sight distance obstructions for vehicles turning left from driveways ▪ Wrong way maneuvers from two-way left-turn lane onto Jackson Avenue	**E**	▪ Right-In / Right-Out Access Drives between Interchange and N Maple Rd

#	Safety Concern	Rating	Recommendations
3	Westbound Jackson Avenue curve ▪ Speeding along curve ▪ Lack of overhead lighting ▪ Missing eastbound to westbound turnaround signage	**E**	▪ Consider optical speed bars ▪ Replacing or fix current speed feedback sign ▪ Reflective signage at turnaround and along the curve ▪ Consider corridor lighting ▪ Apply a High Friction Surface Treatment (HFST) ▪ Expand median, define as gateway treatment to lower speeds and create reduced distance pedestrian crossing opportunity
4	Queueing at eastbound bus stop at Maple ▪ Queues extending to the westbound Off-ramp ▪ Evasive maneuvers due to backups	**D**	▪ Coordinate with TheRide to relocate eastbound or westbound bus stop to reduce congestion and the potential for mid-block pedestrian crossings conflicts

5.1 SAFETY CONCERNS AND TREATMENT OPTIONS

Safety concerns identified within the study area are shown in order of perceived relative concern, graded highest to lowest. The following sections provide detail regarding the concerns identified under each grouping, along with several potential treatments that cover a range of time frames and levels of investment.

VULNERABLE ROAD USERS

Vulnerable road user safety concerns were noted as a primary focus area in the original road safety audit request. Based on conversations with local stakeholders and business owners, review of available crash data, and field observations made by the audit team, issues related to vulnerable road users along the corridor were confirmed as a focus area. The Jackson Avenue corridor in particular experiences a significant amount of pedestrian and bicyclist traffic, both in terms of residents and students traveling the corridor as well as the influx of visitors to the area during typical tourist seasons and regular events. The main safety concerns involving vulnerable road users are detailed below.

SAFETY CONCERNS

Discontinuous Sidewalks

There are several sections of discontinuous sidewalk on the north side of Jackson with limited guidance and crossing opportunities, including: (1) just west of the eastern most driveway of the Varsity Ford property, (2) west of the Hampton Inn north of westbound Jackson, (3) terminating west of where I-94 crosses over Jackson, and (4) at the westbound I-94 entrance ramp from westbound Jackson. The team also observed that bus riders at certain times made mid-block crossings outside of the formal crossings at the Maple Road intersection when they got off the bus. Figure 15 shows one of the discontinuous sidewalks by Hampton Inn.

Figure 15 - Hampton Inn Sidewalk

Non-ADA Compliant Ramps

Several minor street and driveway crossings did not have ADA compliant ramps and/or had faded pavement markings (crosswalk at Maple/Jackson is pictured). Some of the markings such as the westbound approach at the westbound I-94 intersection were difficult to see during both daytime and nighttime observations. Figure 16 shows some examples of non-compliant ramps and faded markings.

Figure 16 – Non-ADA Compliant Ramps and Faded Pavement Markings

Vehicles Not Yielding to Pedestrians in Crosswalks at Maple/Stadium

Cars were observed starting their movement before looking for pedestrians when trying to turn right from eastbound Jackson to Stadium (consider restricting right turns on red). The crash analysis showed that there were at least two pedestrian crashes at this intersection involving right- turning vehicles.

Lack of Pedestrian Signal at Westbound I-94 Off-Ramp

There are no pedestrian signals in place at the westbound I-94 off ramp to Jackson which can create confusion for pedestrians and a potential conflict with high-speed vehicle traffic exiting from the freeway. Figure 17 shows the current pedestrian facilities at the intersection.

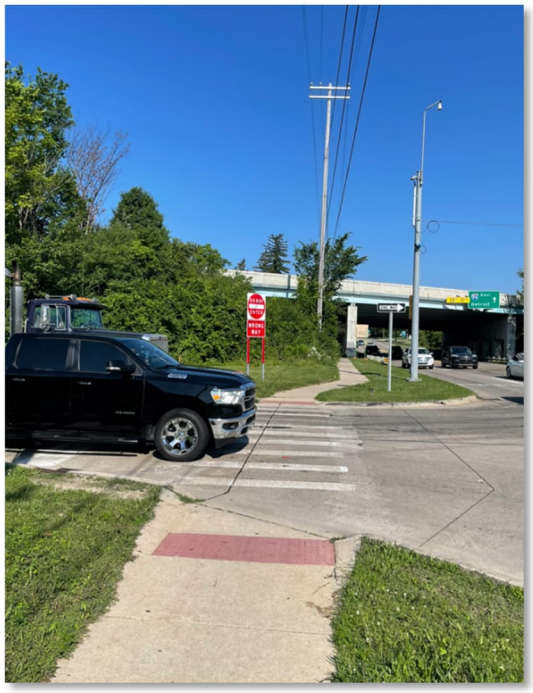


Figure 17 -Westbound I-94 Off-ramp Crosswalk

Lack of Consistent Bike Lane Signage

Lack of consistent signage and markings for the bike lane adjacent to westbound Jackson, west of the interchange. There is also no formal entryway for the bikes to enter the bike lane from the sidewalk. The bike lane sign is also blocked by an informational sign. Vehicles were observed travelling at high speeds through the sharrow section. Figure 18 shows some of the bike signage along the corridor.

Figure 18 - Westbound Jackson Avenue Bike Lane Signage

Members of the audit team felt that crashes related to vulnerable road user safety concerns would occur occasionally, with high severity resulting in an overall rating of E.

Expected Crash Types:	Non-Motorized
Expected Frequency:	Occasional
Expected Severity:	High
Rating:	**E**

POTENTIAL TREATMENTS

ADA Compliance

Consider updating the ramps at the Maple Road intersection with Jackson Avenue to meet or exceed ADA standards where feasible to ensure compliance with regulations. Additionally, ADA standards promote inclusive design, benefiting everyone, including individuals with disabilities and vulnerable road users. They provide safer passage through the sidewalk facilities and provide continuity with transit facilities, providing seamless access between bus stops and the surrounding area.

Right Turn Signage

Adding a "No Turn on Red" sign for westbound motorists on Market Street could enhance safety and reduce confusion for drivers. One of the primary benefits is that it clearly communicates to drivers that turning on a red signal indication is prohibited, which can help to reduce potential vehicle / pedestrian interactions and their associated crashes. This is particularly important at intersections such as Maple Road and northbound Jackson Avenue where there are several conflict points and vulnerable road user presence. According an FHWA study[4] on "Deployment of Individual Countermeasures", the electronic "NO RIGHT TURN ON RED" sign appeared to act as a better deterrent when compared to the static signs. Figure 19 shows some examples of MMUTCD compliant signage.

Figure 19 - No Turn on Red signs (Source: MMUTCD[5])

Providing Signage for Sidewalks

Provide signage where sidewalk leads to nowhere, so pedestrians are not stranded and do not try to cross mid-corridor due to the distance required to backtrack to a formal crossing such as the one shown in Figure 20. Positive Pedestrian guidance would also be helpful in guiding them to the south side of Jackson Avenue so that they can be redirected to the pedestrian facilities at formalized crossings without resorting to illegal mid-block crossings.

Figure 20 - Sidewalk Ending Sign

[4] https://highways.dot.gov/safety/pedestrian-bicyclist/safety-countermeasures/miami-dade-pedestrian-safety-project-phase-ii-4

[5] https://mdotjboss.state.mi.us/TSSD/getTSDocument.htm?docGuid=a933ceab-0a6c-4c81-a7fa-c3d973b002a5&fileName=mmutcdpart2b_2017.pdf

Addition of Pedestrian Signals at Westbound I-94 Off-Ramp

The addition of countdown pedestrian signals at this intersection would help improve pedestrian safety and add clear guidance for both vehicles and vulnerable road users to navigate the intersection safely. At these intersections, crosswalks should be marked with high visibility, continental markings as shown in Figure 20 to increase driver awareness of pedestrians crossing at the intersection. In addition, backplates and tethers could improve visibility of the signals for approaching drivers, increasing their compliance, and potentially limiting conflicts between vehicles and pedestrians by reducing the likelihood of red-light running.

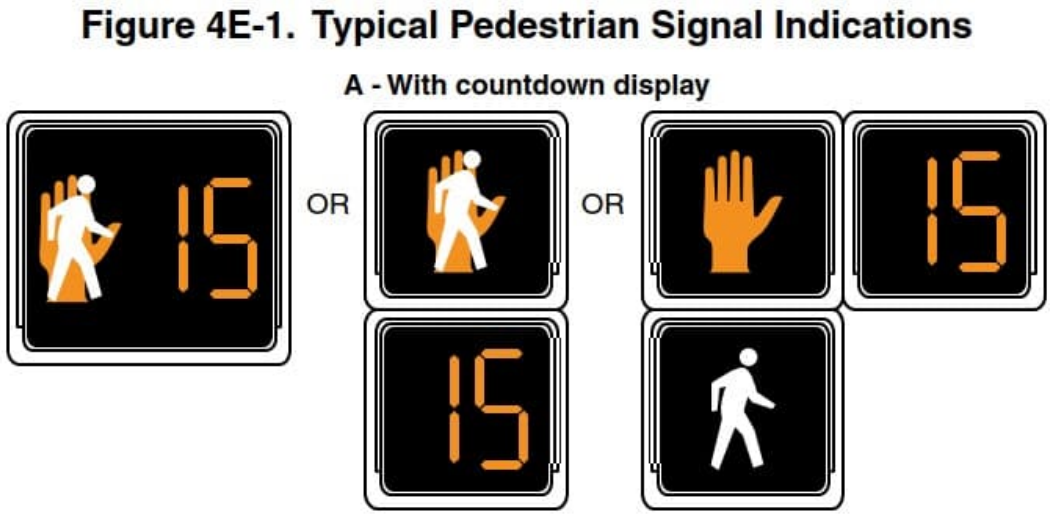


Figure 20–Pedestrian Countdown Timers (Source: MMUTCD)

Mid-block Pedestrian Crossing East of Interchange

Another improvement for consideration is to provide a high-visibility pedestrian crossing across Jackson Avenue, directly accommodating crossing demand along the desire line between bus stops. Pedestrians take the shortest route to reach their destination and are unlikely to significantly deviate to another intersection. This was observed by the RSA team several times especially involving bus riders who got off and wanted to cross to either side of Jackson Avenue. A delineated pedestrian crossing could provide a more comfortable and marked crossing location to reduce the perceived need to cross at other unmarked locations. MDOT requires an engineering study to determine the feasibility of providing a crosswalk, the "Pedestrian Crossing Treatment Flow Chart for Uncontrolled Crossing" included in MDOT's *Guidance for Installation of Pedestrian Crosswalks on Michigan State Trunkline Highways* supports the provision of a marked crosswalk in this location due to distance from the nearest intersection (Maple), which is over 300' away from adjacent signalized intersections and if the following criteria are satisfied:

- There are 20 peds/1 hour, 18 peds/2 hour, 15 peds/3 hour, at the crossing; and
- The minimum pedestrian volumes and stopping sight distance requirements (250' at 35 MPH) are met.

Provided an engineering study verifies these conditions, the "Criteria for Crossing Treatments at Uncontrolled Locations" table indicates that enhanced crossing types appropriate to Jackson's volumes, number of lanes, and posted limit would be:

- If Jackson Avenue gets a geometric improvement such as a raised median with a pedestrian refuge island, crossing type B[6] would apply. This remedy could also be used in conjunction with a Rectangular Rapid Flashing Beacon (RRFB) such as the one shown in Figure 21 to alert drivers that a pedestrian is within or entering the crosswalk in the case where there is an unsignalized crossing.

In the event a mid-block pedestrian crossing is not feasible, consider relocating existing transit stops to better align with existing utilized pedestrian crossings. This treatment option is discussed further in later transit focused sections.

Figure 21 - Mid-block RRFB Crossing Sign

Consider Pedestrian Level Lighting

While overhead lighting is present along most portions of the study corridor, this lighting is focused on the roadway itself and motorized road users. Ambient and adjacent property lighting helps to illuminate VRU facilities in some cases but consider partnering with local property owners along the corridor to provide or otherwise enhance pedestrian level lighting. This provides improved visibility both for and of pedestrians and other non-motorized road users, reducing the potential for a crash or other safety incidents.

Constructing a Shared Path

Consider constructing a shared path on south Jackson adjacent to the cemetery, on a portion of Hilltop Drive, and under the interchange overpass as illustrated in Figure 22 and Figure 23. There appears to be enough space to include a 10' path combined with appropriate signage at crossings to direct VRUs to the facility from the north side of Jackson allowing them to more safely traverse the interchange. This would provide more space than what is available under the existing conditions, where only a standard sidewalk (5 feet or less depending on vegetation encroachment) is present. This would provide spaces for bikes, which were observed as using this path under the existing condition, while helping to reduce conflicts with pedestrians by providing more space for everyone.

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[6] MDOT Guidance for Installation of Pedestrian Crosswalks on Michigan State Trunkline Highways (https://mdotjboss.state.mi.us/TSSD/getTSDocument.htm?docGuid=f9bb5ae7-c3d1-4cbf-9cd5-29b88e7325f2&fileName=mdot_pedestrian_crosswalk_guide_2023.pdf)

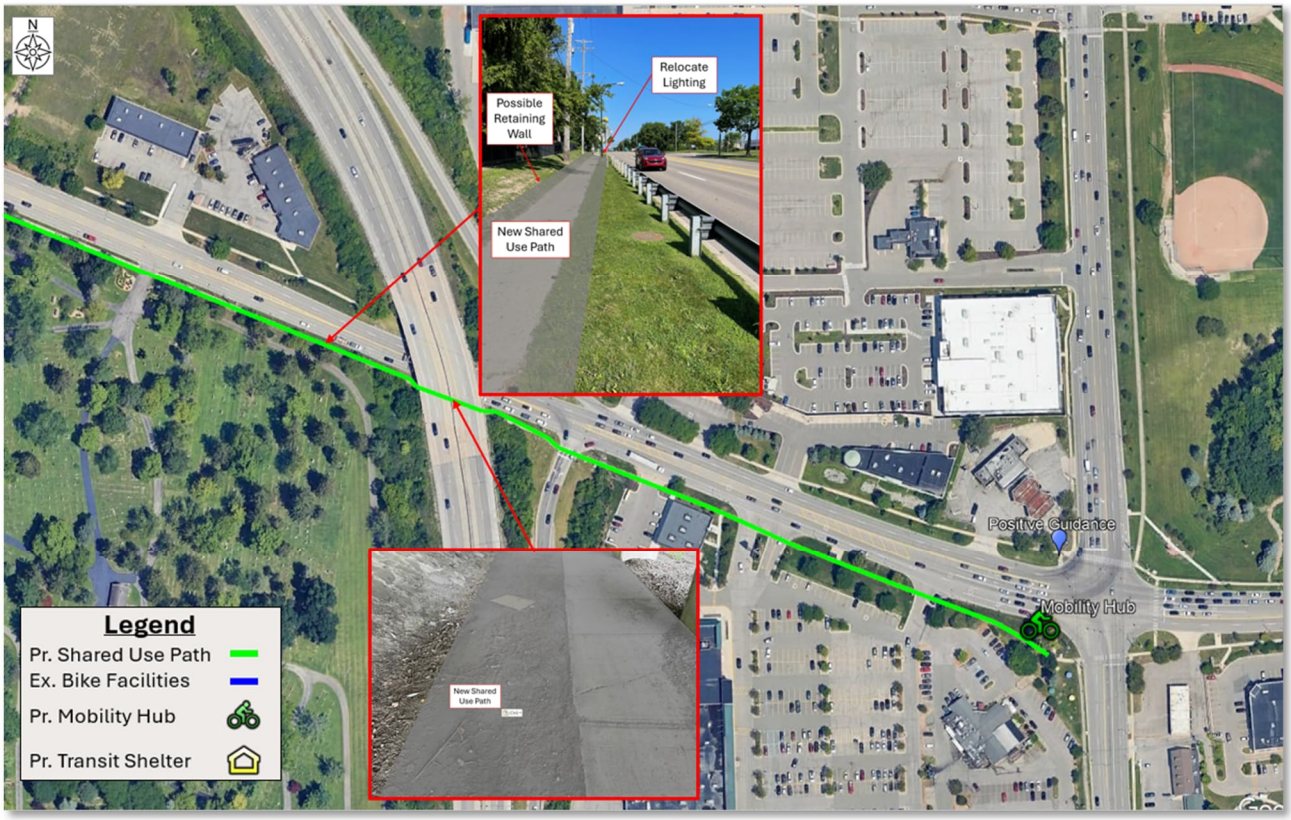

Figure 22 - New Shared Use Path[7]

[7] Section 2D.50 Community Wayfinding Signs of the 2011 MMUTCD
City of Ann Arbor Street Design Manual
https://www.a2dda.org/wp-content/uploads/2024/01/A2DDA_StreetDesignManual_FINAL_Jan2024.pdf

Guardrail Extension and Buffer

With the proposed shared use path, it would be recommended to extend the guardrail where possible to protect this facility, while integrating curb and gutter and buffer space to further separate VRUs from vehicular traffic.

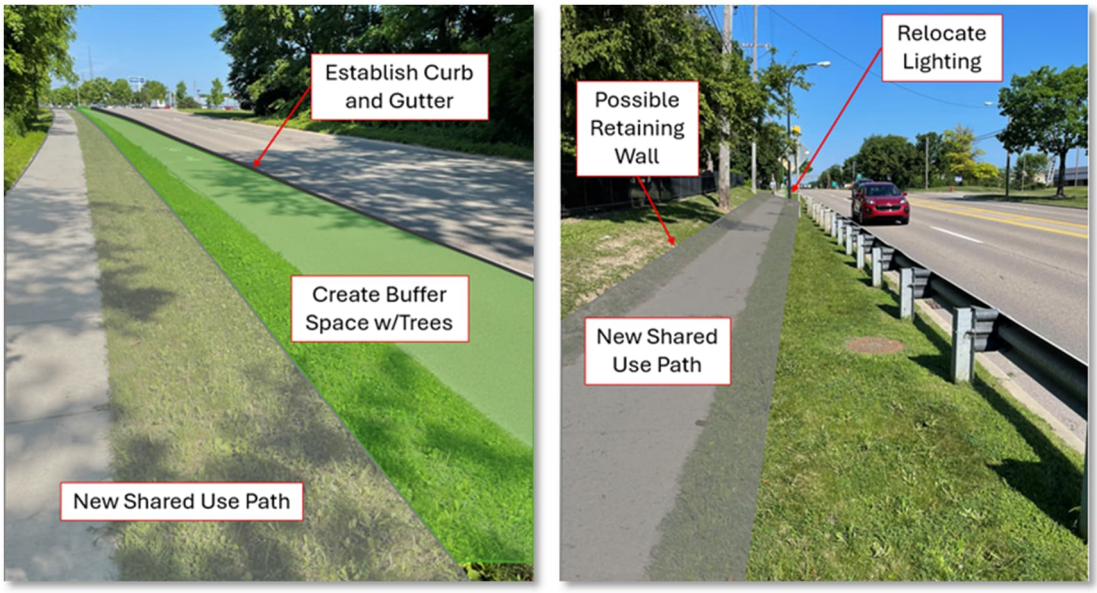

Figure 23 - Shared Use Path Detail

Continuing this path, the RSA team recommends adding dedicated bike lanes on the northern side of Hilltop Drive so that bicyclists can be more visible on the roadway and reduce the potential for conflicts with vehicles sharing the roadway as shown in Figure 24. Adding this feature would remove some on-street parking, which is a consideration to discuss with local stakeholders.

Figure 24 - Bike Lane Hilltop Drive

Improving Bike Lane Signage

Formalizing the entryway for the bikes to enter the bike lane from the sidewalk adjacent to westbound Jackson Avenue. The bike lane sign is currently obstructed by an informational sign and could be relocated to improve visibility. Some of the faded roadway signs along this bike path could also be replaced to increase their visibility and retro reflectivity, especially at night or under inclement weather conditions.

ACCESS MANAGEMENT NEAR WESTGATE SHOPPING PLAZA

SAFETY CONCERNS

Access management is an issue near the Westgate shopping plaza, west of Maple, where several cars were observed forcing their way through queues. This scenario was observed just before and during the PM peak hour as vehicles attempted to complete the left-turn movement by crossing as many as five lanes of traffic from the eastern driveway at Westgate shopping plaza. The shopping plaza which is south of Jackson Avenue has two driveways allowing left turns onto Jackson Avenue which increases conflict points with through traffic and pedestrians on sidewalks. The team observed a few hazardous maneuvers and frustrated horn blowing as left-turning vehicles attempted to access westbound Jackson Avenue during the evening peak hour. Turning vehicles have very limited or no line of sight for the westbound vehicles when eastbound queues are present and these through vehicles cannot see the turning vehicles which increases the potential for crashes or other near-miss incidents. There were instances where vehicles were observed driving in the opposing lane of traffic in an attempt to make left turns as the two way left-turn lane was backed up beyond the driveways. Examples of some observed left-turning maneuvers from the east driveway are shown in Figure 25.

Figure 25 - Left-turning vehicles from the plaza

Members of the audit team felt that based on the existing crash frequency and the potential for future incidents this safety concern would occur frequently combined with moderate potential crash severity, the overall rating is an E.

Expected Crash Types:	Rear end, angle, head-on
Expected Frequency:	Frequently
Expected Severity:	Moderate
Rating:	**E**

POTENTIAL TREATMENTS

Right-In / Right-Out Access Drives

Converting the access drives along Jackson Ave nearest to N Maple Rd into right in / right out only movements is a potential safety measure for the sight distance and turning movement related issues. This would help eliminate conflict points for motorists who currently must cross five lanes of traffic, often through significant queues during the peak periods. The channelized right-turn should help encourage lower speed turns across sidewalks to reduce potential conflicts between drivers and vulnerable road users as illustrated in Figure 26. While this approach could be trialed with signs and quick-curb installations, a long-term solution could involve installing raised concrete channelizing islands to solidify this access management strategy. An operations analysis would be required to confirm feasibility of this recommendation prior to implementation.

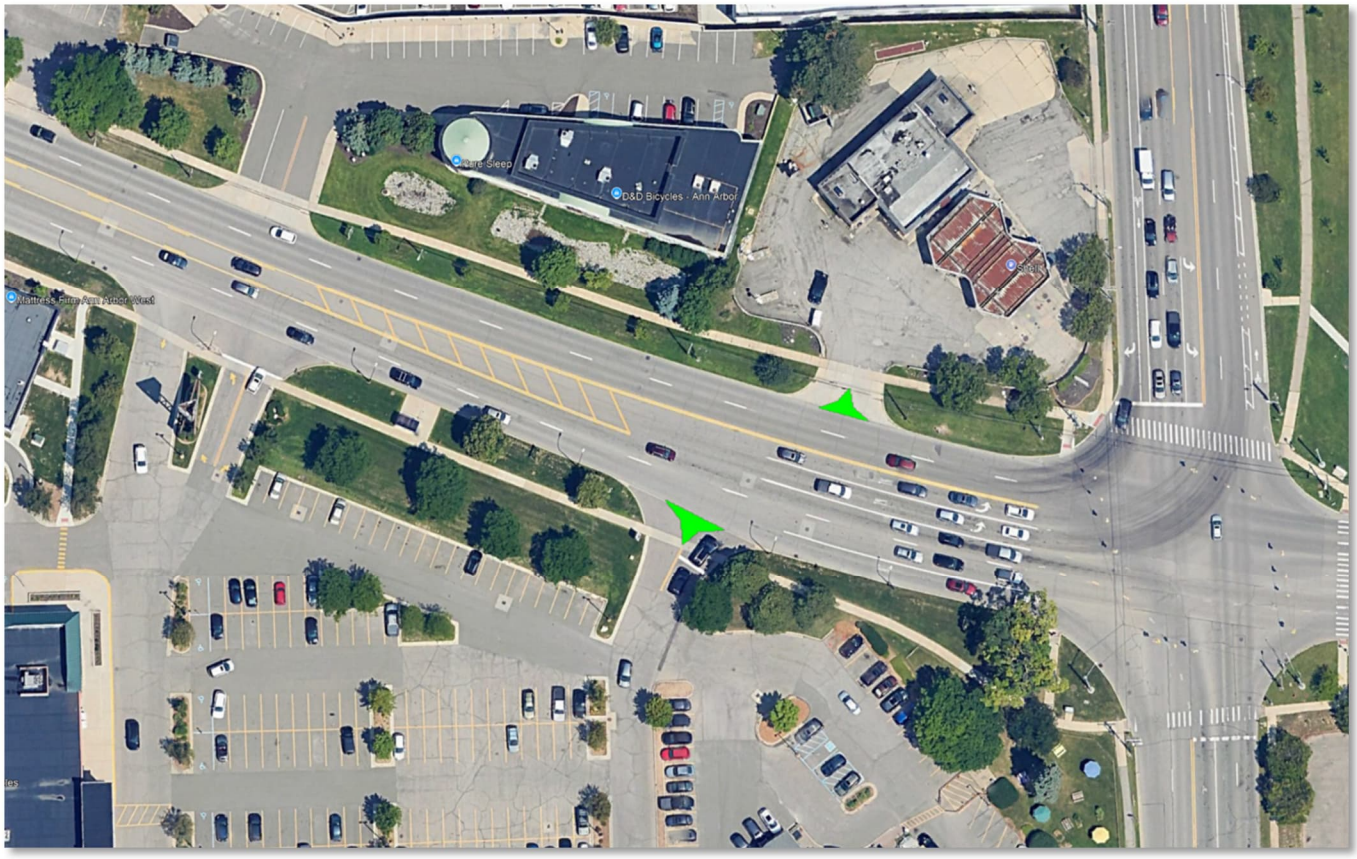

Figure 26 – Potential Right-In / Right-Out Access Management Drives

QUEUEING ISSUES DUE TO EASTBOUND BUS STOP AT N MAPLE RD AND REAR-END CRASHES

SAFETY CONCERNS

Buses were observed causing extensive queues on eastbound Jackson, extending back to the westbound I-94 Off Ramp as shown in Figure 27. At various times the audit team noticed that buses stop for extended periods at this bus stop and given that rear-end crashes are the most frequent type of crash along this corridor, queuing may contribute to the issue. While the audit team was observing the evening peak hour, they observed a rear-end crash occurring just east of the bus stop.

Figure 27 - Queueing at Eastbound Bus Stop

Members of the audit team felt that crashes related to this safety concern would occur frequently with low severity resulting in an overall D rating.

Expected Crash Types:	Rear-end, sideswipe-same
Expected Frequency:	Frequent
Expected Severity:	Low
Rating:	**D**

POTENTIAL TREATMENTS

Consideration was given to the installation of a bus pull off bay to pull stopped transit vehicles out of the flow of traffic. While this would alleviate some of the queueing associated with this stop, the City of Ann Arbor and The Ride expressed concerns given the difficulty experienced by bus drivers attempting to reenter the traffic stream in other pull-off locations. Given traffic volumes along the corridor and other constraints, consider relocating the existing transit stop and associated shelter to another location along the corridor, west of the interchange to avoid conflicts with the freeway exit ramp and Maple Road traffic, or to the east of Maple Road where there is an existing stop without a shelter. This would reduce traffic flow impacts when buses use the outer lane to pick up and drop of passengers and could be located more closely to existing pedestrian crossings.

WESTBOUND JACKSON AVENUE CURVE

SAFETY CONCERNS

Speeding and Roadway Lighting

Going west towards Wagner Road, Jackson Avenue splits into two one-way roadways and the westbound roadway is curved. The audit team noticed that vehicles speed through this curved area, which also has a narrow shoulder designated for bicycle traffic. The high speeds could result in vehicles over tracking through this region as well as encroaching on the bike lane. The observations also highlighted that there is no roadway lighting provided for westbound Jackson, west of the interchange. There are also minimal ambient sources of light available with minimal development in this section as shown in Figure 28 taken during evening observations.

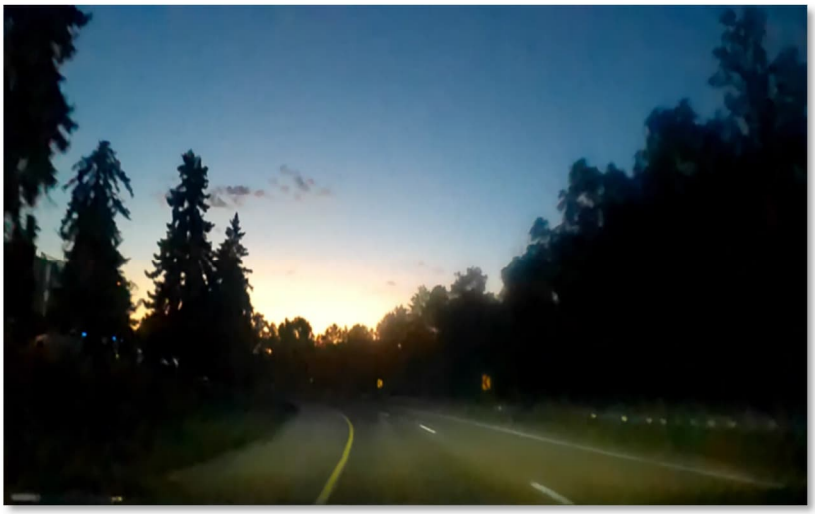

Figure 28 - Curve Nighttime Lighting

Missing Turnaround Sign East of Wagner Intersection

The eastbound to westbound sign for the turnaround east of Wagner is missing as shown in Figure 29, which may cause driver confusion. This is a quick fix that could also provide another indication of the roadside due to retro reflectivity.

Figure 29 - Eastbound to Westbound Turnaround with Missing Signage

Members of the audit team felt that crashes related to this safety concern would occur occasionally with high severity resulting in an overall rating of E.

Expected Crash Types:	Loss of control, Sideswipe, Fixed object
Expected Frequency:	Occasional
Expected Severity:	High
Rating:	**E**

POTENTIAL TREATMENTS

Jackson Avenue Gateway

In response to the lack of crossing opportunities, reported crash history, and a review of geometrics, it is recommended to look at expanding the median island just east of Gralake Avenue to formalize the storage for the westbound to eastbound turnaround there and then reduce the apparent roadway width of westbound Jackson to slow vehicles and reduce the crossing distance for pedestrians. This also creates an opportunity for a mid-block pedestrian crossing that aligns with the sidewalk north of Jackson and bus stop south of Jackson, improving safety for those who already try to cross this section of the study corridor today. This intervention could also include a proper transition for bicycles to enter the bike lane on westbound Jackson. A concept depicting this expansion and potential signs to include is envisioned in Figure 30 as a reference.

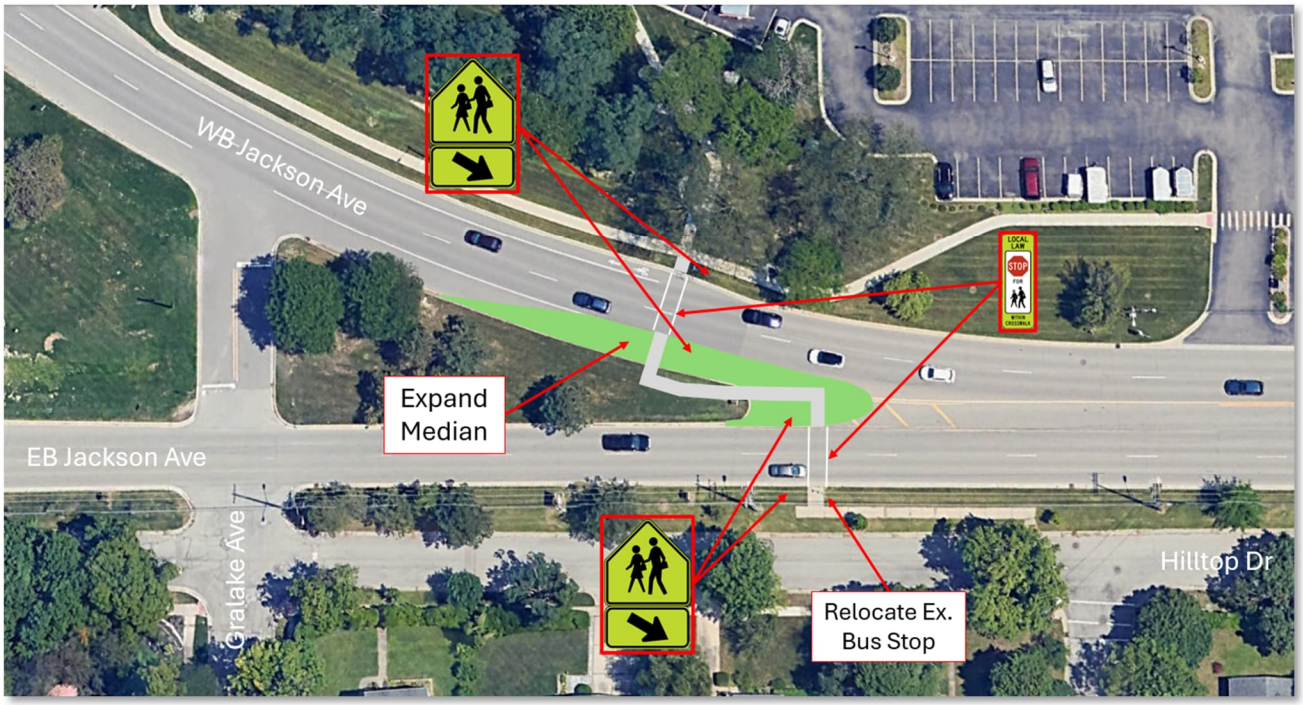

Figure 30 - Westbound Jackson Gateway Treatment and Pedestrian Crossing Opportunity

Optical Speed Bars

Consider installing optical speed bars along both bounds of Jackson Ave, particularly in the area of the westbound curve. These pavement markings are hatched areas installed along the edgeline and/or shoulder and spaced increasingly closely to give passing drivers the impression of increased travel speeds. This has been shown to encourage lower travel speeds. Examples of some installations are provided in Figure 31. This would be a low-cost, shorter-term treatment recommendation.

Figure 31 - Optical Speed Bar Examples (Source: FHWA - Top, Caltrans - Bottom)

Dynamic Speed Feeback Sign

The audit team noticed that there was a driver speed feedback sign near the approach to the curve, but it did not appear to be provide travel speeds to passing drivers at the time of the RSA. It was noted during discussions with the City that these devices may still be collecting data for law enforcement even if the display is dark. Consider turning the speed feedback function back on or coordinating with appropriate agencies to replace these devices if they are no longer functional. Ensuring that the electronic sign is functional would be a helpful deterrent for speeding vehicles through this part of the corridor.

Enhanced Curve Warning Signage

Increasing the number reflective signage along the westbound curve could be utilized to increase visibility along the curve as well as influencing drivers to be more careful along the curve. This could potentially induce a traffic calming effect and would be useful during inclement weather when visibility is compromised. MDOT indicated existing plans to add chevron signs to this curve, but additional retroreflective posts or an ITS based sequential LED curve warning signs could be considered depending on the safety performance of the impending sign installation.

Corridor Lighting

Consider installation of corridor lighting, particularly along the westbound Jackson Ave curve to help improve the visibility of the roadway, other vehicles, and the shoulders. This stretch is relatively dark compared to the rest of the corridor and could benefit from better illumination. The addition of overhead street lighting west of the interchange would be helpful in increasing visibility of both road users and signage during the nighttime and inclement weather conditions which usually impact visibility on roadways. Lighting can be added where it is currently lacking and upgrade sodium lights for more efficient fixtures where possible.

Apply a High Friction Surface Treatment (HFST)

High Friction Surface Treatment (HFST) is a pavement treatment designed to enhance the frictional properties of road surfaces, particularly in areas prone to skidding and accidents. It involves applying a layer of high-quality, polish-resistant aggregate, such as calcined bauxite, bonded with a polymer resin to the pavement. This treatment significantly improves the grip of the road surface, reducing the likelihood of rear end crashes, especially in wet conditions. The expected lifespan of HFST is approximately 10 years. The application of HFST should be considered along Jackson through the curve.

HFST has several effects on different aspects of road use and maintenance. For bicyclists, HFST provides a safer riding surface with improved traction which is beneficial for bike lanes. To date, there have been no problems reported for bicycle use with the HFST. However, as a precaution, it is recommended to ensure that all loose aggregate is removed from the treatment before opening the roadway. Additionally, the treatment should be reswept frequently during the first few weeks of operation. Initial research indicates that snowplows have had minimal impact on the treatment, even in 'bare pavement' states like Michigan. This is attributed to the durability of the calcined bauxite aggregate present in the HFST. Additionally, the HFST is quieter compared to transversely tined concrete pavement, chip seals, and dense-graded asphalt pavements. Maintenance requirements for HFST are relatively low, but periodic inspections are necessary to ensure the surface remains effective and to address any wear or damage over time. Figure 32 shows the HFST applied on a roadway.

Figure 32 - High Friction Surface Treatment Surface Comparison (Source: FHWA)

5.2 OTHER CONSIDERATIONS

Light Pole Foundations and Utility Pole Issues

Some light poles were observed as rusted with foundations showing cracks which could potentially cause a safety issue if the pole is subject to inclement weather or contacted, causing it to fall on the sidewalk or in the roadway. The picture on the right shows a cracked utility pole which was leaning significantly at the Highlake Road intersection. Some of the observations are highlighted in Figure 33.

Figure 33 - Observed Pole Foundation Condition

Vegetation Encroachment on Sidewalks

The audit team also observed that part of the sidewalk on the south side of Jackson Avenue west of the interchange appeared to be partially obstructed by vegetation. Vegetation also obscured large portions of the guardrail reflectors which appeared to reduce visibility of the curve geometry and guard rail itself, especially at night. Tree trimming along the south side of Jackson would help to improve pedestrian path experience and increase sight distance from westbound off ramp as it looked limited for drivers there.

6 SAFETY ANALYSIS

The Highway Safety Manual (HSM) introduced a science-based technical approach to incorporating safety into traditional roadway planning and safety analyses. The first edition of the HSM (2010) provides the best information and tools in a useful way to facilitate roadway planning, design, operations, and maintenance decisions based on precise consideration of their safety consequences. The primary focus of the HSM is the introduction and development of analytical tools for predicting the impact of transportation projects and program decisions on road safety.

For this analysis, the HSM Analysis spreadsheet provided and maintained by MDOT was utilized, which allows the predicted number of crashes to be proportionally increased or decreased based on conditions in Michigan. The Urban & Suburban Segments (MI) and Urban & Suburban Intersection (MI) models were used for this analysis. Crash Modification Factors (CMF) were applied as applicable for the base conditions and proposed treatments. Given current limitations in the HSM methodology not all treatment recommendations were analyzed using the spreadsheet.

6.1 BASE CONDITIONS

An HSM analysis was completed for the length of the corridor utilizing 2024 traffic volumes and five years of crash data spanning from 2020 to 2024. The intersections of Jackson Ave at Wagner Rd and Jackson Ave at N Maple Rd were excluded as they were not part of the complete study area.

INTERSECTION CHARACTERISTICS

The base conditions used in the analysis for the study intersections are as follows:

Jackson Ave and Lakeview Drive

- Type: Urban/Suburban Intersection
- Traffic Control: Four-way Signal
- Major/Minor AADT: 20,849/1,454
- Major/Minor Road Flow Type: Two-way/Two-way
- Major/Minor Median Present: Not Present/Not Present
- Intersection Lighting: Present
- Major/Minor Number of Through Lanes: 4/2
- Major Road Speed Limit: 45 MPH
- Right Turn on Red Status Permitted
- Major Street Left Turn Lane on All Approaches: Present
- Additional CMF's used: None

These base conditions expect a total of 3.9 crashes/year, of which 1.1 would include a fatality or injury. A review of the crash data observed an average of 2.4 total crashes/year, meaning there are 1.5 fewer expected crashes/year.

Jackson Ave and Westbound I-94 Off Ramp

- Type: Urban/Suburban Intersection
- Traffic Control: Three-way Signal
- Major/Minor AADT: 26,241/9,858
- Major/Minor Road Flow Type: Two-way/One-way
- Major/Minor Median Present: Not Present/Not Present
- Intersection Lighting: Present
- Major/Minor Number of Through Lanes: 4/0
- Major Road Speed Limit: 45 MPH
- Right Turn on Red Status: Permitted
- Major Street Left Turn Lane on All Approaches: Not Present
- Additional CMF's used: None

These base conditions expect a total of 2.0 crashes/year, of which 0.35 would include a fatality or injury. A review of the crash data observed an average of 1.2 total crashes/year, meaning there are 0.8 fewer expected crashes/year.

SEGMENT CHARACTERISTICS

The base conditions used in the analysis for the study segments are as follows:

Jackson Ave Boulevard from Wagner Rd to Curves

- Cross-Section: 4 Lane Divided
- CTWLTL: Not Present
- Segment Length (Miles): 0.31
- AADT: 17,305
- Parallel Parking Lane: Not Present
- Median Width 42 ft
- Segment Lighting: Not Present
- Lane Width: 12 ft
- Left Shoulder Width: 8 ft
- Right Shoulder Width: 10 ft
- Additional CMF's used: None

These base conditions expect a total of 2.9 crashes/year, of which 0.2 would include a fatality or injury. A review of the crash data observed an average of 3.4 total crashes/year, meaning there are 0.5 excess expected crashes/year.

Jackson Ave (Westbound) from Boulevard to Merge

- Cross-Section: 2 Lane One Way
- CTWLTL: Not Present
- Segment Length (Miles): 0.26
- AADT: 8,612
- Parallel Parking Lane: Not Present

- Segment Lighting: Not Present
- Lane Width: 9 - 12 ft
- Left Shoulder Width: 6 - 8 ft
- Right Shoulder Width: 8 ft
- Additional CMF's used: None

These base conditions expect a total of 0.68 crashes/year, of which 0.24 would include a fatality or injury. A review of the crash data observed an average of 1.20 total crashes/year, meaning there are 0.52 excess expected crashes/year.

Jackson Ave (Eastbound) from Boulevard to Merge

- Cross-Section: 2 Lane One Way
- CTWLTL: Not Present
- Segment Length (Miles): 0.36
- AADT: 13,445
- Parallel Parking Lane: Not Present
- Segment Lighting: Not Present
- Lane Width: 12 ft
- Left Shoulder Width: 2 ft
- Right Shoulder Width: 8 ft
- Additional CMF's used: None

These base conditions expect a total of 1.3 crashes/year, of which 0.14 would include a fatality or injury. A review of the crash data observed an average of 2.4 total crashes/year, meaning there are 1.1 excess expected crashes/year.

Jackson Ave from Merge to Lakeview Dr

- Cross-Section: 2 Lane Two Way
- CTWLTL: Present
- Segment Length (Miles): 0.10
- AADT: 20,032
- Parallel Parking Lane: Not Present
- Segment Lighting: Present
- Lane Width: 12 ft
- Left Shoulder Width: 0 ft
- Right Shoulder Width: 0 ft
- Additional CMF's used: None

These base conditions expect a total of 2.41 crashes/year, of which 0.25 would include a fatality or injury. A review of the crash data observed an average of 2.8 total crashes/year, meaning there are 0.39 excess expected crashes/year.

Jackson Ave from Lakeview Dr to Westbound I-94 Off Ramp

- Cross-Section: 2 Lane Two Way
- CTWLTL: Present
- Segment Length (Miles): 0.26
- AADT: 20,849
- Parallel Parking Lane: Not Present
- Segment Lighting: Not Present
- Lane Width: 12 ft
- Left Shoulder Width: Curb
- Right Shoulder Width: Curb
- Additional CMF's used: None

These base conditions expect a total of 7.78 crashes/year, of which 1.28 would include a fatality or injury. A review of the crash data observed an average of 8.40 total crashes/year, meaning there are 0.62 excess expected crashes/year.

Jackson Ave from Westbound I-94 Off Ramp to N Maple Rd

- Cross-Section: 2 Lane Two Way
- CTWLTL: Present
- Segment Length (Miles): 0.17
- AADT: 26,241
- Parallel Parking Lane: Not Present
- Segment Lighting: Not Present
- Lane Width: 12 ft
- Left Shoulder Width: Curb
- Right Shoulder Width: Curb
- Additional CMF's used: None

These base conditions expect a total of 14.495 crashes/year, of which 0.96 would include a fatality or injury. A review of the crash data observed an average of 14.40 total crashes/year, meaning there are 0.095 excess expected crashes/year.

6.2 RECOMMENDATION OPTIONS

A summary of HSM compatible crash modification factors (CMFs) and their estimated impact on safety operations at the study intersection are provided in the section below and the attached HSM analysis Excel files. A crash modification factor is applied to the total number of crashes to calculate the expected number of crashes after implementing a specified countermeasure. These factors are used to compare outcomes across various safety treatments, and to identify the most cost-effective measures to reduce crashes. A CMF < 1.0 indicates a decrease in expected crashes, and a CMF > 1.0 indicates an increase in expected crashes. A CMF = 1.0 indicates that no proven safety benefit has been determined. These factors are developed based on published studies on proven crash reduction countermeasures. Table 7 provides a consolidated summary of CMFs available for proposed treatments identified by the audit team. Several proposed treatments do not have CMFs or are not compatible with the current HSM methodology but are still anticipated to provide positive safety benefits for the study intersection. Additionally, the following CMFs are listed individually, where packages of compatible treatments may provide increased efficiency.

Table 5 - Summary of HSM Compatible Crash Modification Factors

Proposed Treatment	Applicable Locations	Crash Type	Crash Severity	CMF
Install Lighting (ID: 7783)	Westbound Jackson Ave Curves	All	All	0.74
*Install Chevrons, Curve Warning Signs, and Sequential Flashing Beacons (ID: 1916)**	Westbound Jackson Ave Curves	All	All	0.627
*Improve Pavement Friction (High Friction Surface Treatment, MI HSM CMF)**	Westbound Jackson Ave Curves	All	All	0.799
*Install Dynamic Speed Feedback Sign (ID: 6885)**	Westbound Jackson Ave Curves	All	All	0.95

**CMF used in HSM analysis*

Several potential treatment combinations exist for the study intersections and segments. The following analysis considers a single scenario for each intersection and segment to help illustrate the potential benefits when implementing some of the recommended countermeasures. The expected improvements (per the HSM) are summarized in Table 8.

Segments

Westbound Jackson Ave Curves (~1,800')

- High Friction Surface Treatment
- Chevrons, Curve Warning Signs, and Sequential Flashing Beacons
- Dynamic Speed Feedback Signs (note: these are present and not functioning under the existing condition)

Table 6 - Expected Crash Frequency per the HSM

Intersection or Segment	Crash Frequency (Crashes/Year)				Total Percent Reduction
	Observed Base Conditions (KABC)	Observed Base Conditions (PDO)	Expected with CMFs Applied (KABC)	Expected with CMFs Applied (PDO)	
Westbound Jackson Ave Curves (~1,800')	0.8	0.4	0.22	0.23	62.5%

OPINION OF PROBABLE COST

Table 7 below provides a high-level summary of an opinion of probable cost associated with recommendation concepts where cost estimates were readily available based on MDOT's annual weight average unit price spreadsheet. These opinions include material pay items along with a 15% contingency. It should be noted that the opinion of probable cost does not include costs associated with mobilization, labor, project management, or other ancillary costs.

Table 7 - Example Treatment Opinion of Probable Cost

Suggestions	Treatment Extent	Opinion of Probable Cost
Refresh Pedestrian Crossing Pavement Markings	Marked Pedestrian Crossings	$1,380
Replace / Install Detectable Warning Surfaces and ADA Ramps	Drive crossings without existing detectable warning surfaces	$7,700
No Right Turn on Red Signage	Intersection of Jackson Ave and N Maple Rd	$900
Positive Guidance Signage for Pedestrians	Intersections of Jackson Ave at both Wagner Rd and Lakeview Dr along sidewalks leading to existing dead ends (5 Signs)	$1,840
Shared Use Path	South side of Jackson Ave from Wagner Rd to N Maple Rd (Segment between Parklake Ave and Lakeview Dr excluded)	$363,400
Pedestrian Lighting	Existing Sidewalk (~6,200)	$353,280
Mid-Block Pedestrian Crossing / Gateway Treatment	Near Jackson Ave Merge point (Approx. Gralake Ave utilizing expanded median for pedestrian refuge)	$76,500
Overhead Roadway Lighting	Westbound Jackson Ave Curves (~1,800')	$100,395
Right-In / Right-Out Channelizing Island	Access points (2) nearest to N Maple Rd	$3,500
Pedestrian Countdown Timer Signals	Westbound I-94 Off Ramp	$3,105
High Friction Surface Treatment	Westbound Jackson Ave Curves (~1,400')	$128,800

7 SUMMARY

The City of Ann Arbor initiated this RSA to investigate issues along the Jackson Avenue corridor between Wagner Road and Maple Road to improve vulnerable road user safety and motor vehicle safety as well. Additionally, the unique shape of the corridor as well as the surrounding landscape has created challenges in connecting the sidewalks on the northern side of the corridor. Limited sidewalk connectivity on the northern side of Jackson Avenue poses a safety concern for vulnerable road users (VRU) who end up crossing outside the designated pedestrian and bicycle crosswalks as they travel to and from the different pedestrian and bicyclist generators in the area.

Jackson Avenue is classified by MDOT as other principal arterial[8]runs east-west through Washtenaw County and connects various cities, neighborhoods, and shopping centers, and is used as a local connector route for traffic entering and exiting from eastbound and westbound I-94 freeway. There is an eastbound I-94 exit ramp which merges with eastbound Jackson Avenue just east of Parklake Avenue. There are three crossovers within the study area, these are all located between Gralake Avenue and Wagner Road. Some high-level observations made during the field review include:

- Signal Operations
  - Accessible pedestrian signals
  - Leading pedestrian intervals (LPI) at Maple Road intersection
  - There are no pedestrian signals at the westbound I-94 Off-ramp to Jackson Avenue
- Nighttime
  - Lighting present east of the interchange
  - No lighting on westbound Jackson Avenue, west of the interchange with a lack of ambient sources
  - Vegetation obscured large portions of the guardrail reflectors at nighttime
- Nonmotorized Facilities
  - Shared use path west of interchange and south of Jackson Avenue
  - Guardrail west of interchange on south side near the cemetery
  - Most crosswalks are well marked and visible
- Roadway Geometrics and Signing
  - Lack of consistent signage and markings for shoulder bike lane for westbound Jackson, west of the interchange. There is also no formal entryway for the bikes to enter the bike lane from the sidewalk. The bike lane sign is also blocked by an informational sign.
  - Multiple shopping complex and local business driveways near the intersection with Maple Road exiting onto Jackson Avenue increase complexity and conflict points
- Road User Behavior
  - Vehicles making left-turns from the shopping complex, near misses were observed
  - Vehicles were not looking for pedestrians for the eastbound right-turning movement from Jackson Avenue to Stadium Road
  - Buses were observed causing extensive queues on eastbound Jackson Avenue, extending back to the westbound I-94 off ramp

[8] https://mdot.maps.arcgis.com/apps/webappviewer/index.html?id=3eafa64de17049989b6968f0faa8e191

    - Speeding vehicles through the curve along the westbound Jackson Avenue curve approaching Wagner Road resulting in over tracking through the turn and possibly endangering bicyclists or pedestrians in the shoulder.

Five years of crash data (2020-2024) were obtained from Numetric and MichiganTrafficCrashFacts.org (MTCF) for the study area, where a total of 240 reported crashes occurred with 37 (15%) resulting in an injury crash. There were eleven vulnerable road user-related crashes resulting from three pedestrian and eight bicyclist crashes during the study period from 2020-2024. Some safety concerns raised during discussions with stakeholders and identified by the audit team included:

- Vulnerable Road Users
    - Discontinuous sidewalks
    - ADA compliance issues associated with some sidewalks
    - Vehicles not yielding to pedestrians in crosswalks
    - No pedestrian signal at westbound I-94 Off-Ramp
    - Lack of consistent bike signage
- Access Management near Westgate shopping plaza
    - Turning left across multiple lanes from driveways
    - Multiple driveways serving plaza create additional conflicts and complexity at Market Street
    - Wrong way driving as vehicles attempt to bypass queues in two way left-turn lane
- Queueing due to eastbound bus stop
    - Vehicles queueing behind stopped buses extending back to the interchange
    - History of rear-end crashes along Jackson Avenue
- Westbound Jackson Avenue curve
    - Speeding vehicles through the curve
    - Lack of overhead lighting and ambient lighting
    - Missing turnaround signage

Various treatments were identified, which have been shown to have positive safety benefits and could help to reduce the potential for future crashes. These treatments are primarily focused on addressing updates to vulnerable road users, improving motorist compliance to prohibited movements, and modernizing/improving the features present at the intersection.