2023 State of Michigan

Vulnerable Road User Safety Assessment

MDOT
Michigan Department of Transportation

TZD
Toward Zero Deaths

STATE OF MICHIGAN
OFFICE OF THE GOVERNOR
LANSING

GRETCHEN WHITMER
GOVERNOR

GARLIN GILCHRIST II
LT. GOVERNOR

November 8, 2023

Dear Traffic Safety Partners:

I am pleased to present the 2023-2026 Michigan Vulnerable Road User (VRU) Safety Assessment. Michigan champions non-motorized transportation as a method offering improved mobility, accessibility, and opportunities for better health and physical activity. Given the lack of physical protection, it is not surprising that crashes involving pedestrians and bicyclists are disproportionately more deadly and severe compared to other modes. Michigan's transition to the Safe System Approach (SSA) recognizes the importance of safe travel for all, especially VRUs like pedestrians and bicyclists.

The SSA represents an evolutionary step in addressing roadway safety as it is human centered. The SSA is founded on the principle that all humans make mistakes and that human bodies have a limited ability to tolerate crash impacts. It is a redundant system that strives to eliminate fatalities and serious injuries by reducing risks and anticipating mistakes. It is critical to proactively design and operate a transportation system that is human-centric and accommodates human vulnerabilities.

The founding principles of the SSA ties into the new federal requirements outlined in the 2021 Bipartisan Infrastructure Law (BIL). The BIL established a new Special Rule for VRUs, or non-motorized road users. The VRU Special Rule is part of a larger focus on non-motorist safety and includes a new requirement for all states to complete VRU Safety Assessment and include it with their Strategic Highway Safety Plan (SHSP). This 2023-2026 VRU Safety Assessment is presented as an addendum to the 2023-2026 SHSP that was approved in March 2023. It will then be updated and placed into subsequent Strategic Highway Safety Plan updates as an appendix, which is every 4 years in Michigan.

The VRU Safety Assessment provides a data-driven process to identify areas of high-risk for VRUs, through a multifaceted, collaborative, and comprehensive approach. The result is a planning level strategy to improve the safety of vulnerable road users within Michigan.

With the implementation of the SSA and the VRU requirements, Michigan can make an impact and change the direction of fatal and serious injuries on our roads. By applying the Safe System Approach through statewide strategies and initiatives that accommodate human mistakes and injury tolerance levels, Michigan can make great strides in achieving our goal of zero deaths and serious injuries by 2050. All travelers whether they drive, ride, walk, or bike should arrive at their destinations safely.

Sincerely,

Gretchen Whitmer
Governor of Michigan

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INTRODUCTION

Michigan's Governor's Traffic Safety Advisory Commission (GTSAC) was formed in 2002 by an Executive Order of the Governor in order to guide and advise Michigan's safety management process. The GTSAC provides leadership in identifying traffic safety challenges and championing strategies to aid Michigan in moving Toward Zero Deaths (TZD) on Michigan roadways.

One document in this process is the Strategic Highway Safety Plan (SHSP), which was first mandated as part of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) Transportation Reauthorization in 2003. This plan is data-driven and regularly reviewed and updated to identify key safety needs and guide investment and research decisions to help eliminate fatal and serious injuries on Michigan's roadways.

In March of 2022 the National Highway Traffic Safety Administration (NHTSA) released their 2020 annual traffic crash data showing that 38,824 lives were lost in traffic crashes nationwide[1]. Not only was that the highest number of recorded traffic fatalities since 2007, but when compared to 2019 data, bicyclist fatalities increased by 9.2 percent (from 859 to 938) and pedestrian fatalities increased by 3.9 percent (from 6,272 to 6,516). In Michigan, the number of bicyclists killed rose from 21 in 2019 to 38 in 2020 – an increase of 81 percent - while the number of pedestrians killed increased from 151 to 178 – an 18 percent increase.

Furthermore, between 2020 and 2021 while the number of bicyclists killed decreased to 29, they unfortunately increased again in 2022 to 36. Pedestrians killed increased to 186 in 2021, while decreasing to 174 in 2022.

The Infrastructure Investment and Jobs Act (IIJA), most commonly known as the Bipartisan Infrastructure Law, (H.R. 3684), is a United States federal statute signed into law on November 15, 2021. Within the IIJA, a new Special Rule was established under the Highway Safety Improvement Program (HSIP) for Vulnerable Road Users (VRUs). The Special Rule is intended to deliver solutions and improve safety for the non-motorized road users.

The VRU Special Rule is part of a larger focus on non-motorist safety. This VRU Safety Assessment is specifically mandated as an assessment of the safety performance of a State with respect to vulnerable road users and the plan of the State to improve the safety of vulnerable road users as described under 23 U.S.C. 148(1). (23 U.S.C. 148(a)(16)).

The United States Department of Transportation (USDOT) published the National Roadway Safety Strategy[2] (NRSS) to prioritize safety and meet milestones laid out in the IIJA, which commits the USDOT and the Federal Highway Administration (FHWA) to "taking substantial, comprehensive action to significantly reduce serious and fatal injuries on the Nation's roadways" in pursuit of the goal of achieving zero highway deaths. FHWA, the Michigan Department of Transportation (MDOT), and many other organizations recognize that zero is the only acceptable number of deaths on our Nation's roads – Michigan is moving Towards Zero Deaths; not 50, or even five is acceptable.

[1] https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813266
[2] https://www.transportation.gov/NRSS

The fundamental basis for the NRSS is the adoption of the Safe System Approach[3], which addresses the safety of all road users – not just vehicular traffic, but also those who travel via foot, bicycle, transit, and other modes of transportation. The Safe System Approach is a paradigm shift for many agencies, as it is founded on the principles that humans make mistakes and that human bodies have a limited ability to tolerate crash impacts.

The Safe System Approach looks to reduce or eliminate opportunities for fatal and serious injury crashes that create forces beyond what the body can tolerate. It seeks safety through vehicle and road design, as well as operational changes, rather than relying on behavioral changes. The focus is on all road users. Strategies based on the Safe System Approach are proactive, introduce redundancy in the system, and promote shared responsibility between all stakeholders with the goal of eliminating fatalities and serious injuries. This is a marked change from past efforts which aimed at eliminating all crashes.

Michigan's SHSP was updated in March 2023 and emphasizes stakeholder outreach, ensures equitable investment in underserved communities, and prioritizes safety for all road users regardless of mode of transportation. The most notable change in the 2023-2026 SHSP is the incorporation of the Safe System Approach. This ensures that statewide strategies and initiatives will accommodate human mistakes and injury tolerance levels. Michigan has long monitored crashes involving vulnerable road users and has led research and other initiatives to counter and reduce these crashes.

In order to move Michigan TZD, the safety of vulnerable road users' needs to be considered in Michigan's transportation investment decisions at all stages of a project's lifecycle – from planning through design, construction, maintenance, and operations.

With the implementation of the Safe System Approach and the VRU requirements, Michigan has the opportunity to make an impact, and change the direction of fatal and serious injuries on Michigan's roads because all travelers, whether they drive, ride, walk, or bike should arrive at their destinations safely.

[3] https://safety.fhwa.dot.gov/zerodeaths/ A Safe System Approach means a roadway design that emphasizes minimizing the risk of injury or fatality to road users; and that: takes into consideration the possibility and likelihood of human error; accommodates human injury tolerance by taking into consideration likely crash types, resulting impact forces, and the ability of the human body to withstand impact forces; and takes into consideration vulnerable road users. (23 U.S.C. 148(a)(9)).

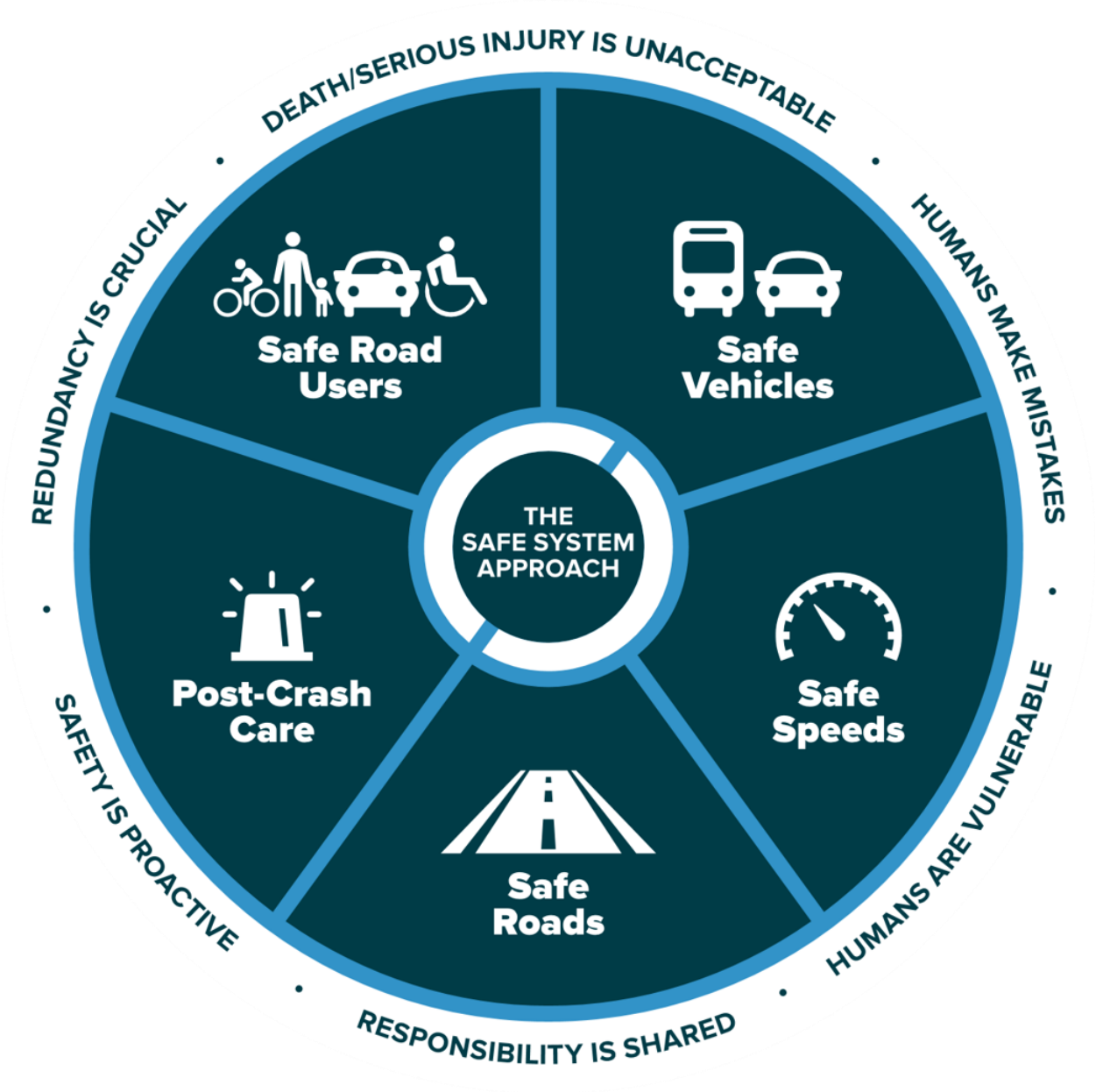

Figure 1 - The Safe System Approach (FHWA)

BACKGROUND

Pedestrian and bicycle safety has been incorporated in the GTSAC and SHSP since their inception, with a dedicated Pedestrian and Bicycle Safety Action Team (PBSAT). The PBSAT has developed an action plan specific to their focus area and a section of the SHSP has been devoted to pedestrian and bicycle safety. **Michigan has been assessing and delivering initiatives to improve VRU safety for more than 20 years.** This VRU Safety Assessment is an extension of the work that Michigan has been doing.

A summary of research efforts and outreach in Michigan that involved or were dedicated to VRUs follows.

RESEARCH AND INITIATIVES

Michigan's history of research and innovation has positioned the state to address the overall increasing trend in VRU crashes, with the goal of reducing the frequency and severity – and eventually eliminating – these crashes. These findings help shape future research needs as well as guide project selection and countermeasures. Past and ongoing research has assisted MDOT in identifying high-risk areas, collaborating with vulnerable users, and identifying strategies and countermeasures. A summary of several of these projects follows.

Assessment of Michigan's Engineering Safety Program (Evaluation of the Michigan Department of Transportation's Highway Safety Programs)

The report "Evaluation of the Michigan Department of Transportation's Highway Safety Program" summarized the findings and work executed by the research project "Assessment of Countermeasures Gaps, Predictive Crash Analysis and Engineering Safety Programs in Michigan". The research project conducted a strategic review of the engineering elements within the current highway safety programs in place by MDOT, in hopes of improving safety on Michigan roadways and achieving its TZD vision. The research began by combing through publications, specifically ones related to the National TZD Strategy, the FHWA's Roadway Safety Noteworthy Practices database, and engineering strategies in place by neighboring states for highway safety, to identify effective strategies already in place that could be implemented in Michigan to improve its safety. An analysis of each states fatal crash rate and funding allocations was completed to determine the leading states throughout the nation and compare those states safety strategies to Michigan's in order to improve Michigan's roadway safety. Afterwards, the funding levels needed for MDOT to incorporate their current countermeasures and proposed countermeasures already introduced by leading states was estimated and recommendations to improve Michigan's safety programs were created.

The recommendations were divided into procedural recommendations and highway safety countermeasure recommendations. These recommendations could directly reduce VRU crashes by implementing projects which reduce

speeds (the Safer Speeds element of the Safe System Approach) which should help reduce the severity of crashes if they occur. Additionally, the directing of increased funding could be targeted to identified high risk locations and facilities that either have a history of VRU crashes or share factors that are associated with VRU crashes. The procedural recommendations include but are not limited to:

- Funding for highway safety programs should be increased by MDOT.
- Funding split between hot spot and systemic projects should be reallocated to provide higher amounts to systemic programs.
- The cap of $600,000 per local agency project should be increased as it limits project ideas/ modifications. Since publication of the report the cap has been increased to $750,000 per project for FY 2024. The maximum per agency is still $1.5 M.
- Consideration of a regional TZD/SHSP coordinator.
- Support Michigan's Streamlined Systemic Safety Program in promoting HSIP applications from local agencies.
- Occasionally update the regional transportation safety plans.
- Continue to develop analytical support tools.

Recommendations for highway safety countermeasures include but are not limited to:

- Shift funding priorities for Michigan trunklines and local agency roadways
  - For trunklines, increase funding for intersection geometric improvements, high friction surface treatments, horizontal alignment projects, service interchange improvements, sign upgrades, and traffic signal improvements.
  - For local agency roadways, increase funding for additional travel lanes, new barrier installations, fixed object removal, traffic signal improvements, and vertical alignment projects.
- At crash hot spots, install technologies that warn drivers of potential conflicts, create physical separation of oncoming traffic on two-lane roads, and implement dynamic speed feedback signs for curve warning.

This research report is available at:

https://www.michigan.gov/mdot/-/media/Project/Websites/MDOT/Programs/Research-Administration/Final-Reports/SPR-1683-Report.pdf

Synthesis of National Best Practices on Pedestrian and Bicycle Design, Guidance, and Technology Innovations

The "Synthesis of National Best Practices on Pedestrian and Bicycle, Guidance, and Technology innovations" report was conducted by Michigan State University (MSU) and sponsored by MDOT. The objective of this project was to determine the best practices for pedestrians and bicyclists as they relate to planning and design. MSU conducted research which provided recommendations to MDOT on how to improve non-motorized users' safety and experience to further progress Michigan's TZD vision. Through this research, key findings included that both MDOT and local Michigan roadway agencies have already implemented or considered many of the non-motorized design treatments recognized; however, there is still an opportunity to expand the treatments. Also, despite Michigan's efforts to incorporate innovative treatments into department policies and procedures, there is still significant room for improvement through

reviewing documents created by the MSU team regarding enhancements to non-motorized transportation options. Lastly, input from Michigan residents and stakeholders provided valuable context and insight regarding non-motorized transportation throughout the state. To gain public opinion regarding Michigan's non-motorized transportation network, a statewide survey was available and advocacy focus groups were conducted.

The full report may be found at:

https://www.michigan.gov/mdot/-/media/Project/Websites/MDOT/Programs/Research-Administration/Final-Reports/SPR-1708-Report.pdf

Leveraging Crowd-sourced Data in Planning, Design, Analysis, and Evaluation of Pedestrian and Bicycle Traffic

Research for the "Leveraging Crowd-sourced Data in Planning, Design, Analysis, and Evaluation of Pedestrian and Bicycle Traffic" project is currently underway. The research focuses on comparing data related to pedestrian and bicycle activity, with crowd-sourced data for validation and the possibility of developing adjustment factors for crowd-sourced data. These factors will then be evaluated for their applicability to crowd-sourced data across Michigan's extensive transportation network. The outcome is invaluable information regarding pedestrian and bicycle traffic exposure. This data can enhance decision-making processes for project planning, design, analysis, and the comprehensive assessment of safety and accessibility within the transportation network.

More information is at:

https://rip.trb.org/View/1993822

Evaluating the Performance and Safety Effectiveness of Roundabouts – An Update

In 2011, MDOT completed an initial analysis focused on the safety aspects of roundabouts. With the presence of over 180 roundabouts in Michigan 2022, an updated assessment was completed to reassess the findings in the initial report. The research conducted in the new report, titled "Evaluating the Performance and Safety Effectiveness of Roundabouts – An Update" consisted of three parts. The first part involved the collection of field data on the speed of vehicles as they entered roundabouts, drivers' gap acceptance and rejection behavior, and drivers' behavior when yielding to vehicles and pedestrians within the roundabout. Following this field data collection, a safety analysis was conducted by gathering data related to traffic patterns, crash incidents, and geometric characteristics from roundabouts throughout Michigan. Lastly, the study compared the operational and environmental benefits of converting traditional intersections into roundabouts.

The collected field data revealed that, in general, vehicle speeds decreased within 200 feet of the yield line within the roundabout. Additionally, the average accepted gap range for passenger cars was between 3.3 seconds and 6.9 seconds, while the average rejected gap fell between 1.4 seconds to 3.5 seconds. Higher critical gaps were observed at roundabouts located in urban areas or on ramp terminals. While lower critical gaps were observed for multilane roundabouts. Overall, the observed yielding rates at the studied roundabouts exceeded 80 percent. Moreover, yielding rates observed towards pedestrians were

lower (≤45 percent) at roundabouts located at interchanges, while roundabouts equipped with pedestrian hybrid beacons (PHB) had higher pedestrian yielding rates (≥90 percent). When analyzing roundabout safety, the study indicated that, on average, the number of crashes at roundabouts increased by 58 percent compared to conventional intersections. However, fatal and injury-related crashes decreased by 27 percent in roundabouts compared to conventional intersections. Lastly, roundabouts generally contributed to a reduction in user delay (by 57-67 percent) and fuel consumption, resulting in savings of nearly $2.30 per vehicle per year when compared to conventional intersections.

Roundabouts emphasize the Safer Roads, Safety Road Users, and Safer Speeds components of the Safe System Approach. The lower speeds are particularly beneficial for vulnerable road users as they should reduce the severity of a crash if one occurs.

This updated roundabout research is available at:

https://www.michigan.gov/mdot/-/media/Project/Websites/MDOT/Programs/Research-Administration/Final-Reports/SPR-1725-Report.pdf

Developing a Consistent Data Driven Methodology to Multimodal, Performance Based, and Context Sensitive Design

The goal of the "Developing a Consistent Data Driven Methodology to Multimodal, Performance Based, and Context Sensitive Design" project was to establish methodologies and tools that could be applied during the early planning phase of a project. The aim was to enhance cost-effectiveness and ensure the project aligns with the needs of the community it is designed for. Through researching best practices for accommodating pedestrians and bicyclists, treatments tailored to specific attributes of the project site were compiled. Based on this research, a tool was created that recommends appropriate treatments for pedestrian segments, bicycle segments, midblock crossings, or intersection crossings taking into account the project sites' annual average daily traffic (AADT), speed limit, context, number of lanes, and median type. When using the tool, users input these project-specific criteria, and it generates three treatment options. The first is a default recommendation, followed by a treatment option that prioritizes greater separation between motorized and non-motorized users, and a third option that prioritizes less separation. Moreover, the tool was developed using Visual Basic for Applications (VBA), making it a practical resource for engineers, planners, and other transportation professionals. Its purpose is to facilitate the development of effective non-motorized transportation solutions during the early stages of project planning, ultimately contributing to more inclusive and cost-effective community-focused designs.

This updated research is available at:

https://www.michigan.gov/MDOT/-/media/Project/Websites/MDOT/Programs/Research-Administration/Final-Reports/SPR-1719-Report.pdf

SidePath Application Criteria Development for Bicycle Use

The "SidePath Application Criteria Development for Bicycle Use" project aimed to address safety concerns related to sidepaths by conducting an extensive safety analysis and survey involving Michigan residents. The outcome of this project was the creation of the "SidePath Intersection and Crossing Treatment Guide" which serves as a valuable resource for effectively selecting appropriate sidepath designs tailored to specific projects.

The safety analysis revealed several key findings. The first is bicyclists who rode against traffic faced a higher risk of collisions with right-turning vehicles and encountered greater risk when crossing commercial driveways and signalized intersections. Furthermore, the analysis indicated that bicyclists were at an elevated risk when travelling through signalized intersections compared to unsignalized intersections. Lastly, intersection-related sidepath bicycle crashes predominately involved collisions with both left-turning and right-turning vehicles. The results from the surveys conducted showed the majority of participants expressed a preference for separated bicycle facilities and indicated if they saw these facilities developed, they would bicycle more frequently. Lastly, participants also noted that high-speed roads posed obstacles to their ability to use bicycles for commuting to work or school.

The "SidePath Intersection and Crossing Treatment Guide" offers a structured approach for selecting suitable sidepath designs, whether for new construction projects, reconstruction projects, or existing right-of-way construction projects. The guide outlines 8 steps which are (1) identify corridor (2) collect data (3) review crash history (4) assess existing bicycle network (5) assess existing bikeways along corridor (6) determine achievable sidepath width (7) select intersection treatments (8) design and engineering. Additionally, the guide presents a range of treatment options aimed at enhancing bicycle safety within sidepath designs. Lastly, as part of its educational efforts, the project created informative videos to educate Michigan residents on safe bicycle practices, contributing to increased awareness within communities.

The full report is online at:

https://mdotjboss.state.mi.us/SpecProv/getDocumentById.htm?docGuid=2bab540b-54cb-4535-8a92-d53c245ee62f

Association of Michigan's Older Adult Crashes with Roadway Features

As drivers age, the likelihood of them crashing and, as a result, suffering from a serious injury increases. With this, the "Association of Michigan's Older Adult Crashes with Roadway Features" project aims to identify roadway features that are contributing to higher crash rates for older adult drivers (65 years and older) and recommend countermeasures in roadway design to reduce the crash rates. To achieve this, Michigan's older adult drivers were surveyed on their thoughts about existing roadway features and recommendations they have to help the older driving population. In addition, crash data was examined to see if there were locations, times of the day, or weather conditions that older adult drivers were more likely to be involved in a crash. Afterwards, an analysis was completed to identify the best solutions for improving roadway features that will increase older adult drivers' safety.

The survey results showed that individuals 65 years and older most often use their personal car, bicycle, or walk as their mode of transportation. More often, they prefer to avoid driving, most notably in bad weather conditions, compared to individuals 64 years and younger. As older individuals are comparatively slower to heal than younger people, improving their safety when they choose to avoid driving is an important consideration. Other instances in which older individuals stated they try to avoid driving is during night-time, peak travel times, and when left turns are needed. Furthermore, individuals aged 65 and older noted having difficulty seeing edge lines, lane markings, street name signs, and highway-rail signs during night-time more than during the daytime and bad weather conditions. Lastly, it was found that individuals aged 65 and older struggle with judging gaps at yield/stop sign controlled intersections and multilane roundabouts, specifically during bad weather.

Two crash analyses were conducted based on five years (2010-2014) of crash data. The first analysis compared the occurrence of different crash types involving a driver aged 65 and older to a driver aged 64 or younger. The second analyzed two-vehicle crashes with one driver aged 65 or older and the other driver being aged 64 or younger to see which driver group was more likely to be at fault for the crash. The results from the first analysis include but are not limited to:

- Crashes occurring in daylight involving a driver 65 years and older occur more frequent (76 percent) than drivers 64 years and younger (58 percent).
- Drivers aged 65 years and older were more likely to crash on a multilane road (22 percent) than drivers aged 64 years and younger (16 percent).
- Drivers aged 65 years and older were less likely to crash while intoxicated (2 percent) compared to drivers aged 64 years and younger (6 percent).
- Crashes that occurred from a left turn involved a driver aged 65 years and older more often (14 percent) than drivers 64 years and younger (10 percent).

The results from the second analysis include but are not limited to:

- Intersections, opposed to midblocks or interchanges, experienced the highest instance of a driver 65 years and older making the hazardous maneuver (54 percent) compared to drivers aged 64 and younger (46 percent).
- Small angle skewed intersections experienced drivers aged 65 years and older making the hazardous maneuver more frequently than drivers aged 64 years and younger. This was more frequent at STOP-controlled skewed intersections (71 percent) than signalized skewed intersections (29 percent).
- Drivers aged 65 years and older were less likely to be responsible for the hazardous maneuver at intersections with raised medians and offset left turn lanes than drivers aged 64 years and younger.
- At midblocks with a lane drop and at midblocks with parking along the road, drivers aged 65 and older were more likely to make the hazardous maneuver causing the crash than drivers aged 64 years and younger.

Then, a comparison was done between MDOT's existing design guidance in place for older adult drivers and the *FHWA Handbook for Designing Roadways for the Aging Population*. From the comparison, improvements for MDOT's design guidance were recommended based on what was

outlined in the FHWA Handbook. These recommendations include but are not limited to:

- Incorporate delineated edge lines and curbs.
- Install ground mounted signals in far-left corners of multi-lane intersections.
- Incorporate offset left-turn lanes.

The final report is at:

https://rosap.ntl.bts.gov/view/dot/32111

Developing Michigan Pedestrian and Bicycle Safety Models

The objective of the "Development of Pedestrian and Bicycle Safety Models for Michigan" project was to create a model that can predict high-risk areas for non-motorized users across the state of Michigan. Through statistical and analytical techniques, this model pinpoints locations within Michigan that exhibit greater risk environments for pedestrians and bicyclists, highlighting a need for countermeasures in these areas.

The model's development relied on the utilization of the empirical Bayes (EB) method as outlined in the Highway Safety Manual (HSM). It was combined with a non-motorized exposure model to generate risk scores specific to non-motorized users at various locations throughout Michigan. The model resulted in a spatial analysis of Michigan.

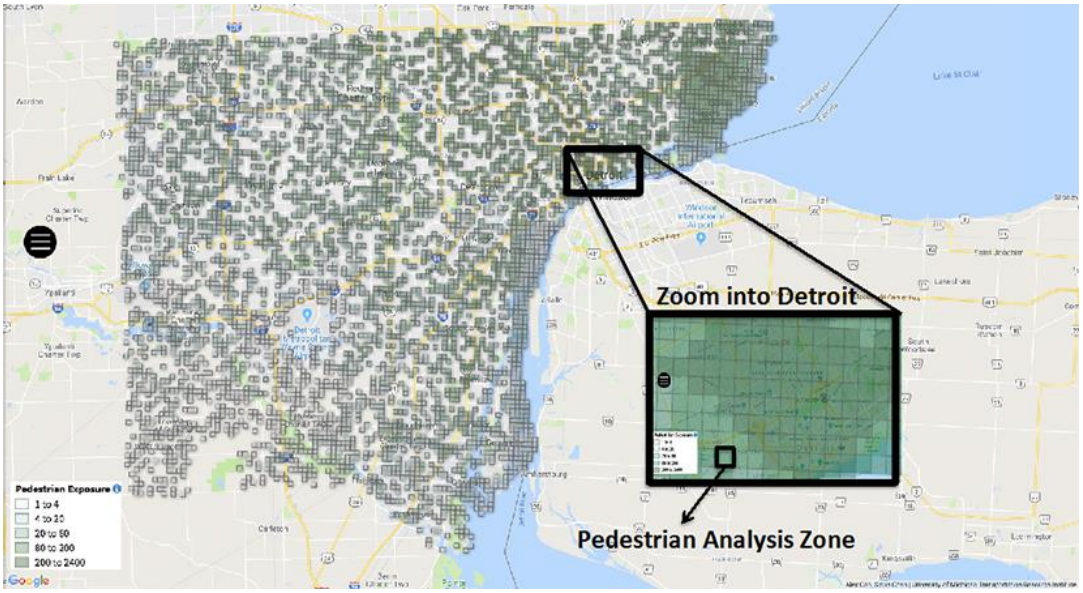

Figure 2 - Analysis example from Detroit

The methodology may be reviewed at: https://rosap.ntl.bts.gov/view/dot/36663

Michigan SPF Development – Urban (Michigan Urban Trunkline Segments and Intersections Safety Performance Functions (SPFs) Development and Support)

The HSM outlines SPFs, which are models used to estimate the frequency of traffic crashes on roadways based on various factors such as traffic volume, roadway geometry, traffic control measures, and more. SPFs are valuable tools for assessing the safety of proposed designs and

identifying locations that require safety updates. However, it is strongly recommended that each state conducts its own research as SPFs have been found to drastically vary by state based on differences in factors like road geometry, design practices, driver behavior, and crash reporting requirements. To address this need, the "Michigan Urban Trunkline Segments Safety Performance Functions (SPFs) Development and Support" project focused on developing specific SPFs tailored to urban trunklines in Michigan. A second initiative, "Michigan Urban Trunkline Intersections Safety Performance Function (SPFs) Development and Support" focused on the intersection nodes.

The process involved creating a database that had crash data, traffic volumes, roadway geometry, crossover counts, and traffic control data. This information was obtained from agencies such as the Michigan State Police, MDOT, Wayne State University (WSU), as well as aerial imagery. Once the dataset was formed, Michigan-specific SPFs were developed that took into consideration differences in annual average daily traffic (AADT), environmental factors, and roadway geometry specific to the state. Subsequently, more comprehensive SPFs were created that accounted for factors like traffic volume, speed limits, functional classification, and various aspects of roadway geometry. With the development of these SPFs, it became possible to estimate average crash frequencies for roadways that align with the base conditions of the SPFs. In cases where certain roadways did not meet these base conditions, crash modification factors (CMFs) were introduced to adjust the SPFs accordingly. These SPFs and CMFs took into account a range of factors including AADT, MDOT region, lane width, shoulder widths, median width, driveway density, on-street parking, driveway density by land use; school count, posted speed limits, and intersection and crossover density. These SPFs were designed to predict crash frequencies not only for motor vehicles, but also for pedestrians and bicyclists, as well as different types of crashes. The project also established severity distribution functions (SDFs) to predict locations where different injury severity crashes will occur. Lastly, the project outlined a process for adjusting the SPFs over time to account for changes in traffic volume and evolving trends in crash data. By creating Michigan-specific SPFs for urban trunklines, MDOT gained a valuable tool to effectively allocate safety resources in the state.

The developed Safety Performance Functions have been incorporated into Michigan's HSM analysis spreadsheet. The research reports may be found at:

https://mdotjboss.state.mi.us/TSSD/getTSDocument.htm?docGuid=4c75cd17-8c14-4204-a6d5-0003dc4fe157&fileName=SPR-1639-Report.pdf

https://mdotjboss.state.mi.us/TSSD/getTSDocument.htm?docGuid=24833cc8-134a-456c-b3c0-be3edd4b6d9f&fileName=SPR-1628-Report.pdf

Michigan SPF Development – Rural (Safety Performance Functions for Rural Road Segments and Rural Intersections in Michigan)

The "Safety Performance Functions for Rural Road Segments and Rural Intersections in Michigan" project developed specific SPFs tailored to Michigan's rural highways and intersections. These SPFs allow for the estimation of crash frequencies along rural roadways across the state. To create these functions, data was compiled on traffic crashes, traffic volumes, and roadway characteristics obtained from agencies such as the Michigan State Police, MDOT, and

MSU. The data was gathered for rural trunkline segments, rural stop-controlled intersections, and rural signal-controlled intersections.

Following the data collection, an analysis was performed using crash data from 2011 to 2015 and corresponding HSM models. The models were then calibrated to see how the HSM models fit into the Michigan data. It was found that the models did not fit well with Michigan's rural facilities, primarily due to the notably high number of animal-related crashes, particularly those involving deer. To combat the inaccurate HSM models, basic Michigan-specific SPFs were developed, taking into account AADT and variations in driver behavior, weather, and terrain across different regions of Michigan. These basic SPFs were then refined to enhance accuracy, incorporating additional factors such as lane width, shoulder width, road curvature, terrain, passing zones, median presence, surface type, and driveway density for rural road segments. For rural intersections, the SPFs took into account driveway counts, lighting, turn lanes, and intersection skew. Furthermore, deer-related crashes were excluded from the models to improve accuracy. Separate SPFs, SDFs, and crash distributions were developed to predict crash type frequencies and injury severity.

The analysis results revealed there is a lower risk of single-vehicle midblock crashes on four-lane undivided and two-lane trunklines opposed to four-lane divided trunklines. Paved two-lane rural roadways experienced roughly twice as many midblock crashes as two-lane rural trunklines. Gravel two-lane rural roadways had significantly higher midblock crash rates than both paved two-lane rural roadways and two-lane rural trunklines. The Michigan-specific intersection SPFs showed that three-leg signalized and stop-controlled intersections had lower crash rates than four-leg signalized and stop-controlled intersections. Lastly, signalized intersections within designated census places had lower rates of injury crashes than those outside of such areas.

Furthermore, CMFs were developed to adjust SPFs for locations where base conditions were not met on rural roadways. The results of the SPFs created from CMFs show wider paved shoulders result in fewer crashes and less severe crashes, while increased driveway density and greater horizontal curvature correlated with higher crash rates and severity.

Overall, these Michigan-specific SPFs for rural roadways and intersections will play a crucial role in enhancing safety planning by identifying high-risk crash locations across the state. Moreover, they can be adapted to account for changing trends over time, making them a valuable tool for years to come. When combined with the current assessment of high-speed pedestrian crossing locations this research will help identify locations and compare countermeasures aimed at reducing the frequency and severity of VRU crashes.

Like the urban and suburban SPFs, the rural SPFs have also been incorporated into Michigan's HSM spreadsheet. The research is available at: https://mdotjboss.state.mi.us/TSSD/getTSDocument.htm?docGuid=f758a84e-6933-4c82-92f7-5e13caeb2e3d&fileName=SPR-1645-Report.pdf

Comparison of Alternative Pedestrian Crossing Treatments

The "Comparison of Alternative Pedestrian Crossing Treatments" project aimed to assess whether the installation of R1-6 in-street signs led to a higher rate of vehicles yielding to pedestrians. In the study, the R1-6 in-street signs were placed along both edges of the roadway, the centerline, and each lane line (if the roadway had multiple lanes) creating a gateway configuration. The

results showed that the gateway configuration for sign placement was more effective in promoting vehicles to yield to pedestrians because the configuration forced vehicles to slow down due to the narrower path created by the sign placement.

Furthermore, the gateway configuration was more effective when R1-6 signs were present as opposed to blank signs with the same background color and size. Additionally, the study found that the effectiveness of yielding was nearly the same whether the signs were mounted on the curb face or placed within the gutter pan. Lastly, yielding was only slightly less effective when robust delineators were positioned on the lane lines instead of using the R1-6 signs. Figure 3 provides a visual of a R1-6 sign.

In Street Pedestrian Gateways was also adopted as part of the AASHTO Innovation Initiative: https://trid.trb.org/view/1458105

Figure 3 - R1-6 In-street Signs

Effective Pedestrian/Non-Motorized Crossing Enhancements Along Higher Speed Corridors

The "Effective Pedestrian/Non-Motorized Crossing Enhancements Along Higher Speed Corridors" project aimed to determine the causes of pedestrian and bicycle crashes occurring on high-speed roads, which are defined as those with speed limits of 45 miles per hour or greater. These roads experience a higher rate of fatal non-motorized crashes, particularly at night, due to their higher speeds and limited lighting.

The project began by conducting an extensive review of previously documented countermeasures designed to reduce non-motorized crashes. This review relied heavily on data from the FHWA Crash Modification Factors Clearinghouse. The countermeasures addressed were then evaluated to determine their effectiveness in mitigating crashes on high-speed roads, particularly at signalized intersections, unsignalized intersections, and midblock locations. Additionally, the project examined countermeasures aimed at reducing speeds and improving lighting along these high-speed corridors.

Next, the project investigated existing treatments already implemented on high-speed roads in Michigan and neighboring states with similar weather patterns. The review found that treatments being used in Michigan, that are in accordance with federal guidelines, closely resembled those used in neighboring states. These treatments consisted of various strategies, including traffic signals, pedestrian hybrid beacons (PHB), rectangular rapid flashing beacons (RRFB), and grade separation.

To identify areas with frequent non-motorized crashes in Michigan, the project analyzed crash data spanning from 2009 to 2020. The analysis considered factors such as crash severity, area type (rural or urban), lighting conditions, and crash location (intersection or midblock). The findings showed that a significant majority (70 percent) of pedestrian and bicycle crashes resulting in fatalities or serious injury occurred during nighttime conditions.

Site visits to nine locations with a high number of non-motorized crashes were then conducted by the Western Michigan University (WMU) research team. The team reviewed the sites during the daytime to assess lane widths, crosswalk markings, curb turning radii, and presence of crash countermeasures, as well as nighttime to assess light intensity. The results found that many high crash locations had an absence of dedicated bicycle facilities, infrequently marked crosswalks, and inadequate levels of lighting. The recorded light levels at these locations ranged from 0.1 to 5.2 Lux, signifying extreme darkness, as adequate lighting typically measures at 25 Lux.

Based on the comprehensive data complied, the project recommended a series of countermeasures. At signalized intersections, these countermeasures included the installation of LED light bars under mast arms, LED luminaires directed towards crosswalks and entry points (especially at locations with span wire), tightening the turning radii, enhancing visibility crosswalk markings, and the implementation of leading pedestrian intervals (LPIs). For unsignalized locations and midblock crosswalks, suggested countermeasures include introducing PHB or RRFB systems, advanced stop or yield markings, and refuge islands. Lastly, along high-speed corridors, proposed countermeasures include the addition of sidewalks, solar powered dynamic feedback signs, widening shoulders, and the installation of LED streetlights. Importantly, the majority of these countermeasures are cost-effective and hold the potential to significantly improve non-motorized users' safety along high-speed roads.

As part of this research, a high-risk network was developed for rural facilities, and the methodology was extended to develop potential urban locations of concern as well. Beyond high-speed locations WMU also identified low speed locations of concern using the same crash criteria as the high speed locations, MDOT will review these locations and recommendations made by WMU and reach out and coordinate with local officials on non-trunkline locations. MDOT will also evaluate the identification of these locations based on the statewide VRU crash analysis done in this report with particular attention to the equity analysis. The research will be available upon publication.

PAST ENGAGEMENT AND OUTREACH

Michigan has focused on gaining community and stakeholder input for a variety of projects in recent years. These have included statewide and local planning efforts, research projects, and partnerships with other agencies. This summarizes many of the opportunities and findings from these engagements, especially as they relate to VRU programs and concerns.

Continuing dialogue with local agencies, Metropolitan Planning Organizations (MPOs), tribal communities and other communities is important. This VRU Safety Assessment identifies various facilities and factors that are over-represented and identified as high risk for VRU crashes and should be a focus of future consultation efforts.

- **More than 1.2 million interactions were logged by the people of Michigan during the visioning phase of the State Long-Range Transportation Plan (MM2045)**
- **Almost 10,000 additional responses were logged as part of surveys, townhall meetings, transit forums, and other meetings during the development phase of MM2045**
- **More than 400 survey responses were received from stakeholders across the state and dedicated listening sessions were held with interested Tribes in Michigan as part of the Strategic Highway Safety Plan**
- **Three Tribes provided additional comments specifically for the VRU Safety Assessment**

Michigan's SHSP - MetroQuest Survey

The SHSP was developed under the leadership of the GTSAC and allows traffic safety advocates from all levels of government to come together and discuss traffic safety in Michigan. The plan provides an all-inclusive framework for reducing fatalities and serious injuries on Michigan roadways by identifying key safety needs. The initial SHSP recognized traffic safety emphasis areas and action teams were formed to develop strategies to improve the recognized areas in traffic safety. Over the years, the SHSP has been updated to reflect current Michigan traffic safety issues. The most recent 2023 plan involved engaging traffic safety stakeholders through MetroQuest surveys as well as other virtual sessions. By prioritizing stakeholder input, the SHSP update would better incorporate community needs.

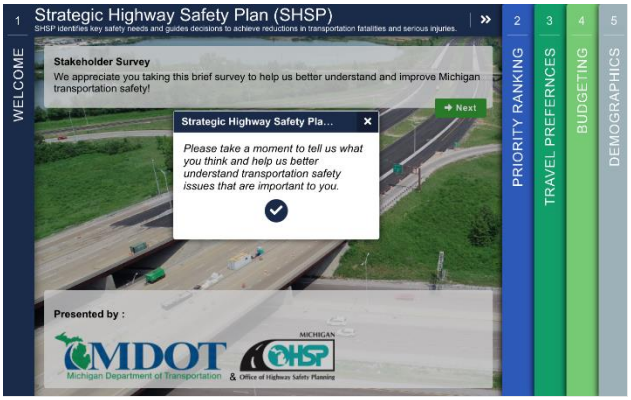

Figure 4 - Michigan SHSP MetroQuest Survey

Traffic Safety stakeholders, which included elected officials, emergency management professionals, public safety officials, transportation planners, GTSAC Safety Action Teams, and other key stakeholders were sent MetroQuest surveys between December 2021 and March 2022. Within this time, stakeholders

were regularly emailed regarding completing the surveys with additional targeted outreach for stakeholder groups showing low response rates. The MetroQuest surveys received a total of 457 responses and the top five transportation concerns were distracted driving, safety roadway improvements, impaired driving, pedestrian and bicycle safety, and inexperienced drivers. The survey also found that most participants preferred to use their personal vehicle for both local and long-distance trips regardless of whether the trip is for work/errands or leisure/travel. Lastly, the respondents showed they would put budgeting priority on local roads, followed by freeways, and rural roads. The respondents' demographics shows the majority affiliations are public agencies (41 percent) and general public (40 percent). In addition, 54 percent of respondents identified as male, 43 percent identified as female, and 3 percent identified as other or preferred not to answer. The majority of participants were White (91 percent), followed by Asian/Pacific Islander (3 percent), and Black/African American (2 percent). Most participants were ages 45-59 (45 percent), then ages 35-44 (24 percent).

Michigan's Strategic Highway Safety Plan is available at: https://www.michigan.gov/msp/-/media/Project/Websites/msp/ohsp/1_March-2023/2023_2026_MI_SHSP_v7.pdf

Michigan's SHSP - Tribal Listening Sessions

All Tribal Nations in Michigan were invited to share their thoughts on the existing and upcoming transportation safety conditions on Tribal land as well as opportunities for better communication between the SHSP group and the Sovereign Tribal Government of Michigan through listening sessions. The invited Sovereign Tribal Governments of Michigan are shown below:

- Bay Mills Indian Community
- Grand Traverse Band of Ottawa and Chippewa Indians
- Hannahville Indian Community
- Keweenaw Bay Indians Community
- Lac Vieux Desert Band of Lake Superior Chippewa Indians
- Little River Band of Ottawa Indians
- Little Traverse Bay Band of Odawa Indians
- Gun Lake Tribe/Match-E-Be-Nash-She- Wish Band of Pottawatomi Indians
- Nottawaseppi Huron Band of the Potawatomi
- Pokagon Band of Potawatomi Indians
- Saginaw Chippewa Indian Tribe of Michigan
- Sault Ste. Marie Tribe of Chippewa Indians

Of the 12 Tribes invited, four accepted and listening sessions were scheduled. The four Tribes that accepted were:

- Bay Mills Indian Community
- Gun Lake Tribe
- Grand Traverse Band of Ottawa and Chippewa Indians
- Little River Band of Ottawa Indians.

The Bay Mills Indian Community listening session took place on March 2, 2022. In attendance for the session was the Tribal President, Transportation Planner, and Tribal Manager. The session began with the Tribal President pointing out that there is a lack of understanding about who is responsible for roadway services and poor channels of communication between the Tribe and Chippewa County. It is noted that the Tribe does not think this is intentional but does believe it is something that should be improved. The Tribe is involved with Chippewa County on a transportation corridor known as Six Mile Road that will be converted into a state highway due to its increase in traffic. The Tribe and County are heavily focused on enhancing the shoulder of the highway to allow safer crossings for bikers, the Amish community

nearby, and pedestrians. It was also discussed that there is a large presence of off-road vehicles leading to wear and tear on local roadways and it can often times be hard to keep up the maintenance. An example of this that was discussed is extreme drop-offs in the pavement onto the gravel shoulders. Lastly, it was encouraged by the Tribal President that signs are put up recognizing Tribal Territory on the nearby highway system.

The Gun Lake Tribe's listening session took place on March 4, 2022. In attendance for the session was the Governmental Affairs Officer, Tribal Transportation Planning Representative, and five Gun Lake Tribal members. It was mentioned during the meeting that the tribe has had a positive experience with MDOT stating that their relationship is "working well". The Gun Lake Tribe participates with the Indian Reservation roads program for their local roadways. Like the Bay Mills Indian community, the Gun Lake tribe expressed their desire to see signage on roadways indicating Tribal Territory. One Tribe member stated they would like to see more electric car infrastructure and the Tribal Transportation Planning Representative voiced that they would like to see the level of service issue be addressed to ensure safety is not being impacted. The Governmental Affairs Officer and a Tribal Member discussed the lack of sidewalks and high-speed traffic present in the local roadways. It was noted that this could be a contributing factor to the lack of pedestrian activity among Tribal members. Lastly, a discussion about implementing annual listening sessions occurred in which it was establish doing so would be beneficial to both the tribe and MDOT.

The Grand Traverse Band of Ottawa and Chippewa Indians listening sessions took place on March 9, 2022,. In attendance for the session was the Public Works Manager and Housing Department Representative from the Grand Traverse Band of Ottawa and Chippewa Indians. It was mentioned during the meeting that while the tribe does not reach out to MDOT often, they are still well informed from MDOT and would like to start engaging more with MDOT, especially around M-22. Regarding M-22, it was mentioned that there is a lack of multimodal accessibility, in particular, the lack of sidewalks in areas with high pedestrian activity. It was also stated that lack of sidewalks and safe crossings were a major concern on all roadways and roundabouts around the area. The session participants stated that youth travel on bikes and by foot often outside of their villages. In terms of public transportation around the area, it was noted that the community has been proactive in building bus shelters and providing adequate lighting to make the bus stops more comfortable. It was noted the tribe has worked with MDOT previously on US-31 North, East M-72, and M-22 and states they had a positive experience and believed MDOT was doing a good job within the area. However, it was noted that better streamlined inter-departmental outreach would be beneficial to the tribe. With that, like the Gun Lake Tribe, the Grand Traverse Band of Ottawa and Chippewa Indians expressed their desire to schedule regular meetings with MDOT.

Vulnerable Road User Safety Assessment – Tribal Responses

Additional outreach was facilitated in the summer of 2023 to further engage with the Tribal Nations in Michigan regarding their comments and concerns regarding VRUs. Three Tribes provided comments specifically for the VRU Safety Assessment. Tribal respondents were first responders, engineers, and planners. These Tribes were as follows:

- Grand Traverse Band of Ottawa and Chippewa Indians

- Saginaw Chippewa Indian Tribe of Michigan
- Sault Ste. Marie Tribe of Chippewa Indians

Vulnerable Road User priorities on or adjacent to tribal lands included flooding and climate impacts, as well as roadways without walkable shoulders; these affect pedestrians and bicyclists. Speed limits – particularly the desire to lower them – was also mentioned. The safety of workers on the roadway was raised as a concern.

These issues were repeated when asked about issues that may specifically impact tribal youth, tribal elders, and users with disabilities. Safe bicycle operation was discussed as an opportunity to educate community members and particularly tribal youth, and safety for wheelchair users and users of other personal mobility devices was identified as a concern for elders.

State Long-Range Transportation Plan (Michigan Mobility Plan 2045)

The Michigan Mobility 2045 Plan, also called the State Long-Range Transportation Plan, outlines Michigan's vision for existing and future transportation systems over the next 25 years. The plan establishes goals, objectives, and strategies for developing long-term multimodal transportation investments. The Michigan Mobility 2045 Plan combines multiple plans (e.g., long-range transportation, freight, rail, statewide active transportation, and statewide transit) into one, comprehensive plan that lays out the foundation for a flourishing and sustainable transportation system in Michigan. This plan keeps Michigan competitive in the transportation sector by providing a framework for navigating new technologies and travel preferences such as on-demand vehicles (e.g., Lyft and Uber), e-bikes, and bus rapid transit. The plan incorporates extensive public and stakeholder input with participation coming from all counties in Michigan. Participants had diverse backgrounds and interests to create an all-encompassing plan for the people of Michigan. This plan was adopted by the State Transportation Commission on November 21, 2021.

A public stakeholder participation plan (PSPP) was created by MDOT for Phase I (visioning) and Phase II (plan development) of the Michigan Mobility 2045 Plan. The input gathered from the public and stakeholders consisted of concerns regarding efficiency, capital investments, safety, and mobility in multi modes of transportation. The modes of transportation included freight, rail, transit, passenger, aviation, bicycle, pedestrian, and highway. The PSPP was created alongside the Michigan MPOs, FHWA, Federal Railroad Administration (FRA), and Federal Transit Administration (FTA). The public and stakeholders were able to voice their concerns and opinions around the Michigan Mobility 2045 plan by visiting www.MichiganMobility.org; sending an e-mail to MDOT-MichiganMobility@Michigan.gov; filling out a MetroQuest survey online; attending townhall meetings; commenting on the Facebook (www.facebook.com/MichiganDOT) or Twitter (www.twitter.com/MichiganDOT); or sending a letter to the Michigan Department of Transportation office.

For Phase I (visioning) of the PSPP, more than 1.2 million interactions occurred by the people of Michigan through MetroQuest surveys and Attitude and Perception (A&P) surveys. From the MetroQuest surveys, the top priority, by a large majority, was preserving the existing transportation system in Michigan. This meant that the public wants to see the existing roads and bridges in Michigan get improved and maintained instead of rebuilt. The next priorities were quality of service and quality of life. Quality of service in the MetroQuest surveys was defined as investing

in improving public transit services and vehicles through incorporating innovative technologies and communication systems into transportation services. Quality of life was defined as investing in systems that prioritize prosperity, health, sustainability, and accessible multimodal transportation options. From the A&P surveys, maintaining existing roads was also the top priority by a large margin. However, these surveys found reducing traffic congestion and finding alternative transportation options for seniors and persons with disabilities to be important issues. The next ranked priorities were focusing on improving and adding routes for passenger rail and adding sidewalks to improve safety. Also, the majority of Michiganders surveyed expressed a negative attitude towards self-driving vehicles and ranked preparing for self-driving vehicles to be a low priority. Despite the results of the survey regarding self-driving cars, Michigan will continue to make it a priority as it provides enormous potential to save lives as most crashes are a result of human error. It is important to understand why the public does not view self-driving cars as a priority and educate Michiganders on its importance and potential to positively impact both Michigan's automotive and transportation industries.

In Phase II (plan development), there were multiple outreach opportunities:

- a total of 1,237 MetroQuest surveys were completed
- two (2) virtual townhall meetings engaged 6,352 participants
- an active transportation townhall meeting had 88 participants
- four (4) transit forums with a combined attendance of 48 participants
- four (4) freight and rail forums that attracted a total of 122 participants.
- MDOT also connected with over 1,000 Michiganders across the state through 51 meetings that were either hosted by MDOT or standing meetings in which MDOT attended.

Lastly, MDOT created a survey specific to stakeholders with disabilities with the help of the Michigan Department of Civil Rights. The MetroQuest surveys had participants rank categories based on priority and those categories had more detailed subcategories. The categories participants ranked were Safety and Security, Condition and Mobility, and Quality of Life. The results from the survey found the top priority to be ensuring safety for at-risk users such as pedestrians, bicyclists, motorcyclists, seniors, and youth. The next ranked priorities included promoting safety for passengers and operators on roadways and maintaining transit facilities and equipment. During the two townhall meetings, attendees answered polling questions related to transportation priorities. The townhall polling questions showed that the public prioritizes the condition of roadways when travelling on roads, reliability of services when using public transportation, and safety when walking and biking. The complete plan may be viewed at: https://www.michigan.gov/mdot/programs/planning/slrp

Highway Safety Improvement Program Implementation Plan

Michigan's Highway Safety Improvement Program (HSIP) Implementation Plan for 2022 was created by MDOT to address unmet targeted safety performance measures set forth in the Michigan CY 2020 Safety Performance Target Assessment and FY 2023 HSIP Special Rule Determinations. The implementation plan was created with a focus on high-risk behaviors, at-risk users, engineering infrastructure, and system administration. In order to reduce, and eventually

eliminate, fatal and serious injury crashes in Michigan, the HSIP allocated funding to improving safety, signs, pavement markings, and delineation on Michigan trunklines. Funding also was included for non-trunkline programs such as the HSIP Safety Program, Streamlined Systemic HSIP, and High-Risk Rural Roads program.

The development of the HSIP was a collaborative process through meetings, stakeholder engagement, and continuous outreach efforts. Collaboration efforts had a strong emphasis on promoting highway safety and MDOT's TZD initiative in Michigan. Regular internal meetings were held by MDOT to determine needs and solutions for the program. These meetings specifically focused on improving collaboration with tribal and local agencies. MDOT also conducted annual outreach events to engage stakeholders throughout Michigan. These events promoted collaboration to determine safety performance targets with the Michigan Office of Highway Safety Planning (OHSP) and the University of Michigan Transportation Research Institute (UMTRI). Various safety campaigns were conducted by MDOT to address issues such as work zone safety, excessive speeding, teen passenger safety, impaired driving, and raising awareness about traffic crash fatalities.

Also, MDOT's Local Safety Initiative (LSI) is a free service to help local agencies identify safety issues and improve local road safety by performing a complete crash analysis of their local road system, compiling a list of intersections and roadway segments of concern, and identify and suggest potential improvements and countermeasures. The LSI offers a unique opportunity to aid local agencies with identifying potential safety concerns using MDOT resources. Based on this VRU Safety Assessment, MDOT should direct the LSI to engage with local agencies that have higher numbers of VRU crashes or facilities and areas that exceed multiple threshold categories as discussed in the Equity portion of this assessment.

Lastly, MDOT collaborated with universities and colleges to promote research on safety topics such as program evaluation, program countermeasures, and the development of safety performance metrics.

Safe System Approach

The Safe System Approach is an all-encompassing approach that MDOT has implemented to address roadway safety. The approach is based on six core principles which are death and serious injuries are unacceptable, humans make mistakes, humans are vulnerable, responsibility is shared, safety is proactive, and redundancy is crucial. Based on these principles, the implementation of the approach is centered around five objectives which are safe road users, safe vehicles, safe speeds, safe roads, and post-crash care. By implementing this approach, MDOT aims to prioritize safety when investing in road systems, with the ultimate goal of eliminating fatalities and serious injury crashes on its roadways, achieving TZD.

Figure 5 - Safe System Approach

With this approach, the public and stakeholders play a part in ensuring the roadways are being used safely regardless of the mode of transportation being used. MDOT has created partnerships with stakeholders such as health professionals, parents, community organizations, law enforcement, members of the justice system, and nonprofit organizations to propel the education of safe roadway use. The most effective way in ensuring safety has been developing research-based programs and safety campaigns to promote safe roadway behavior. Some campaigns that NHTSA has developed nationally and OHSP has developed in Michigan for Michiganders are driving sober with the "Drive Sober or Get Pulled Over" campaign, wearing seatbelts with the "Buckle Up. Every Trip. Every Time." campaign and the "Click It or Ticket" campaign, and being attentive when driving with the "U Text. U Drive. U Pay." campaign. These campaigns gain awareness through social media, digital advertisements such as billboards, and educational videos. Additional programs that have been set in place include educating motorcycle users on proper safety equipment, educating pedestrians on safety tips, and educating seniors on how their driving can be affected as they age.

NHTSA's Safe System Approach: Educating and Protecting All Road Users | FHWA (dot.gov)

https://www.michigan.gov/msp/divisions/ohsp/campaign-materials

Safe System Approach (michigan.gov)

Synthesis of National Best Practices on Pedestrian and Bicycle, Guidance, and Technology Innovations

The "Synthesis of National Best Practices on Pedestrian and Bicycle, Guidance, and Technology innovations" report was conducted by MSU and sponsored by MDOT. The objective of this project was to determine the best practices for pedestrians and bicyclists as they relate to planning and design. MSU conducted research in order to provide recommendations to MDOT on how to improve non-motorized users' safety and experience in order to progress Michigan's TZD vision. This research found that although MDOT and local Michigan roadway agencies have already implemented or considered many of the non-motorized design treatments recognized, there is still an opportunity to expand the treatments. Input from Michigan residents and stakeholders provided valuable context and insight regarding non-motorized transportation throughout the state. In order to gain public opinion regarding Michigan's non-motorized transportation network, a statewide survey was available and advocacy focus groups were conducted.

The State of the State Survey (SOSS) was available for Michigan residents from October 2020 to December 2020. The survey included ten questions related to personal walking and biking behaviors and was weighted to include diversity in its participation. There was a total of 1,000 responses collected whose demographic characteristics were the following:

- Gender: Male participation was 48.7 percent while female participation was 50.7 percent. There was 0.6 percent that did not answer.
- Age: Ages ranged from 18 to over 69. The most common participation age range was 18-29 (20.9 percent), followed by 50-59 (19.0 percent), 40-49 (16.5 percent), and 30-39 (15.1 percent).
- Race: Most participants were White or Caucasian (83.9 percent), then Black/African

American (12.3 percent). There was 2.8 percent that were other and 1.0 percent that did not answer.

- Ethnicity: The participants were 4.7 percent Hispanic and 94.8 percent non-Hispanic. There was 0.5 percent that did not answer.
- Marital Status: Married/living together participants consisted of 51.1 percent and single participants consisted of 47.9 percent. There was 1.0 percent that did not answer.
- Children in the House: Most participants did not have children living in the house (74.4 percent). Participants that did have children living in the house consisted of 24.7 percent and 1.0 percent did not answer.
- Employment Status: The participants were closely split with 49.3 percent of participants being in the labor force and 49.2 percent of participants not in the labor force. There was 1.5 percent that did not answer.
- Income: The most common income range was above $59,999 (36.6 percent), then between $30,000 and $59,999 (32.4 percent), and lastly below $30,000 (29.0 percent). There was 2.0 percent that did not answer.
- Education: Participants that had a high school education or less consisted of 37.4 percent. Participants with some college education consisted of 31.5 percent and participants with a college education or above consisted of 30.9 percent. There was 0.2 percent that did not answer.
- Place of Residence: Majority of participants live in the suburbs (41.4 percent). Following that is small city or town (23.0 percent), rural community (21.7 percent), and urban community (13.0 percent). There was 0.9 percent that did not answer.

The survey answers indicated that participants tend to walk or bike most often for recreation or exercising purpose. Additionally, participants walk more frequently than bike regardless of their trip purpose. Most participants answered they were at least somewhat satisfied with the current availability of pedestrian and bicycle facilities in Michigan.

Regarding safety when walking, biking, crossing the street on foot, and crossing the street on a bicycle many participants noted they felt at least somewhat safe while walking (75.5 percent) but fewer participants indicated they felt at least somewhat safe while bicycling (48.1 percent). However, it is important to note about 30 percent of participants answered “unsure” or “not applicable” to bicycle safety.

When asked if participants walking and biking habits would change if their local facilities were improved, the majority said their habits would not change. However, about 40 percent of participants said they would walk more often and 26 percent said they would bicycle more often. Furthermore, survey results show Michigan residents prefer a more direct, unsafe route when traveling on foot or bicycle opposed to a longer, safer one. The one exception found was for participants bicycling for recreation or exercise who then would prefer a longer but safer route.

When walking along a route without sidewalks present it was found that most participants position themselves along the left edge/shoulder of the roadway (25.8 percent), completely outside the roadway (21.2 percent), or along the right edge/shoulder of the roadway (21.0 percent).

While bicycling, majority of participants use the right edge/shoulder of the roadway (30.9 percent).

When asked how the COVID-19 pandemic effected participants walking and biking behavior nearly 50 percent said their behavior did not change.

For walking, 22.4 percent said their walking trips increased while 22.4 percent said their walking trips decreased.

For bicycling, 16.2 percent of participants indicated their trips decreased while only 8.7 percent of participants said their trips increased.

Finally, while about half of participants said they did not plan to change their number of walking and bicycling trips in the future, some participants indicated they planned to increase their number of walking (34.3 percent) and bicycling (19.1 percent) trips in the future.

From the survey results, a list of socio-demographic factors that impacted the response of the questions were provided in order to better understand the responses.

Also, focus groups were conducted in May and June of 2021, hosting pedestrian and bicycle advocacy groups across Michigan. These advocacy groups consisted of members of the American Association of Retired Persons (AARP) of Michigan, representatives from disability advocacy groups of Michigan, and representatives from bicycling and trails advocacy groups of Michigan.

Members of the AARP focus group were divided into two groups based on their preference of walking or bicycling. There were 5 participants discussing walking-related issues and 3 participants discussing bicycle-related issues. The focus groups were presented infrastructure treatment options for their respective group and discussed their thoughts on the treatments. The overall conclusion made from the walking-related issues focus group was high-visibility crosswalk markings, curb extensions, in-street signs, refuge islands, PHBs, and conventional traffic signals were highly desirable among the group as pedestrian treatment options. For the bicycle-related issues focus group, it was determined that implementing buffered bicycle lanes was largely preferred over conventional bicycle lanes. Additionally, having a separate facility for bicycles was preferred where feasible. The idea of incorporating bicycle boxes received mixed feedback where some participants expressed their uncomfortableness with vehicles being located behind them and other participants encouraged bicycle boxes stating they provide a designated space and establish their right to be on the road. Participants also encouraged two-stage turn boxes, green intersection crossing markings, bicycle signals, and bicycle wayfinding.

There were three participants from disability advocacy groups including representatives from the Disability Network of Northern Michigan (Traverse City/ Alpena), Disability Network of Southwestern Michigan (Benton Harbor/Kalamazoo), and Graham Rehabilitation Services (Greater Grand Rapids). During the session, primary challenges faced by people with disabilities were discussed. These challenges include shared use paths, downtown areas, complex roadway settings, and accessible pedestrian pushbuttons. In situations where shared use paths are present, it is important to provide clear delineations between the pedestrian and bicycle paths and install braille on wayfinding signage. In downtown areas, people with hearing and sight difficulties would benefit from having louder audio signals and simpler designs to minimize visual clutter. In addition, pedestrian islands, sidewalk gaps, and scooters left within the sidewalk pose challenges for people with disabilities in complex roadway settings. Lastly, having accessible pedestrian pushbuttons, which includes ensuring the face plate of the button is positioned parallel with the walkway and located within reach of the paved sidewalk, minimize the challenges faced by people with disabilities. Some current practices that were considered to be positive for people with disabilities include green pavement markings, vertical profile of the bicycle lanes

relative to travel lanes, and use of color, profile, and tactile for pedestrian crossings. However, some improvements to better accommodate people with disabilities were also noted. Some of the improvements include ensuring that all paths are at least 5 feet wide, ramps are aligned at intersections, pushbuttons are physically accessible from the pavement, and designs are consistent throughout the transportation network. Additional recommendations for decreasing barriers faced by people with disabilities include designing passing zones in places with shared environments for bicycles and pedestrians, going beyond ADA minimum standards when possible, and providing accessibility details online for trails.

There were five members present for the bicycle and trails advocacy focus group with participation from the Detroit Greenways Coalition, Bike Friendly Kalamazoo, Washtenaw Walking and Biking Coalition (two representatives), and Iron Ore Heritage Recreation Area (Marquette). Some challenges noted for bicyclists in Michigan include a lack of trails in the upper peninsula, lack of paved shoulders in rural areas, lack of connectivity for bicyclists in urban and suburban areas, and lack of commuter trails connecting bicyclists to central business districts. In addition, speed limit laws have placed constraints on implementing certain design treatments for bicyclists and some bicycle-focused treatments do not help encourage bicyclists of all skill levels to participate. Some improvements that members of the group would like to see implemented include paving shoulders along rural roadways, reducing speed limits in urban areas, adding buffered or separated bicycle lanes when possible, and having a minimum width of ten feet for off-roadway paths and trails. Additionally, cultural concerns were addressed that limit the expansion of bicycle-focused transportation networks such as the advertisement of “fast” or “powerful” cars adding to the dominance of motor vehicles, social media posts portraying cycling negatively, and the desire in some agencies to increase speed limits. Lastly, some positively viewed bicycle-focused treatments include bicycle boxes and intersection bicycle crossing markings.

League of Michigan Bicyclists

To make Michigan more bicycle friendly, MDOT partnered with the League of Michigan Bicyclists (LMB) which has the vision of promoting cycling as a way to get the community healthier and more connected to the natural world and one another. LMB ensures cycling trails in Michigan are safe and accessible for every Michigander. In addition, LMB develops and shares educational material for bicyclists, motorists, engineers, and law enforcement.

Through outreach efforts at both the state and local levels, the League of Michigan Bicyclists are ensuring Michigan is a bicycle-friendly state. LMB is involved at the state level, being an advocate for bicycle-friendly policies at the State Capitol. These policies include increasing bicyclists’ safety through encouraging focused driving and educating new drivers on bicyclist safety. In addition, LMB is involved at the local level by hosting multi-day and single day bicycle tours that take place all over the state. Lastly, LMB has a micro-grant program in which projects that align with LMB’s strategic plan can receive funding to improve bicycling experiences throughout Michigan. Anyone is allowed to become a member and get involved by signing up on their website.

About - League of Michigan Bicyclists (lmb.org)

Michigan Trails and Greenways Alliance

The Michigan Trails and Greenways Alliance (MTGA) is a group that supports the creation and maintenance of trails and greenways in Michigan. Michigan is the #1 trail state in the nation with over 12,500 miles of land trails and 4,280 miles of water trails. The alliance aims to preserve and expand the integrated network of trails and greenways across the state in order to protect the environment and cultural heritage. The special interest group is a voice for non-motorized trail users at the state and local level by assisting in trail and greenway planning and development. In addition, MTGA has strong public support and engages regularly with local communities to promote their vision. By doing so, MTGA hopes Michigan will become a healthier and more prosperous state.

MTGA is active in communities throughout Michigan through governmental advocacy and special events. The group participates in state and local government advocating for trail and greenway planning, funding, development, and maintenance. MTGA also plans events that allow the public to come together and use the trails such as the Michigander bicycle tour and the lakeshore harvest ride. There are also maps showing all the trails in Michigan on their website to educate and encourage Michiganders to explore the trails. The public can get involved in the group by visiting their website and signing up to become a member or donate.

Michigan Trails & Greenways Alliance – Statewide voice for non-motorized trail users

Southeast Michigan Council of Governments – Walk.Bike.Drive Safe

Walk.Bike.Drive Safe is an education campaign created by the Southeast Michigan Council of Governments (SEMCOG) and is supported by MDOT that engages the public in creating a safe environment for mobility. The campaign was guided by the Southeast Michigan Transportation Safety Action Committee to implement the Southeast Michigan Traffic Safety Plan. The campaign hopes to educate drivers on safe behaviors to engage in while using transportation systems in Southeast Michigan. The education is focused on what the public should and should not do when walking, biking, and driving.

Outreach efforts to the community of Southeast Michigan have consisted of social media by creating YouTube videos, broadcasting local commercials, displaying billboards, and writing articles on work zone awareness, crash responders' safety, driving sober, passing bicyclists properly, and more. In addition, the public can access the campaigns website and newsletter. The campaign has also created tip cards the community can access that concisely detail the do's and don'ts when walking, biking, and driving. Since Spring 2023, more than 310,000 Walk.Bike.Drive Safe materials, including tip cards, pamphlets, posters, wristbands, bike lights, and armbands, have been distributed to 144 communities and 39 partner agencies/organizations throughout Southeast Michigan.

Walk Bike Drive Safe (semcog.org)

Michigan Safe Routes to School

Michigan is involved in the federal program called Safe Routes to School (SRTS). This program, partnered with MDOT, encourages children across Michigan to walk or bicycle to school. This all-inclusive program allows children to have a safe, fun, and physical activity inducing way to get to school. By encouraging kids to walk and bicycle to school, less traffic congestion occurs, and communities are healthier and more united.

SRTS is largely involved with communities across Michigan and organize events such as walk & roll to school day and bike & roll to school day. In October of 2022, 178 schools in Michigan participated in walk & roll to school day and 105 schools participated in bike & roll to school day. The participation in these events ranked Michigan 6th nationally. The program also awards grants to programs that support SRTS's vision. In 2022, there were 52 schools across Michigan that received mini grants totaling $286,334 to encourage and educate students to walk and bicycle to school. Additionally, $2,000,000 was awarded in major grants to 8 schools in 2 communities of Michigan to improve the schools' sidewalks, pathways, signals, and signage. Trainings are also held throughout communities in Michigan to educate principals, superintendents, school transportation officials, road authorities, and more about the SRTS program and further develop the project.

Home | Safe Routes to School (saferoutesmichigan.org)

Road Safety Audits

Michigan has a robust Road Safety Audit (RSA) program, and guidance from MDOT's Transportation Systems Management and Operations Division (TSMO) division about when to facilitate an RSA is documented in MDOT Guidance Document 10241 (current version is dated November 12, 2019).

An RSA is a formal safety performance examination of an existing or future road or bridge project by an independent, multi-disciplinary RSA team.

RSAs are a proactive approach to safety, as they can be performed at any stage in a road's lifecycle and look for concerns and solutions for all road users – not just vehicles. RSAs may also be tailored to focus on a particular area of concern; non-motorized RSAs are common in many states, and additional VRUs could benefit as well. For example, Missouri has developed guidance for facilitating work zone RSAs, and Iowa facilitated the first known RSA focusing on an Amish community.

The Kentucky Transportation Cabinet (KYTC) has a policy to facilitate an RSA for any crash resulting in a pedestrian or bicycle fatality.

Currently, per the Guidance Document, RSAs are optional for specific funding categories such as passenger transportation (carpool, roadside, or multi-modal) and non-motorized designs crossing trunklines or major roadways. As noted in the recommendations later in this VRU Safety Assessment, strengthening the requirements for RSAs with a focus on past VRU crashes or facilities prone to VRU crashes could be beneficial.

Beginning in FY 2025 the HSIP Local Safety program has provided a financial goal of $50K for VRU Specific RSAs and $50K for traditional RSAs per FY.

FUTURE ENGAGEMENT AND OUTREACH

Building upon the successes and lessons learned from previous engagement and outreach, there is a need to prepare a workplan for the execution of stakeholder engagement/consultation efforts. It is necessary to collect information related to the VRU high-risk areas beyond those identified through the crash analysis by Western Michigan University and vetted by the analysis later discussed in this assessment. The engagement/consultation efforts, which will be done as part of the next assessment, will involve multiple individuals and groups with diverse backgrounds and experiences as called for by FHWA. The nature of this effort will be formed by past surveys, interviews, and engagement efforts performed by MDOT, or on behalf of MDOT, within the last several years. There is also a need to review data produced from this assessment and update it ensuring it is centered on identifying areas and metrics with equity and environmental justice considerations. This will help inform where VRU crashes intersect with disadvantaged communities and align with goals in the BIL regarding Transportation Insecurity, Climate and Disaster Risk Burden, Environmental Burden, Health Vulnerability, and Social Vulnerability.

MDOT will need to take the lead identifying stakeholders, such as MDOT staff, Metropolitan Planning Organization (MPO)s, local agencies, and Tribes for future outreach. Initially, the efforts from the previous MetroQuest Survey need to be evaluated and retooled before relaunching. As with the statewide engagement for the Michigan SHSP, we anticipate this survey will be available to any respondent to allow for asynchronous engagement regarding VRU concerns and letting the live engagement focus on stakeholders. When completed, the statewide results will be broken out by MDOT Region and MPO/planning region with corresponding charts for each MetroQuest question.

MDOT will facilitate workshops with stakeholders to understand their concerns related to VRUs. These need to balance geographic differences, priority locations, and targeted stakeholders including transportation facility owners, MPOs, Tribal residents, and SHSP Action Teams (as part of the Governor's Traffic Safety Advisory Commission). The workshops will be both in-person or virtual, depending on the best match for the targeted stakeholders. Sessions will also be requested with the GTSAC Traffic Safety Engineering Action Team (TSEAT) and Pedestrian and Bicycle Safety Action Team (PBSAT) for their input on VRU concerns.

OVERVIEW OF VRU CRASHES

In Fiscal Year 2023, Michigan was required to obligate not less than fifteen (15) percent of the amount apportioned under 23 U.S.C. 104(b)(3) for highway safety improvement projects to address the safety of vulnerable road users. All highway safety improvement projects, including those implemented under the VRU Special Rule, must be on a public road consistent with the SHSP and correct or improve a hazardous road location or feature, or address a highway safety problem. The state of Michigan is in the same position for Fiscal Year 2024 in obligating not less than fifteen (15) percent for VRU improvements. A list of proposed improvements can be found in Appendix C.

While pedestrian-involved crashes have trended downward since 2013, with a noticeable drop in 2020 generally associated with the impacts of the COVID-19 pandemic, the number of fatal crashes has tracked in the opposite direction significantly increasing in 2020. As a percent of total crashes in the state, pedestrian crashes have accounted for a generally decreasing share of the total while the pedestrian involved fatal and serious injury[4] crashes has generally increased. Despite accounting for only 0.7 percent of all crashes over the past ten years, pedestrians have represented an average of almost ten percent (9.8 percent) of all fatal and serious injury crashes during the same time period. **Fatal (K) and serious injury (A) pedestrian crashes are over-represented by almost 14 times their share of total crashes.**

Table 1 - Pedestrian Crashes in Michigan, 2013-2022 (Michigan Traffic Crash Facts data)

Year	Pedestrian Crashes				Persons in Pedestrian Crashes			All Crashes			
	Crashes	Fatal (K) Crashes	A Injury Crashes	All Injury Crashes	Fatalities	A Injuries	All Injuries	Statewide Crashes	Pedestrian % of Total	Total KA Crashes	Pedestrian % of KA
2013	2,248	149	367	1,840	151	398	2,089	289,061	0.8%	5,192	9.9%
2014	2,280	148	354	1,876	149	381	2,081	298,699	0.8%	4,851	10.3%
2015	2,354	168	368	1,944	174	412	2,151	297,023	0.8%	4,832	11.1%
2016	2,232	164	357	1,777	168	377	1,973	312,172	0.7%	5,545	9.4%
2017	2,285	156	424	1,860	159	459	2,040	314,921	0.7%	5,972	9.7%
2018	2,203	145	406	1,760	148	434	1,979	312,798	0.7%	5,565	9.9%
2019	2,260	143	441	1,815	151	470	2,027	314,376	0.7%	5,590	10.4%
2020	1,682	173	353	1,281	178	387	1,471	245,432	0.7%	5,494	9.6%
2021	1,790	182	343	1,397	186	374	1,573	282,640	0.6%	6,015	8.7%
2022	1,897	172	371	1,487	174	401	1,677	293,341	0.6%	5,863	9.3%

[4] The Federal Highway Administration's (FHWA) Safety Performance Management Measures Final Rule (23 CFR 490) and the National Highway Traffic Safety Administration's (NHTSA) Uniform Procedures for State Highway Safety Grants Program Interim Final Rule (23 CFR 1300) use the following terminology for serious injuries – "Suspected Serious Injury". For the purpose of this document, "Suspected Serious Injury" means the same as "Serious Injury".

Table 2 - Pedestrian Crashes in Michigan, Five-Year Averages, 2013-2022 (Michigan Traffic Crash Facts data)

5-Year Avg	Pedestrian Crashes				People in Pedestrian Crashes			All Crashes			
	Crashes	Fatal (K) Crashes	A Injury Crashes	All Injury Crashes	Fatalities	A Injuries	All Injuries	Statewide Crashes	Pedestrian % of Total	Total KA Crashes	Pedestrian % of KA
13-17	2,280	157	374	1,859	160	405	2,067	302,375	0.75%	5,278	10.10%
14-18	2,271	156	382	1,843	160	413	2,045	307,123	0.74%	5,353	10.09%
15-19	2,267	155	399	1,831	160	430	2,034	310,258	0.73%	5,501	10.11%
16-20	2,132	156	396	1,699	161	425	1,898	299,940	0.71%	5,633	9.81%
17-21	2,044	160	393	1,623	164	425	1,818	294,033	0.69%	5,727	9.67%
18-22	1,966	163	383	1,548	167	413	1,745	289,717	0.68%	5,705	9.58%

When averaging the data to reduce the noise associated with single years, we see that pedestrian-involved crashes have continued to decrease, with an associated decrease in injury crashes. Fatal pedestrian-involved crashes and suspected serious injury crashes have not seen the same downward trend, however. As a percentage of total crashes, the share of pedestrians has decreased even as their raw numbers have risen.

The trends associated with pedestrian crashes are also present with bicycle-involved crashes. Bicycle crashes have generally trended downward over the past ten years, while the number of fatal and serious injury crashes has been largely flat. Bicycle crashes have generally accounted for 0.5 percent of the total statewide crashes while simultaneously accounting for about 3.2 percent of all fatal and serious injury crashes. **Fatal (K) and serious injury (A) bicycle crashes are over-represented by almost six times their share of total crashes.**

Table 3 - Bicycle Crashes in Michigan, 2013-2022 (Michigan Traffic Crash Facts data)

Year	Bicycle Crashes				People in Bicycle Crashes			All Crashes			
	Crashes	Fatal (K) Crashes	A Injury Crashes	All Injury Crashes	Fatalities	A Injuries	All Injuries	Statewide Crashes	Bicycle % of Total	Total KA Crashes	Bicycle % of KA
2013	1,888	29	169	1,477	29	171	1,513	289,061	0.7%	5,192	3.8%
2014	1,749	21	135	1,372	21	137	1,414	298,699	0.6%	4,851	3.2%
2015	1,869	34	139	1,463	34	144	1,514	297,023	0.6%	4,832	3.6%
2016	1,959	33	150	1,512	38	159	1,563	312,172	0.6%	5,545	3.3%
2017	1,712	21	155	1,358	21	158	1,390	314,921	0.5%	5,972	2.9%
2018	1,546	23	135	1,199	23	139	1,233	312,798	0.5%	5,565	2.8%
2019	1,492	21	152	1,123	21	158	1,153	314,376	0.5%	5,590	3.1%
2020	1,224	37	146	928	38	154	952	245,432	0.5%	5,494	3.3%
2021	1,248	29	126	967	29	129	999	282,640	0.4%	6,015	2.6%
2022	1,340	35	146	1,026	36	151	1,059	293,341	0.5%	5,863	3.1%

Table 4 - Bicycle Crashes in Michigan, Five-Year Averages, 2013-2022 (Michigan Traffic Crash Facts data)

5-Year Avg	Bicycle Crashes				People in Bicycle Crashes			All Crashes			
	Crashes	Fatal (K) Crashes	A Injury Crashes	All Injury Crashes	Fatalities	A Injuries	All Injuries	Statewide Crashes	Bicycle % of Total	Total KA Crashes	Bicycle % of KA
13-17	1,835	28	150	1,436	29	154	1,479	302,375	0.61%	5,278	3.37%
14-18	1,767	26	143	1,381	27	147	1,423	307,123	0.58%	5,353	3.18%
15-19	1,716	26	146	1,331	27	152	1,371	310,258	0.55%	5,501	3.15%
16-20	1,587	27	148	1,224	28	154	1,258	299,940	0.53%	5,633	3.10%
17-21	1,444	26	143	1,115	26	148	1,145	294,033	0.49%	5,727	2.96%
18-22	1,370	29	141	1,049	29	146	1,079	289,717	0.47%	5,705	2.99%

When reviewing the five-year averages, we see a steeper decline in bicycle-involved crashes and bicycle-involved injury crashes, with more than a 25-percent decrease in the average over the ten-years reviewed. Fatal bicycle-involved crashes and suspected serious injury crashes have not seen the same downward trend, however, and largely stayed level. As a percentage of total crashes, the share of bicycles has decreased even as their raw numbers have risen.

National Comparison

When comparing Michigan to national trends we see how Michigan is improving. Michigan's percentage of total pedestrian-involved crashes averages lower than the national equivalent, even as this percentage decreases within the state and nationally. Nationally, pedestrian fatalities have increased as a proportion of the total number of people killed in traffic crashes, though Michigan has seen this proportion decrease, and now tracks below the national average.

Table 5 - Pedestrian Crashes Nationally (blue) and in Michigan (orange), Five-Year Averages, 2012-2021 (NHTSA and Michigan Traffic Crash Facts data)

Yrs.	Pedestrian Crashes						All Crashes						Comparison			
	Crashes		Fatal (K) Crashes		Fatalities		Crashes		Fatal (K) Crashes		Fatalities		Pedestrian % of Total Crashes		Pedestrian % of Fatalities	
12-16	72,847	2,279	4,829	152	5,216	156	6,096,697	294,169	31,710	886	34,542	958	1.2%	0.8%	15.2%	17.1%
13-17	72,016	2,280	5,065	157	5,468	160	6,264,207	302,375	32,421	899	35,280	976	1.1%	0.8%	15.6%	17.5%
14-18	73,372	2,271	5,362	156	5,787	160	6,473,765	307,123	33,164	904	36,068	981	1.1%	0.7%	16.1%	17.3%
15-19	75,308	2,267	5,627	155	6,059	160	6,612,125	310,258	33,850	923	36,791	1,003	1.1%	0.7%	16.6%	16.8%
16-20	72,595	2,132	5,814	156	6,273	161	6,403,100	299,940	34,530	947	37,495	1,027	1.1%	0.7%	16.8%	16.5%
17-21	67,776	2,044	6,044	160	6,535	164	6,259,461	294,033	35,482	964	38,522	1,040	1.1%	0.7%	17.0%	16.5%

When looking at bicyclists, we see similar trends. Michigan's percentage of bicycle-involved crashes is slightly lower than nationally, and both have trended downwards. When reviewing the bicyclists killed, Michigan and the nation are going in opposite directions – as the percentage of bicyclists killed nationally slowly rises, Michigan has seen these numbers decrease and if trends continue Michigan will fall below the national percentage in a few short years.

Table 6 - Bicycle Crashes Nationally (blue) and in Michigan (orange), Five-Year Averages, 2012-2021 (NHTSA and Michigan Traffic Crash Facts data)

Yrs	Bicycle Crashes						All Crashes						Comparison			
	Crashes		Fatal (K) Crashes		Fatalities		Crashes		Fatal (K) Crashes		Fatalities		Bicyclist % of Total Crashes		Bicyclist % of Fatalities	
12-16	57,197	1,887	769	27	779	28	6,096,697	294,169	31,710	886	34,542	958	0.9%	0.6%	2.4%	3.0%
13-17	56,889	1,835	783	28	793	29	6,264,207	302,375	32,421	899	35,280	976	0.9%	0.6%	2.4%	3.1%
14-18	56,067	1,767	805	26	818	27	6,473,765	307,123	33,164	904	36,068	981	0.9%	0.6%	2.4%	2.9%
15-19	55,439	1,716	830	26	844	27	6,612,125	310,258	33,850	923	36,791	1,003	0.8%	0.6%	2.5%	2.9%
16-20	53,916	1,587	853	27	867	28	6,403,100	299,940	34,530	947	37,495	1,027	0.8%	0.5%	2.5%	2.8%
17-21	49,048	1,444	878	26	890	26	6,259,461	294,033	35,482	964	38,522	1,040	0.8%	0.5%	2.5%	2.7%

VRU CRASHES IN MICHIGAN

Ultimately, a deeper understanding of Michigan's crashes will help identify opportunities for improvement. Unless otherwise noted, this review utilizes crashes in the years 2018 through 2022.

Crash Analysis – Statewide

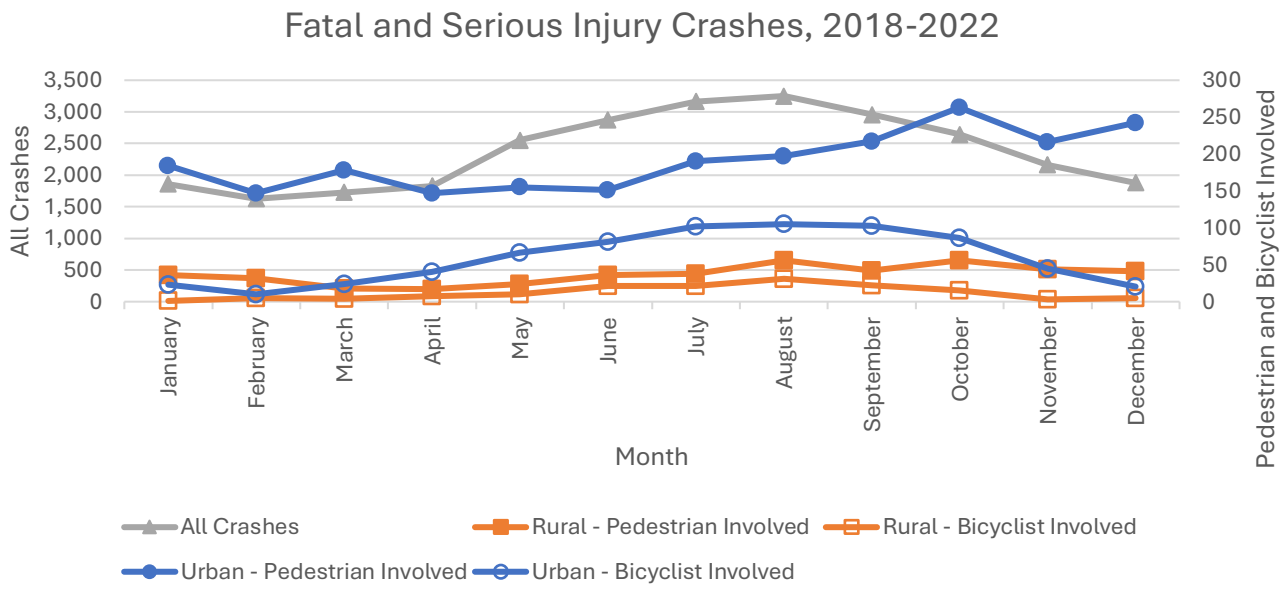

Figure 6 - Fatal and Serious Injury Crashes by Month, 2018-2022 (Michigan Traffic Crash Facts data)

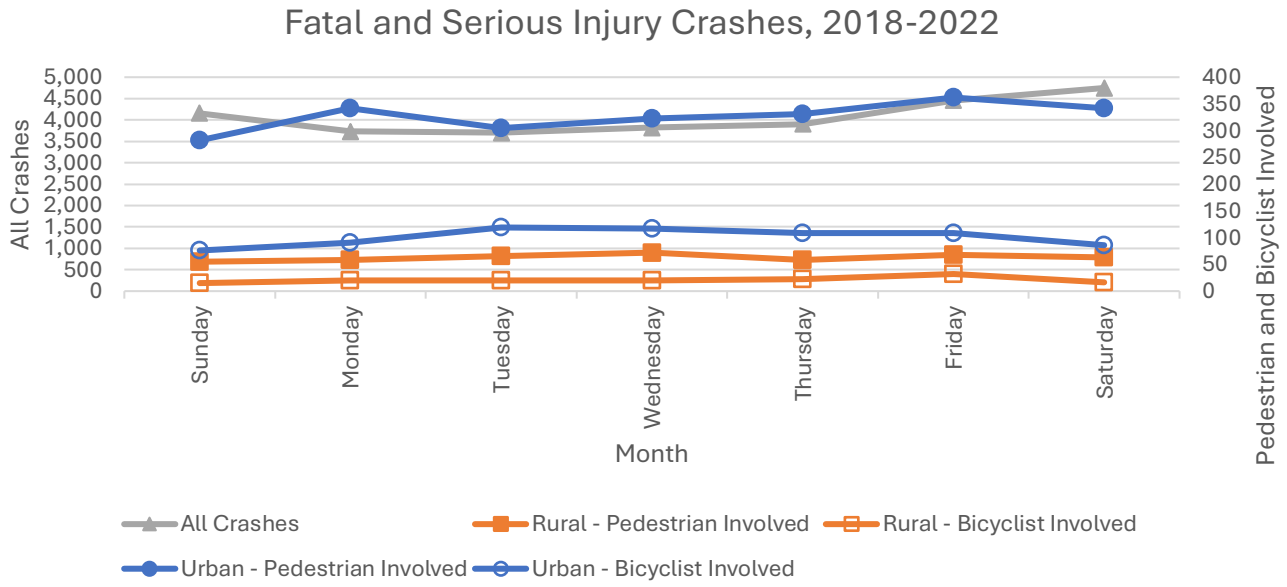

Figure 7 - Fatal and Serious Injury Crashes by Day of Week, 2018-2022 (Michigan Traffic Crash Facts data)

In rural areas, severe pedestrian crashes are lowest in spring, and steadily rise through the summer to peaks in August and October, though urban areas see their peaks in October and December. This is in contrast to severe vehicular crashes, which are lowest in winter and peak in the summer.

Bicycle crashes follow a trend more similar to vehicular crashes, as they both peak in summer (August) and are lowest in winter months. There are few bicycle-involved crashes in winter months – especially compared to pedestrian-involved crashes – with a possible explanation that bicycling is a choice, whereas pedestrian activity is a necessity for people without access to other forms of travel. Additionally, many students will continue walking to school in the fall, winter, and spring.

The day of the week does not significantly affect when pedestrian or bicycle crashes occur in rural areas, while bicycle crashes in urban areas decrease on Saturdays and Sundays, and pedestrian crashes peak on Mondays and Fridays.

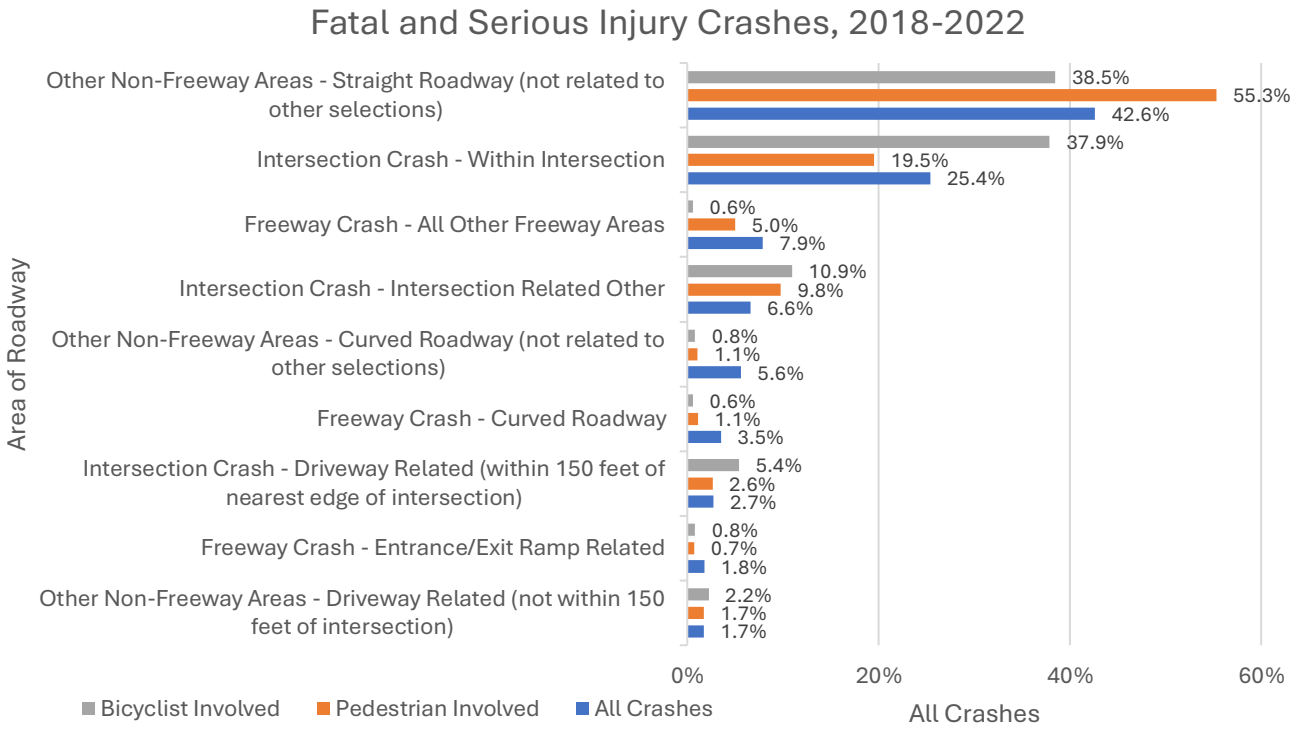

Figure 8 - Fatal and Serious Injury Crashes by Location, 2018-2022 (Michigan Traffic Crash Facts data)

The location on the roadway where a crash occurs differs when a pedestrian or bicyclist is involved. In Figure 8 the location of pedestrian, bicycle, and vehicular crashes are shown by location (locations where less than one percent of total crashes occurred has been omitted for clarity). While the greatest proportion of pedestrian, bicycle, and vehicle crashes all occur on straight roadways, their relative percentage differs. Bicyclists are far more likely to be killed or seriously injured within intersections or when crossing driveways. Pedestrians are also more likely to be killed or seriously injured within intersections, though more than half of pedestrians are killed along roadway segments.

A troubling statistic is that more than one in twenty pedestrians were killed or seriously injured along freeways; this includes construction workers and motorists outside of their vehicles (such as people changing a tire). In areas where motorists have been frequently struck, the available shoulder width may be a factor, though this data point is not widely available to assess. It is possible that improvements in the roadway surface and delineation – part of the "Safe Roads" element of the Safe System Approach – may help reduce these crashes. Additionally, the "Safe Vehicles" element will likely improve as a greater number of vehicles have lane keeping assistance and pedestrian detection technologies.

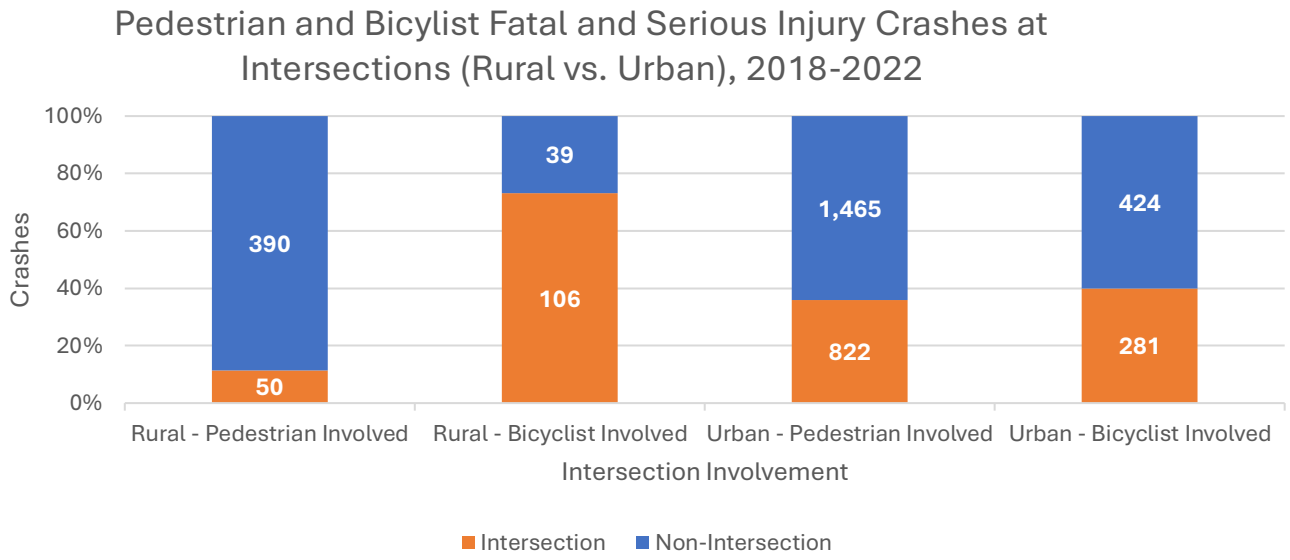

Figure 9 - Pedestrian and Bicyclist Fatal and Serious Injury Crashes at Intersections, 2018-2022 (Michigan Traffic Crash Facts data)

In urban areas, pedestrian and bicycle crashes have similar proportions, with about 35-30 percent of these crashes occurring at intersections. In rural areas, there is a large difference, where about 11 percent of pedestrian crashes occur at intersections, and more than 70 percent of bicycle crashes.

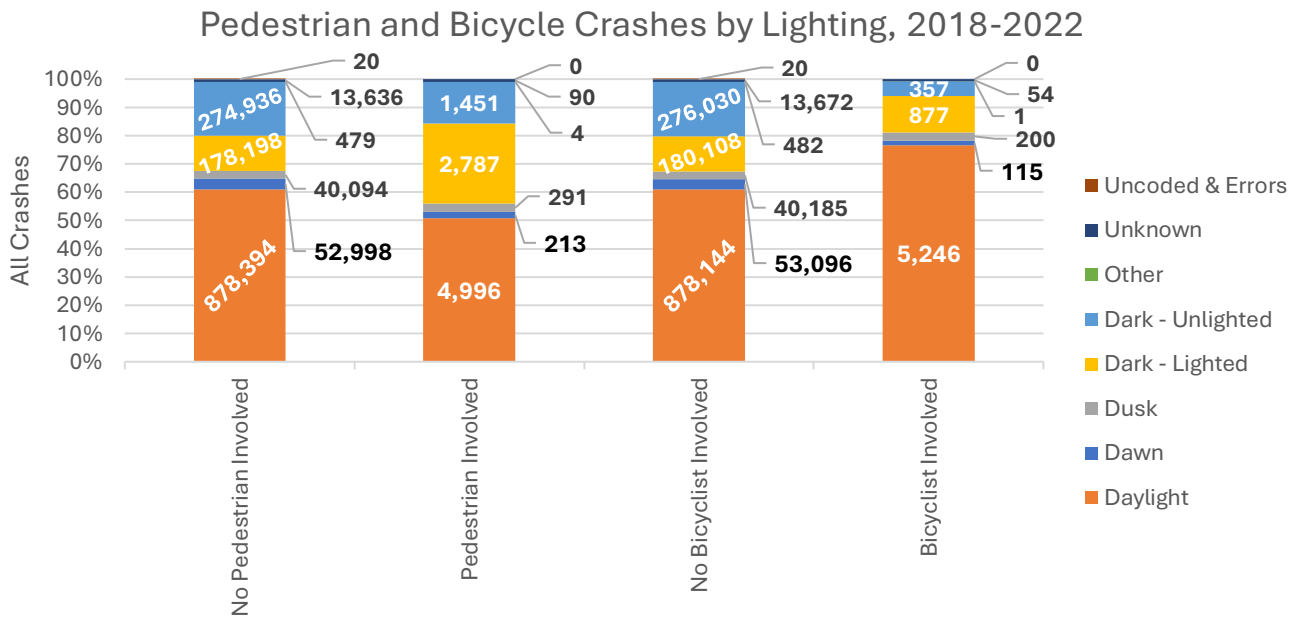

Figure 10 - Pedestrian and Bicycle Crashes by Lighting, 2018-2022 (Michigan Traffic Crash Facts data)

Other than in daylight, dark conditions with artificial lighting account for the second highest tally of pedestrian and bicycle crashes. There are two possible explanations for this finding: lighting is installed where there is a demonstrated history of pedestrian and bicycle activity, or the lighting may be providing a false sense of visibility to pedestrians and bicyclists. In other words, the lighting may not be adequate to properly illuminate the non-motorized facilities.

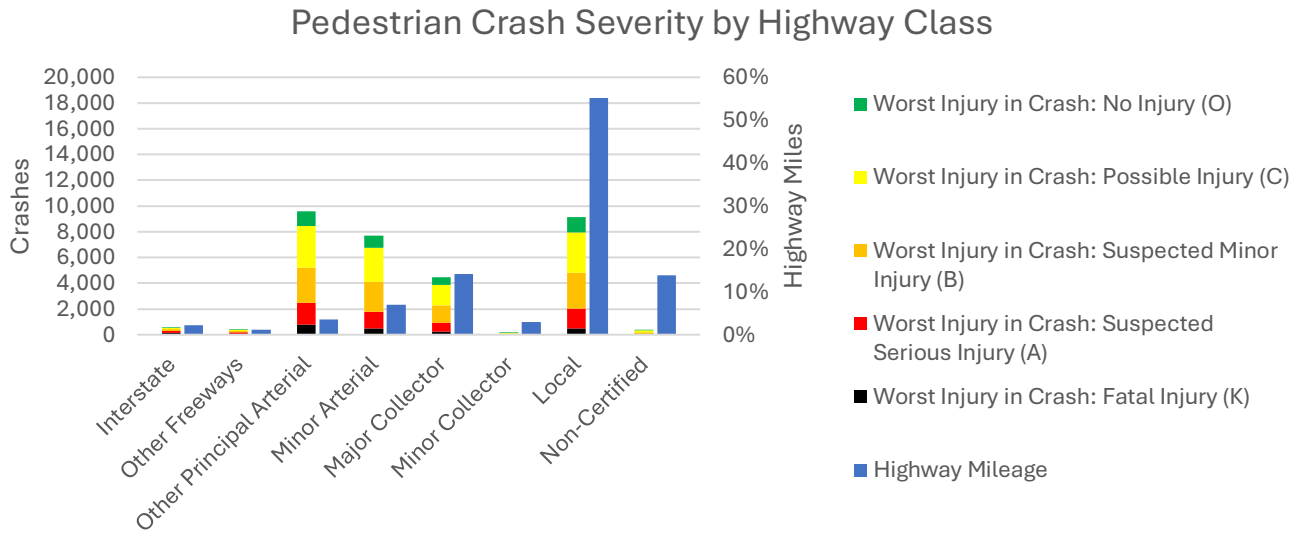

Figure 11 - Pedestrian Crashes by Highway Classification, 2018-2022 (Michigan Traffic Crash Facts data)

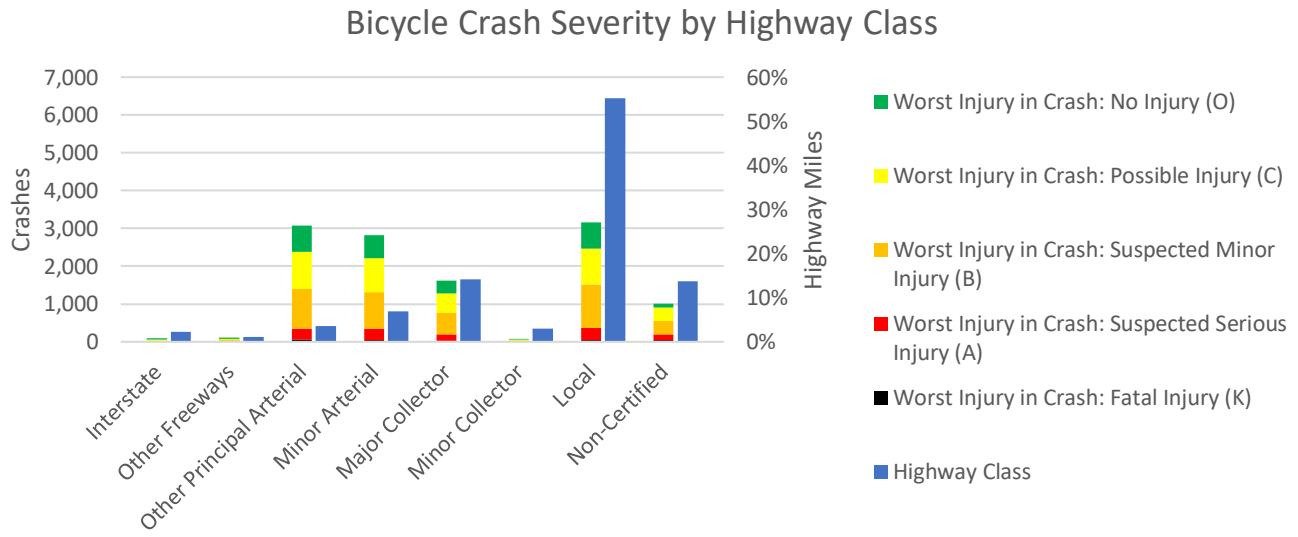

Figure 12 - Bicycle Crashes by Highway Classification, 2018-2022 (Michigan Traffic Crash Facts data)

In Figure 11, the number of pedestrian crashes (by severity) within 50-feet of the facility centerline is compared to their proportion of highway miles. While the total number of crashes in this chart exceeds the total number of actual pedestrian crashes, it helps to include crashes assigned to an intersecting facility (such as when a local roadway intersects an arterial). From this we can see that

local roadways account for over 55 percent of the centerline miles in Michigan, about 28 percent of pedestrian crashes occur near these facilities. On the other hand, minor arterials account for seven percent of centerline miles and almost 24 percent of pedestrian crashes, which means that minor arterials are overrepresented by about 3.4 times. Principal arterials account for only 3.5 percent of highway miles, but 29.5 percent of pedestrian crashes – a more than eight-fold overrepresentation.

Bicycle crashes are similarly displayed in Figure 12. While the general trends mirror those of pedestrians, the number of bicycle crashes along interstates and other freeways drop further while non-certified roadways increase to 8.5 percent of reported crashes. A review of these locations often includes drives within county and state parks, as well as trail crossings with other facilities. As with pedestrian crashes, principal arterials represent almost 26 percent of bicycle crashes along 3.5 percent of roadways, or a 7.3 times overrepresentation. **Combined, principal and minor arterials represent 10.5 percent of centerline miles and 53.3 percent of pedestrian crashes and 49.4 percent of bicycle crashes.**

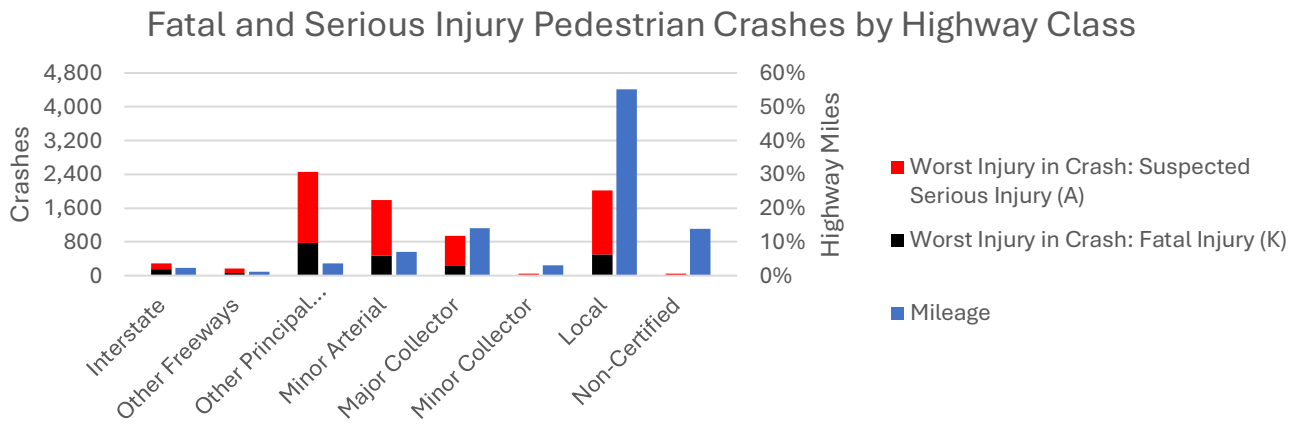

Figure 13 - Fatal and Serious Injury Pedestrian Crashes by Highway Classification, 2018-2022 (Michigan Traffic Crash Facts data)

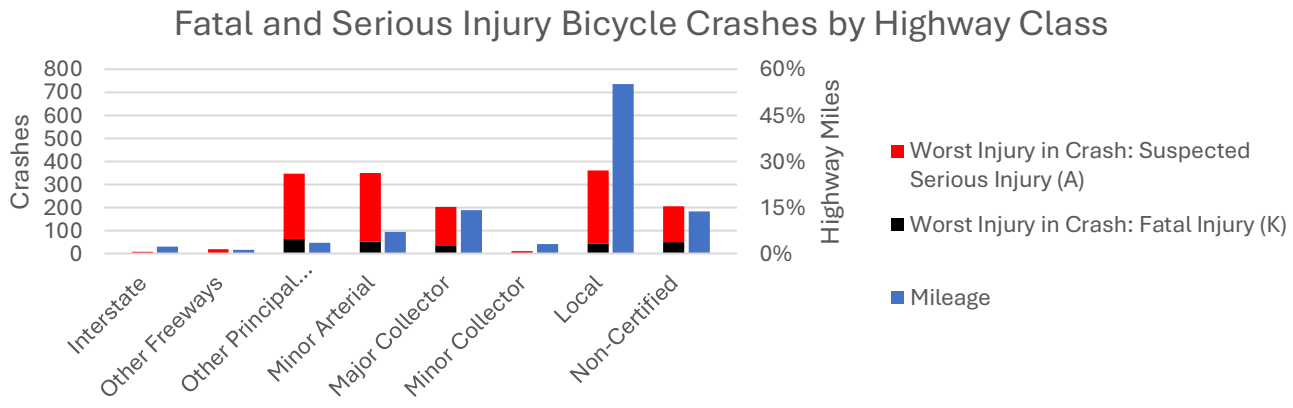

Figure 14 - Fatal and Serious Injury Bicycle Crashes by Highway Classification, 2018-2022 (Michigan Traffic Crash Facts data)

Table 7 – High-Risk Network (Western Michigan University Research, 2023)

High-Risk Network						
Roadway Classification	**Rural**		**Urban**		**Total**	
	Miles	% of Total	Miles	% of Total	Miles	% of Total
Interstate	-	0.0%	-	0.0%	-	0.0%
Other Freeway	-	0.0%	-	0.0%	-	0.0%
Other Principal Arterial	4.87	3.4%	111.41	76.9%	116.31	**80.3%**
Minor Arterial	10.87	7.5%	12.06	8.3%	23.01	**15.9%**
Major Collector	3.99	2.8%	0.81	0.6%	4.83	3.3%
Minor Collector	-	0.0%	-	0.0%	-	0.0%
Local	0.69	0.5%	-	0.0%	0.69	0.5%
Total	20.43	14.1%	124.28	85.8%	144.85	100.0%

A recent effort sponsored by the Michigan Department of Transportation was to identify effective pedestrian and non-motorized crossing enhancements along higher speed corridors. This research effort, led by Western Michigan University[5] also performed a statewide network screening to identify high-risk corridors on lower speed corridors.

About 14 percent of this network is in rural areas while 86 percent is in urban areas. By classification, this research independently identified a significant length of arterial roadways – 96 percent of the identified high-risk network.

When focusing on fatal and serious injury pedestrian and bicycle crashes, the numbers are clear: **focusing our attention on arterial roadways offers the greatest potential for decisively reducing the number of fatal and serious injury pedestrian crashes on Michigan's roadways.**

[5] At the time of this VRU Safety Assessment Western Michigan University's research report is not yet published.

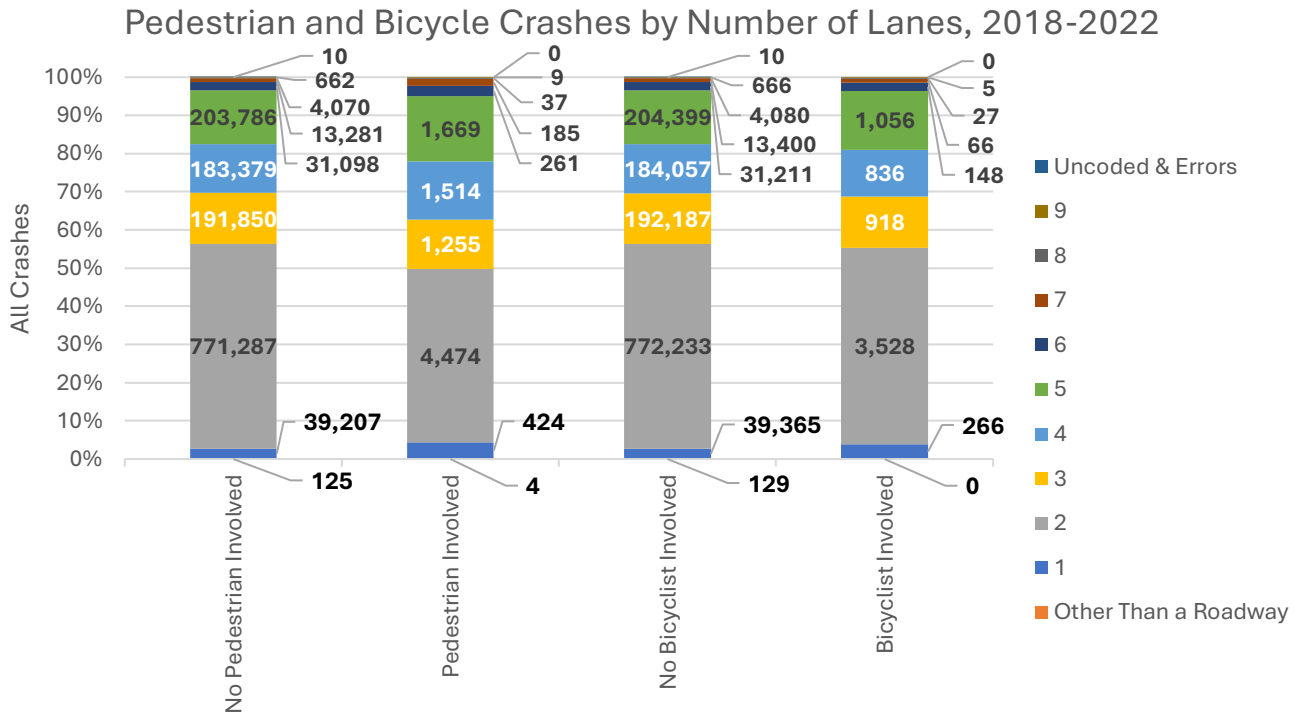

Figure 15 - Pedestrian and Bicycle Crashes by Number of Lanes, 2018-2022 (Michigan Traffic Crash Facts data)

Regarding the how many lanes there are at the crash location the responding officer is able to indicate the number of lanes on the roadway where a crash occurred when filling out the UD-10 crash report. In all cases – with and without pedestrian and bicycle crashes – two-lane roadways account for the bulk of crashes, followed by five-lane sections. At this time, there is not a complete statewide dataset with an inventory of the number of through lanes; 99.8 percent of local roads (Functional Class 7) are coded as having zero (0) lanes.

County Analysis

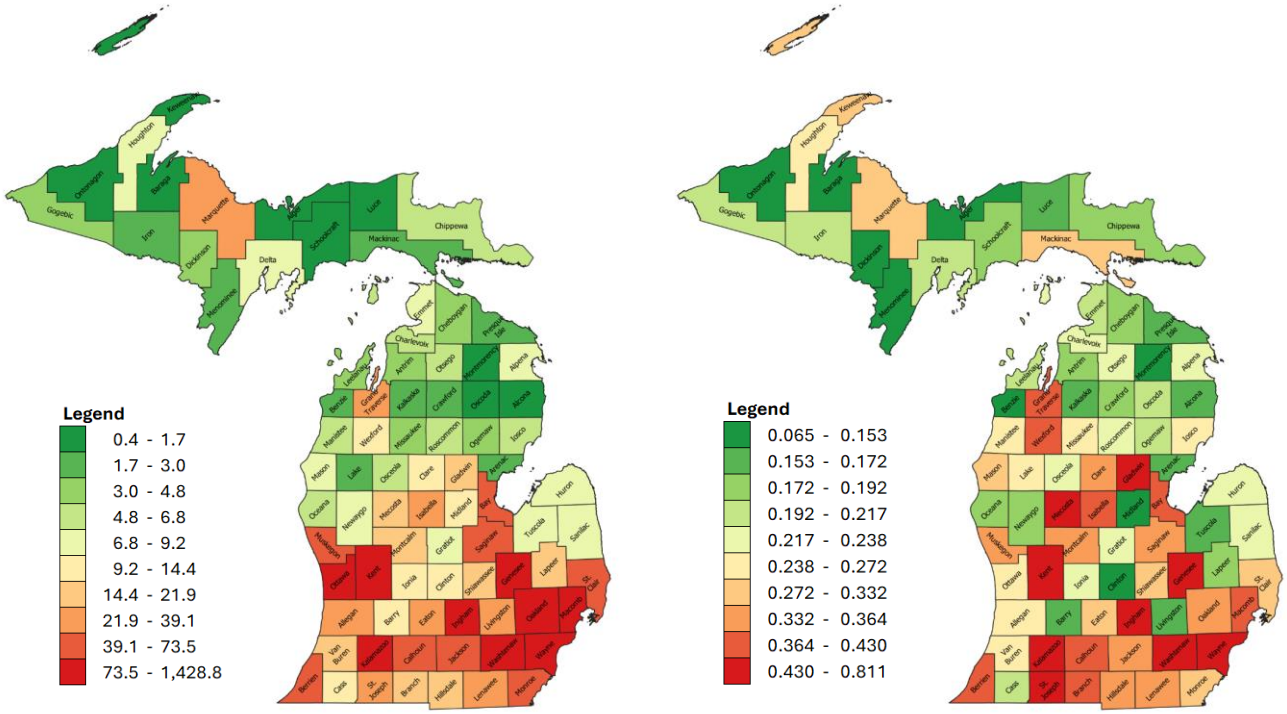

Figure 16 – Yearly Average Pedestrian Crashes by County - Total (Left) and Per Capita, 1k residents (Right)

Table 8 – Yearly Average Pedestrian Crashes by County

Pedestrian Crashes by County		
Rank	**Total**	**Per Capita**
1	Wayne	Wayne
2	Oakland	Kent
3	Kent	Gladwin
4	Macomb	Ingham
5	Washtenaw	Kalamazoo
6	Genesee	Washtenaw
7	Ingham	St. Joseph
8	Kalamazoo	Mecosta
9	Ottawa	Genesee
10	Saginaw	Calhoun

In Figure 16, the total number of pedestrian crashes for each county are shown, with the total on the left and the per capita value on the right[6]. The total pedestrian crashes are largely concentrated in the southern portion of the state, which largely matches the higher population counties.

When adjusting for each county's population, a different picture emerges (see Table 8); while Wayne County still tops the list, Kent County moves to the second highest ranking, followed by Gladwin County. Using the per capita rankings, Oakland County drops to 22nd on the list; conversely, Gladwin County was 33rd when ranked by total pedestrian crashes.

[6] Crashes within 100 feet of each county border have been included.

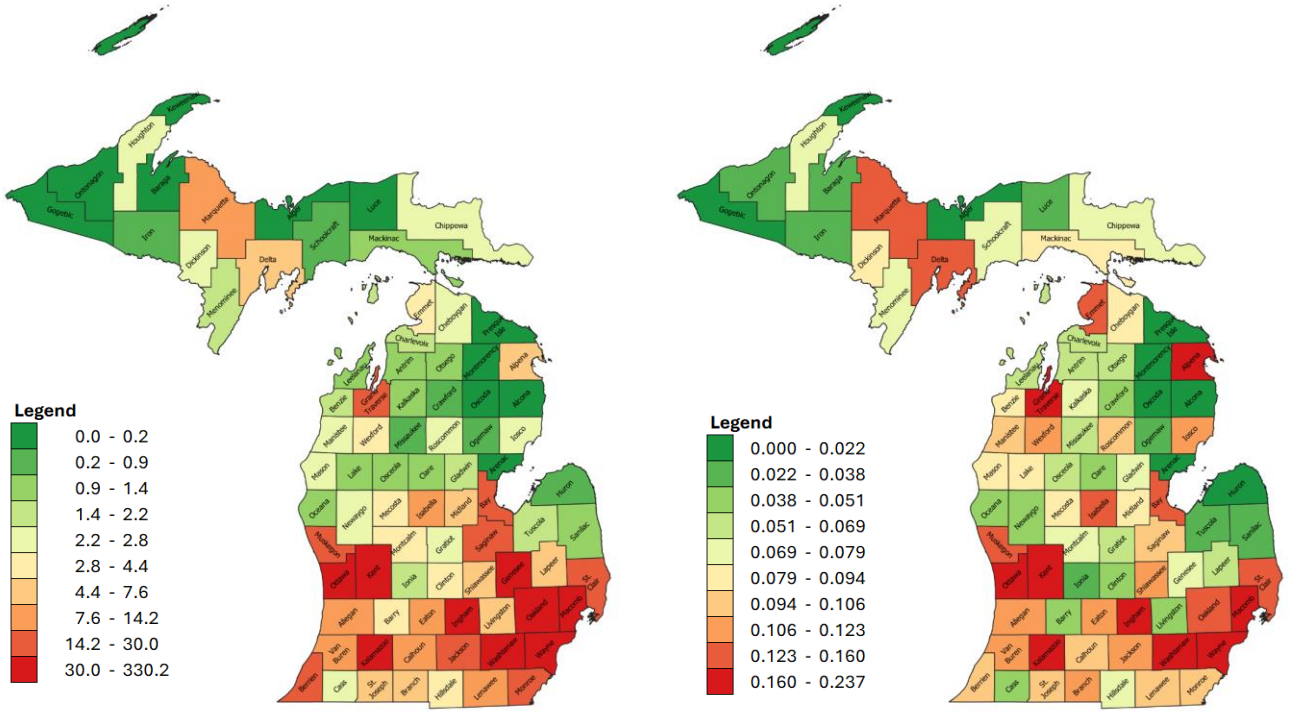

Figure 17 – Yearly Average Bicycle Crashes by County - Total (Left) and Per Capita, 1k residents (Right)

Table 9 – Yearly Average Bicycle Crashes by County

Bicycle Crashes by County		
Rank	**Total**	**Per Capita**
1	Wayne	Ingham
2	Oakland	Grand Traverse
3	Macomb	Ottawa
4	Kent	Washtenaw
5	Washtenaw	Alpena
6	Ingham	Kalamazoo
7	Ottawa	Wayne
8	Kalamazoo	Kent
9	Genesee	Macomb
10	St. Clair	Delta

In Figure 17, the total number of bicycle crashes for each county are shown, with the total on the left and the per capita value on the right[7]. The total bicycle crashes are largely concentrated in the southern portion of the state, which largely matches the higher population counties, though Grand Traverse County in northern lower Michigan ranks 12th for total average bicycle crashes. The four highest ranked counties (Wayne, Oakland, Macomb, and Kent) match the highest ranked for pedestrian crashes, though Macomb and Kent Counties swap rankings.

When adjusting for each county's population (see Table 9), Grand Traverse County rises to number two, while Ingham County has the highest spot. Per capita, Wayne County drops to the seventh position, Oakland County to 14th, and Macomb County to ninth.

Keweenaw, Montmorency, and Oscoda Counties were the only counties to record zero bicycle crashes between 2018 and 2022.

The full rankings for all counties are included in Appendix A – VRU Crashes by By County.

[7] Crashes within 100 feet of each county border have been included.

EQUITY

In Michigan, there are 2,767 Census Tracts. Census Tracts are composed of Census Block Groups, which are in turn composed of Census Blocks. The census blocks are the smallest geographic unit used by the United States Census Bureau when tabulating their complete 100-percent data, which is data collected from all houses, rather than just a sample of houses. Due to slight differences in the data sources, these blocks were buffered by 100 feet to capture crashes that may have been omitted when the census tract layer did not neatly align with the roadway centerline layer.

Statewide, the average yearly reported pedestrian crashes per tracts was 2.48, ranging from zero (0) reported pedestrian crashes to a high of 39.4 reported. 110 tracts reported zero pedestrian crashes between 2018 and 2022 (Four (4) percent of the state).

Bicycle crashes are concentrated in fewer areas. The average reported bicycle crash count ranges from zero (0) to 12.0, with a statewide average of 0.79 reported crashes. 545 tracts (19.7 percent of the state) reported zero (0) bicycle crashes.

Other demographic data may also be compared to crash locations. When looking at census tracts with at least 100 residents (2,747 of the 2,767 total tracts), Michigan averages 0.90 pedestrian crashes per 1,000 residents, ranging from zero (0) to 51.92. For bicycle crashes, the average is 0.27, with a range of 0.0 to 19.23.

There are 2,207 census tracts with at least 80 percent White residents (80.3 percent of all tracts). These tracts average 0.60 pedestrian crashes per 1,000 residents and 0.24 bicycle crashes.

393 tracts are at least 50 percent Black or African American (14.3 percent of tracts), and these tracts average 2.37 pedestrian crashes and 0.38 bicycle crashes per 1,000 residents. This is 3.95 times higher for pedestrian crashes and 1.58 times higher for bicycle crashes than the majority White tracts.

21 tracts are at least 50 percent Hispanic or Latino (0.8 percent of tracts), and these average 1.84 pedestrian crashes and 0.30 bicycle crashes per 1,000 residents. This is 3.07 times higher for pedestrian crashes and 1.25 times higher for bicycle crashes than majority White areas. Every majority Hispanic/Latino census tract averaged at least nine (9) pedestrian crashes per year.

1,001 tracts (36.4 percent) in Michigan are identified as disadvantaged per data from the Climate and Economic Justice Screening Tool (CEJST) provided by the White House Council on Environmental Quality[8]. These tracts average 1.55 pedestrian crashes per 1,000 residents and 0.34 bicycle crashes. These disadvantaged areas are 1.72 times more likely to experience a pedestrian crash and 1.26 more likely to experience a bicycle crash than the statewide average, and when compared to non-disadvantaged areas, they are 2.98 times higher for pedestrian crashes and 1.55 times higher for bicycle crashes.

Table 10 details the number of pedestrian and bicycle crashes per census tract based on the number of threshold categories exceeded as describe in the preceding paragraph. Census tracts that exceed four (4) or more threshold

[8] There are eight (8) categories, and a community is considered disadvantaged if it exceeds the threshold in one (1) or more category.

categories have 3.9 times higher pedestrian crashes per capita than those with three (3) or fewer, as well as 2.2 times higher bicycle crashes per capita. The map in Figure 18 displays this graphically.

Table 10 - Threshold Categories Exceeded by Census Tract

		Pedestrian per 1,000 Residents			Bicycle per 1,000 Residents		
Categories Exceeded	**Count**	**Average**	**Minimum**	**Maximum**	**Average**	**Minimum**	**Maximum**
0	1,821	0.53	0.00	28.28	0.22	0.00	13.68
1	146	0.67	0.00	4.23	0.21	0.00	1.38
2	177	0.57	0.00	4.05	0.18	0.00	1.23
3	162	0.92	0.00	4.35	0.24	0.00	1.39
4	143	2.02	0.00	51.92	0.49	0.00	19.23
5	181	2.30	0.00	12.33	0.39	0.00	3.22
6	153	2.60	0.08	8.24	0.51	0.00	3.31
7	26	3.21	0.23	12.74	0.57	0.00	1.95
8	4	2.82	1.88	3.96	0.34	0.19	0.51

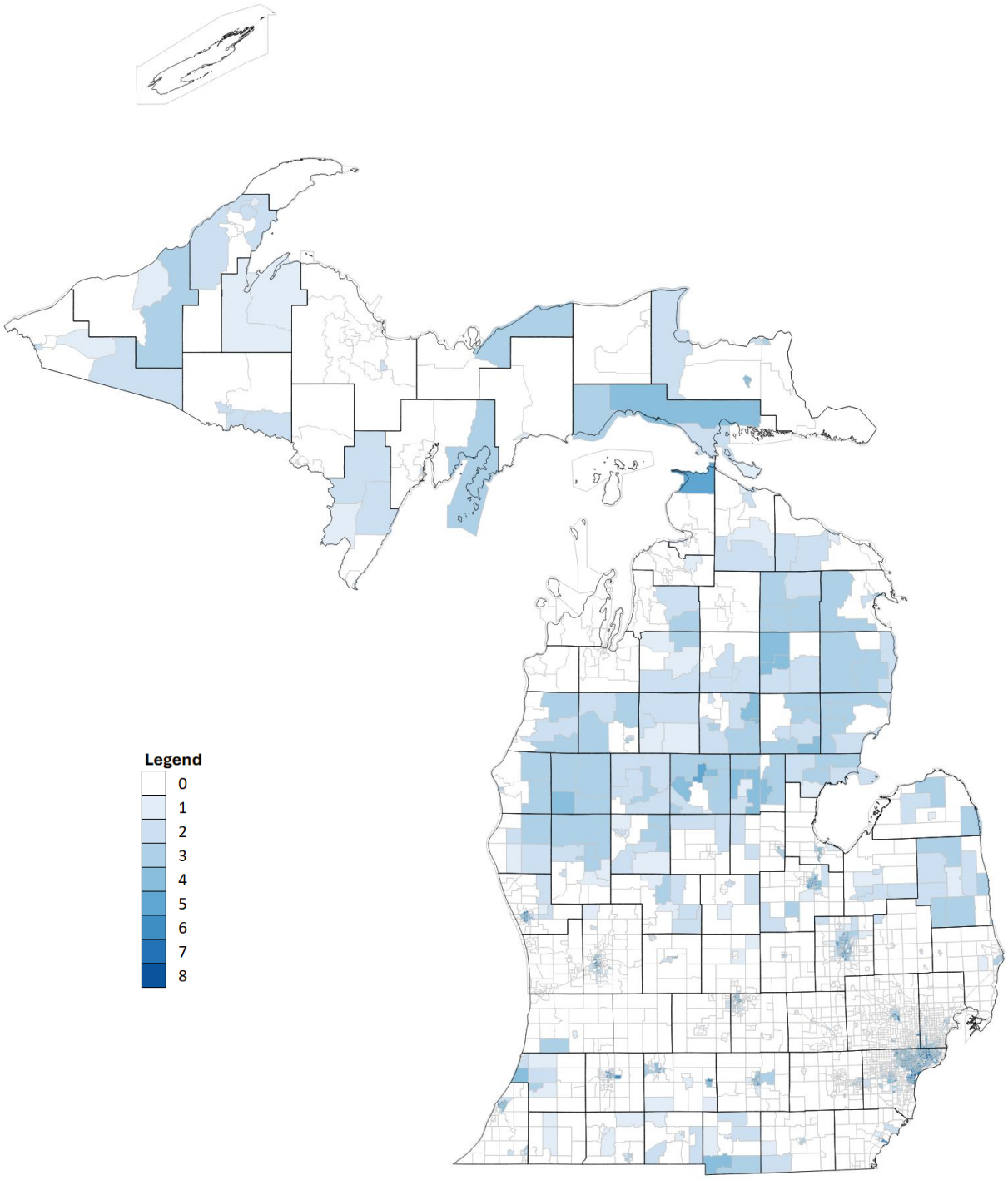

Figure 18 - Total Categories Exceeded by Census Tract

A correlation matrix for the CEJST data and the associated pedestrian and bicycle crashes was generated (see Tables 11 and 12, respectively). The largest positive and negative correlations are indicated for each category. For example, the presence of leaky underground storage tanks and the proximity to hazardous waste sites is highly correlated with high numbers of pedestrian crashes. The higher the percentage of White residents and the larger proportion of residents over the age of 64, the lower the number of pedestrian crashes.

Table 11 - Largest Positively and Negatively Correlated Variables with Average Pedestrian Crashes

Average Pedestrian Crashes				
Rank	**Largest Positive Correlation**		**Largest Negative Correlation**	
1	Leaky underground storage tanks	0.5116	Percent White	-0.3918
2	Proximity to hazardous waste sites	0.4962	Percent age over 64	-0.2853
3	Housing burden (percent)	0.4919	Median household income as a percent of area median income	-0.2771
4	Traffic proximity and volume	0.4659	Expected agricultural loss rate (Natural Hazards Risk Index)	-0.1961
5	Diesel particulate matter exposure	0.4570	Median value ($) of owner-occupied housing units	-0.1752
6	Percent of individuals < 100% Federal Poverty Line	0.4463	Expected building loss rate (Natural Hazards Risk Index)	-0.0733
7	Share of the tract's land area that is covered by impervious surface or cropland as a percent	0.4421	Life expectancy (years)	-0.0678
8	Percentage households below 100% of federal poverty line in 2009 (island areas) and 2010 (states and PR)	0.4401	Percent of residents who are not currently enrolled in higher ed	-0.0632
9	Percent of individuals below 200% Federal Poverty Line	0.4389	Greater than or equal to the 90th percentile for DOT transit barriers and is low income?	-0.0598
10	Percent Black or African American alone	0.4098	Expected population loss rate (Natural Hazards Risk Index)	-0.0529

Table 12 - Largest Positively and Negatively Correlated Variables with Average Bicycle Crashes

Average Bicycle Crashes				
Rank	**Largest Positive Correlation**		**Largest Negative Correlation**	
1	Proximity to hazardous waste sites	0.4465	Expected agricultural loss rate (Natural Hazards Risk Index)	-0.2168
2	Diesel particulate matter exposure	0.3976	Percent age over 64	-0.1998
3	Leaky underground storage tanks	0.3564	Greater than or equal to the 90th percentile for DOT transit barriers and is low income?	-0.1508
4	Traffic proximity and volume	0.3492	Energy burden	-0.1432
5	Share of the tract's land area that is covered by impervious surface or cropland as a percent	0.3026	Median household income as a percent of area median income	-0.1060
6	Percent age 10 to 64	0.2528	Coronary heart disease among adults aged greater than or equal to 18 years	-0.1004
7	PM2.5 in the air	0.2528	Percent of residents who are not currently enrolled in higher ed	-0.0895
8	Housing burden (percent)	0.2476	Greater than or equal to the 90th percentile for energy burden and is low income?	-0.0857
9	Proximity to Risk Management Plan (RMP) facilities	0.2376	Greater than or equal to the 90th percentile for heart disease and is low income?	-0.0841
10	Percent pre-1960s housing (lead paint indicator)	0.1986	Percent White	-0.0828

Table 13 - Largest Positively and Negatively Correlated Variables with Average Pedestrian Crashes per 1,000 Residents

Average Pedestrian Crashes per 1,000 Residents				
Rank	**Largest Positive Correlation**		**Largest Negative Correlation**	
1	Percent Asian	0.3136	Life expectancy (years)	-0.1234
2	Percent of individuals < 100% Federal Poverty Line	0.1817	Percent of residents who are not currently enrolled in higher ed	-0.1057
3	Proximity to hazardous waste sites	0.1321	Percent White	-0.1009
4	Percent of individuals below 200% Federal Poverty Line	0.1175	Total population	-0.0957
5	Greater than or equal to the 90th percentile for share of the tract's land area that is covered by impervious surface or cropland as a percent	0.1167	Median household income as a percent of area median income	-0.0947
6	Share of the tract's land area that is covered by impervious surface or cropland as a percent	0.0973	Percent age over 64	-0.0886
7	Percent age 10 to 64	0.0922	Current asthma among adults aged greater than or equal to 18 years	-0.0847
8	Diesel particulate matter exposure	0.0918	Median value ($) of owner-occupied housing units	-0.0742
9	Percent pre-1960s housing (lead paint indicator)	0.0798	Coronary heart disease among adults aged greater than or equal to 18 years	-0.0722
10	Unemployment (percent)	0.0769	Percent age under 10	-0.0482

Table 14 - Largest Positively and Negatively Correlated Variables with Average Bicycle Crashes per 1,000 Residents

Average Bicycle Crashes per 1,000 Residents				
Rank	**Largest Positive Correlation**		**Largest Negative Correlation**	
1	Percent Asian	0.2989	Percent of residents who are not currently enrolled in higher ed	-0.1093
2	Percent of individuals < 100% Federal Poverty Line	0.1445	Life expectancy (years)	-0.0850
3	Proximity to hazardous waste sites	0.1008	Total population	-0.0634
4	Greater than or equal to the 90th percentile for share of the tract's land area that is covered by impervious surface or cropland as a percent	0.0997	Current asthma among adults aged greater than or equal to 18 years	-0.0631
5	Percent of individuals below 200% Federal Poverty Line	0.0900	Percent age over 64	-0.0619
6	Diesel particulate matter exposure	0.0766	Percent White	-0.0600
7	Percent age 10 to 64	0.0753	Median household income as a percent of area median income	-0.0599
8	Share of the tract's land area that is covered by impervious surface or cropland as a percent	0.0704	Coronary heart disease among adults aged greater than or equal to 18 years	-0.0579
9	Percent pre-1960s housing (lead paint indicator)	0.0537	Percent age under 10	-0.0535
10	Leaky underground storage tanks	0.0529	Diagnosed diabetes among adults aged greater than or equal to 18 years	-0.0391

Superior Region

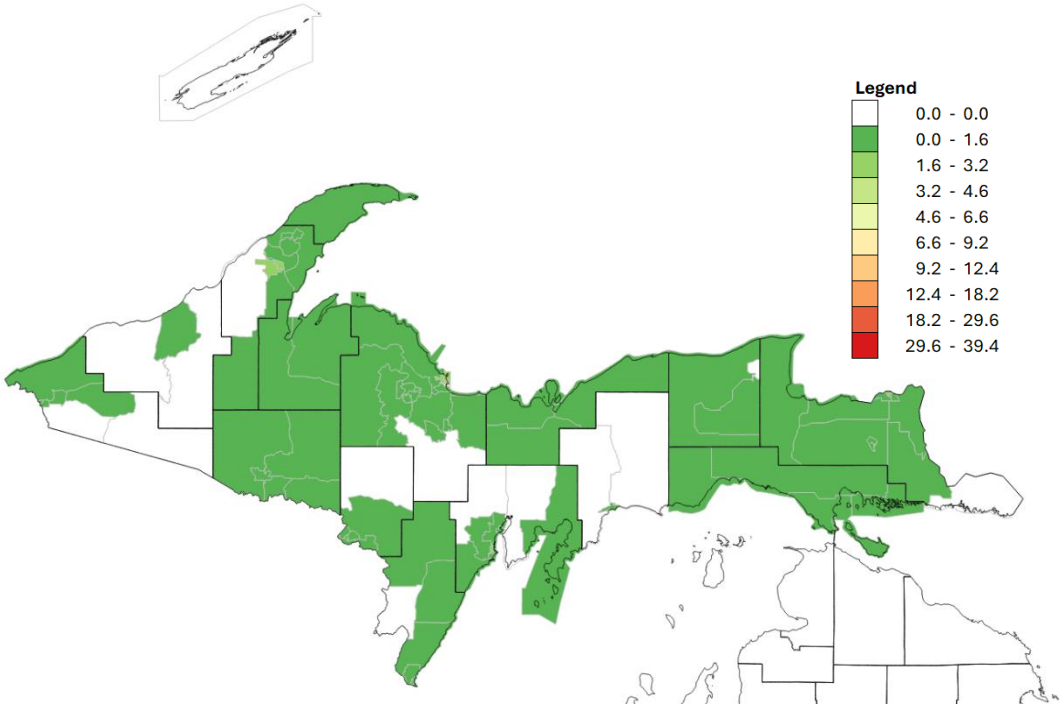

Figure 19 - Superior Region, Average Yearly Pedestrian Crashes by Census Tract

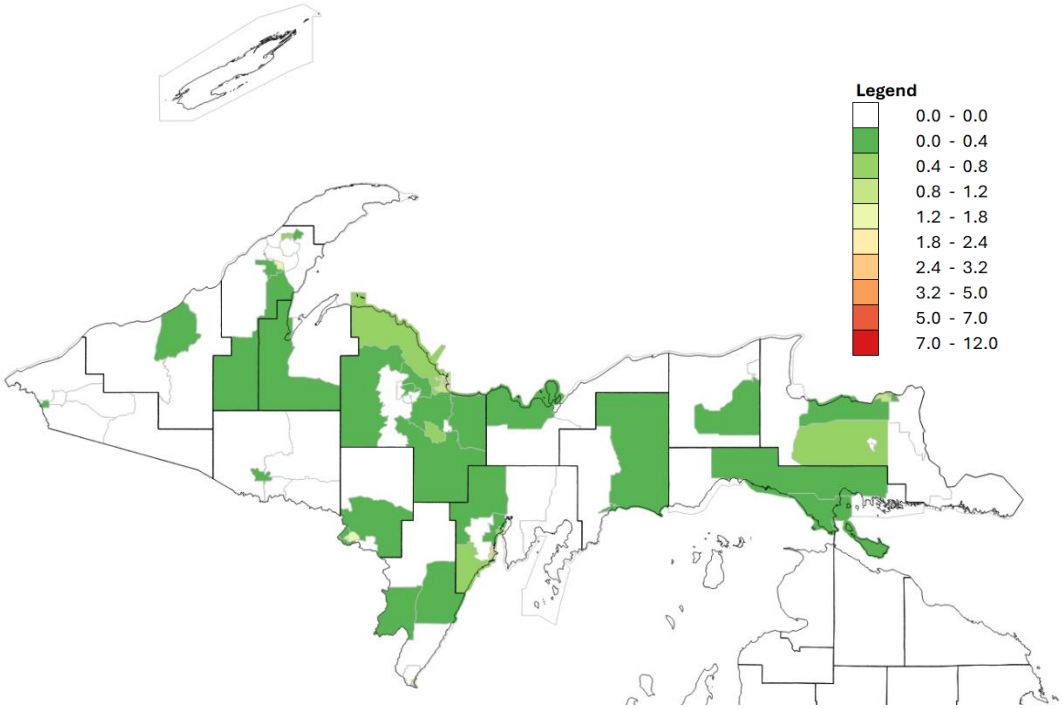

Figure 20 - Superior Region, Average Yearly Bicycle Crashes by Census Tract

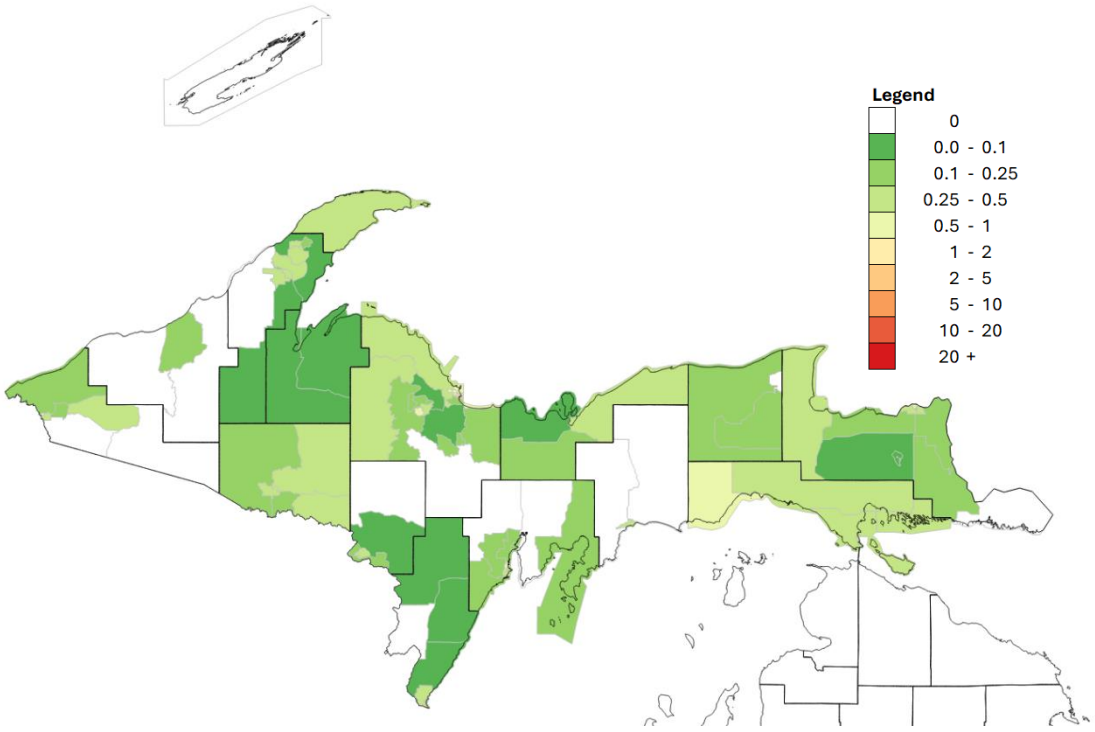

Figure 21 - Superior Region, Average Yearly Pedestrian Crashes per 1,000 Residents by Census Tract

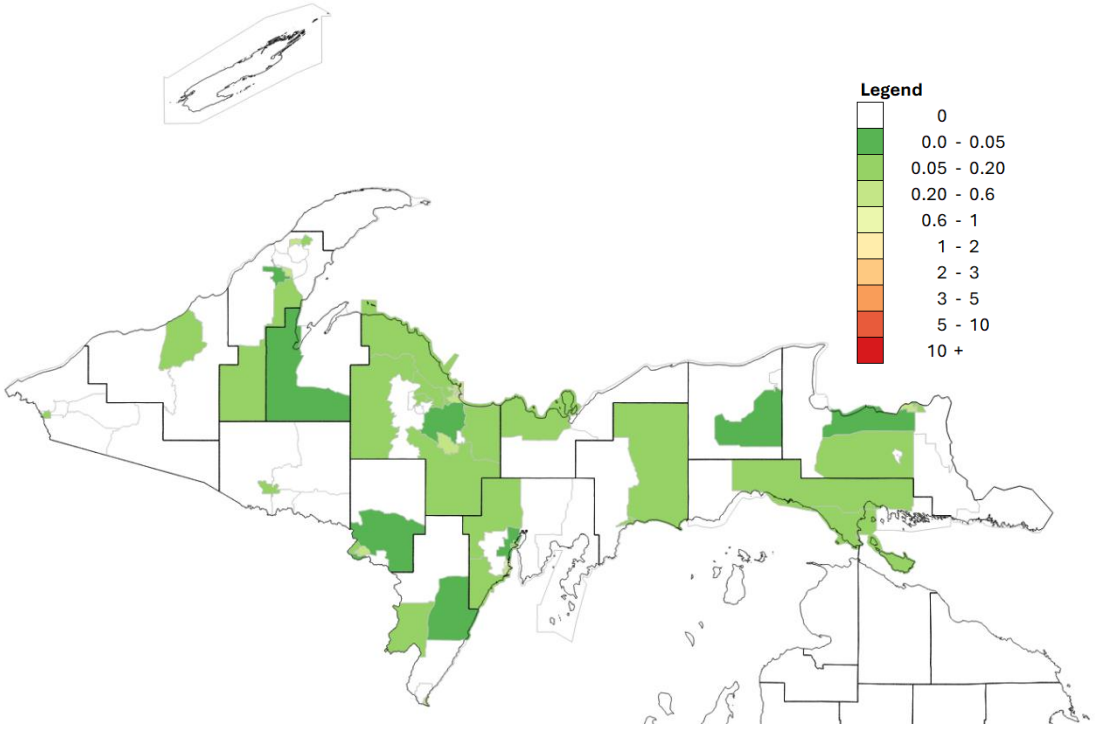

Figure 22 - Superior Region, Average Yearly Bicycle Crashes per 1,000 Residents by Census Tract

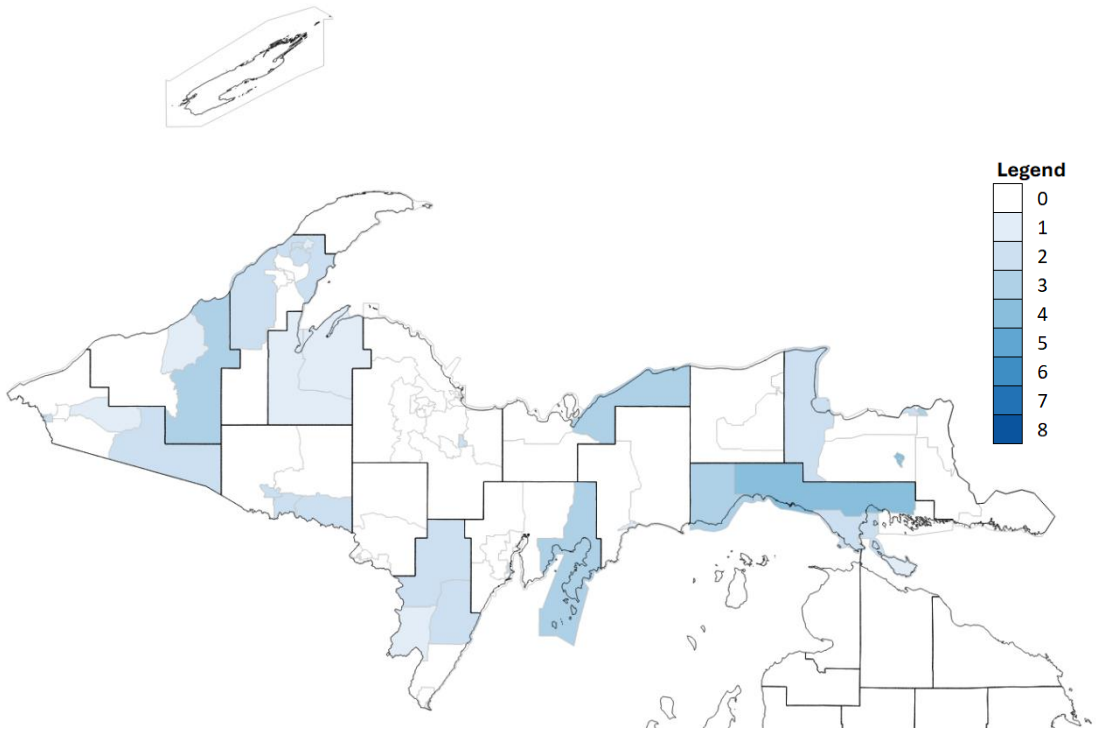

Figure 23 - Superior Region, Total Disadvantaged Categories Exceeded by Census Tract

Superior Region has 106 census tracts, ranging from zero (0) to 7.4 pedestrian crashes per year, with an average of 0.82. Eighteen (18) reported zero crashes (17.0 percent). Six (6) of the ten (10) highest tracts in the region are within Marquette County.

With regards to bicycle crashes, Superior Region ranges from zero (0) to 3.2 reported crashes per year, averaging 0.36. 48 tracts reported zero (0) crashes (45.3 percent). Four (4) of the ten (10) highest tracts are within Marquette County, with

Per 1,000 residents, Superior Region averages 0.30 pedestrian crashes per 1,000 residents, ranging from zero (0) to 3.41. For bicycle crashes, the average is 0.12, with a range of 0.0 to 1.47.

40 tracts in Superior Region are identified as disadvantaged per data from the CEJST provided by the White House Council on Environmental Quality. These tracts average 0.28 pedestrian crashes per 1,000 residents and 0.12 bicycle crashes.

North Region

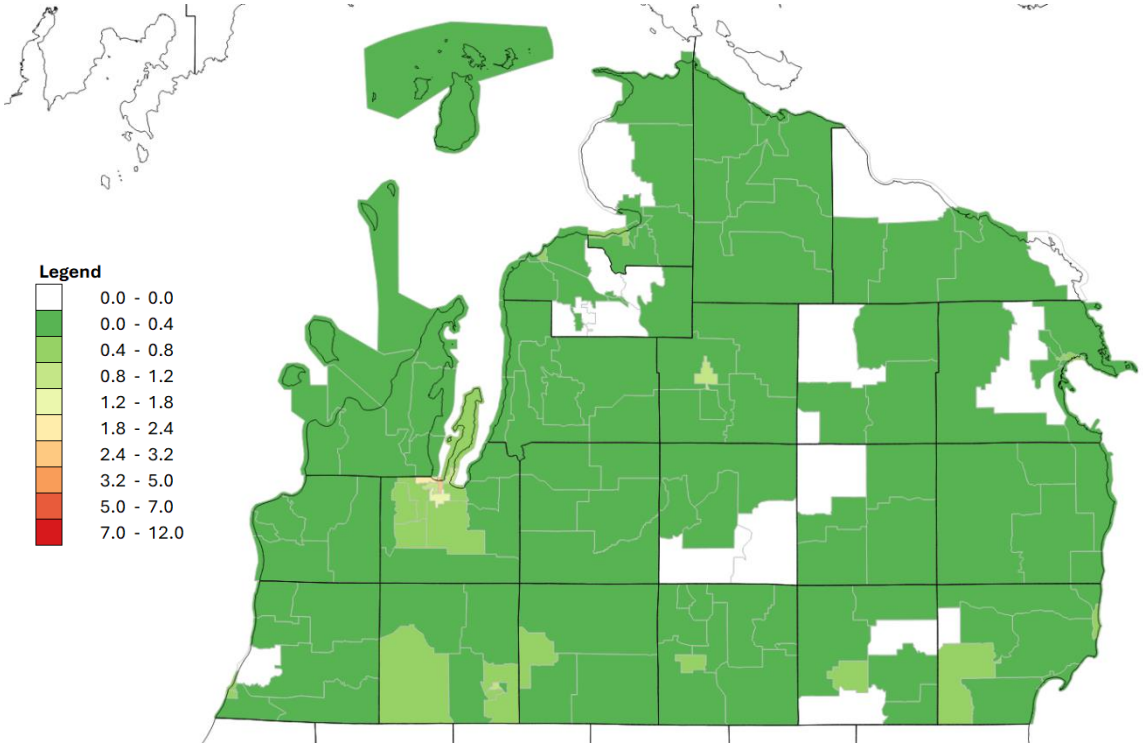

Figure 24 - North Region, Average Yearly Pedestrian Crashes by Census Tract

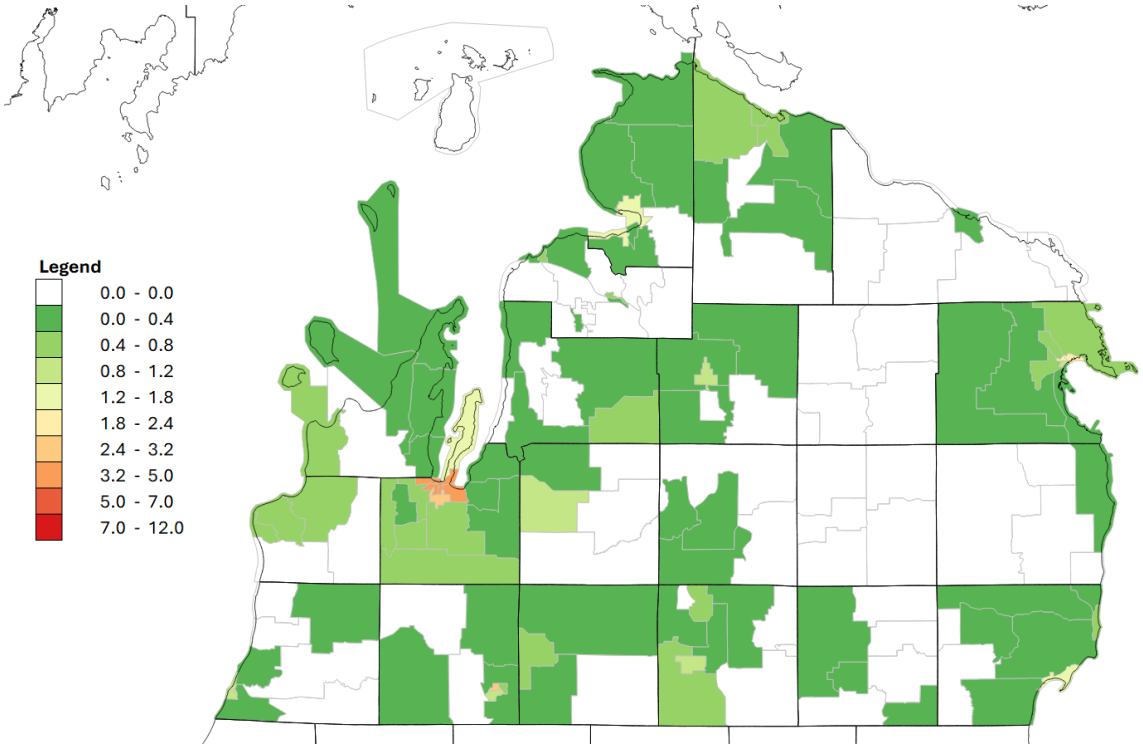

Figure 25 - North Region, Average Yearly Bicycle Crashes by Census Tract

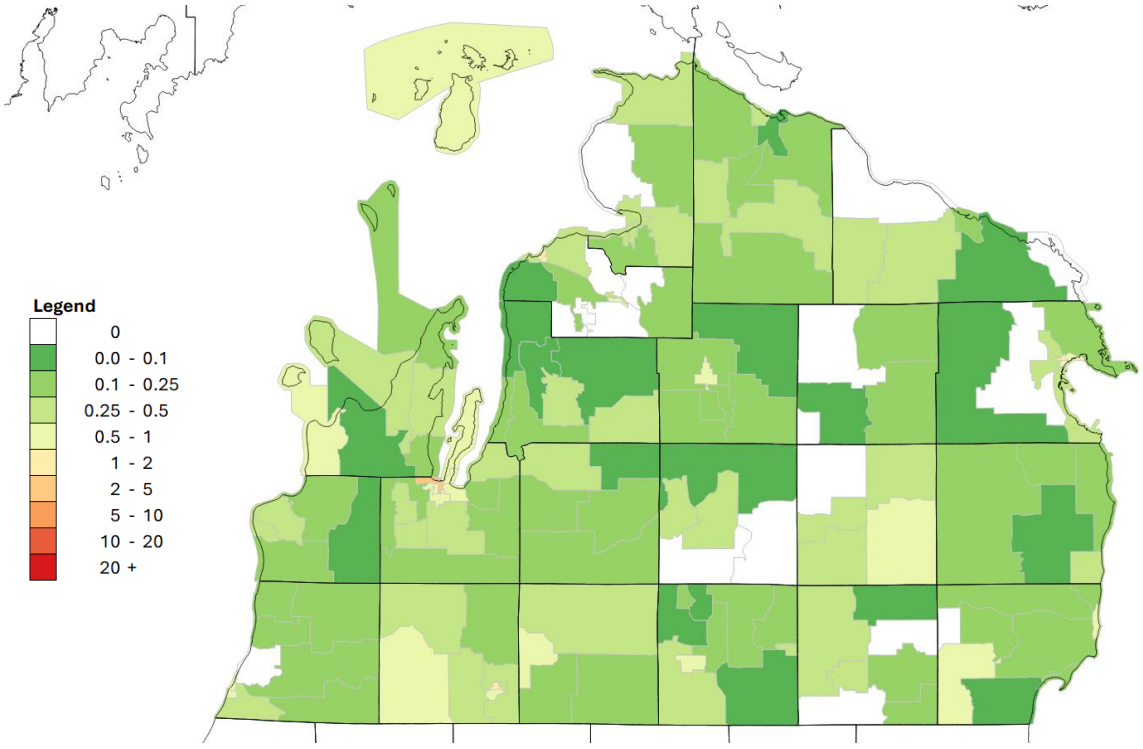

Figure 26 - North Region, Average Yearly Pedestrian Crashes per 1,000 Residents

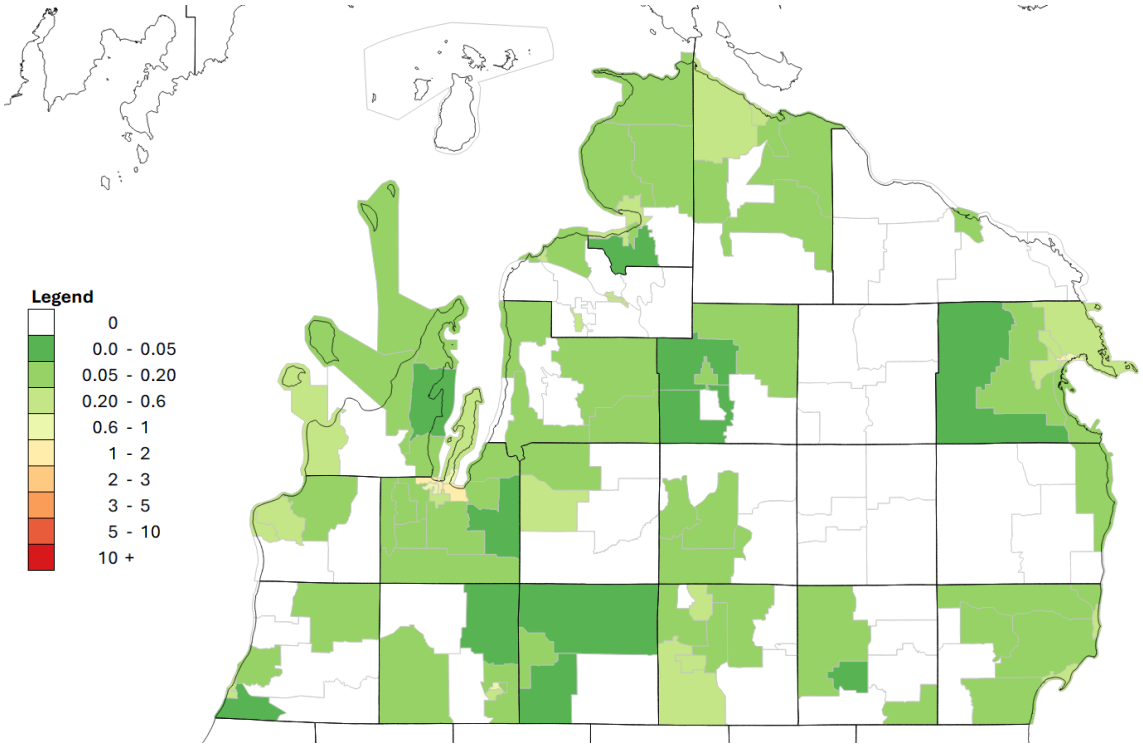

Figure 27 - North Region, Average Yearly Bicycle Crashes per 1,000 Residents

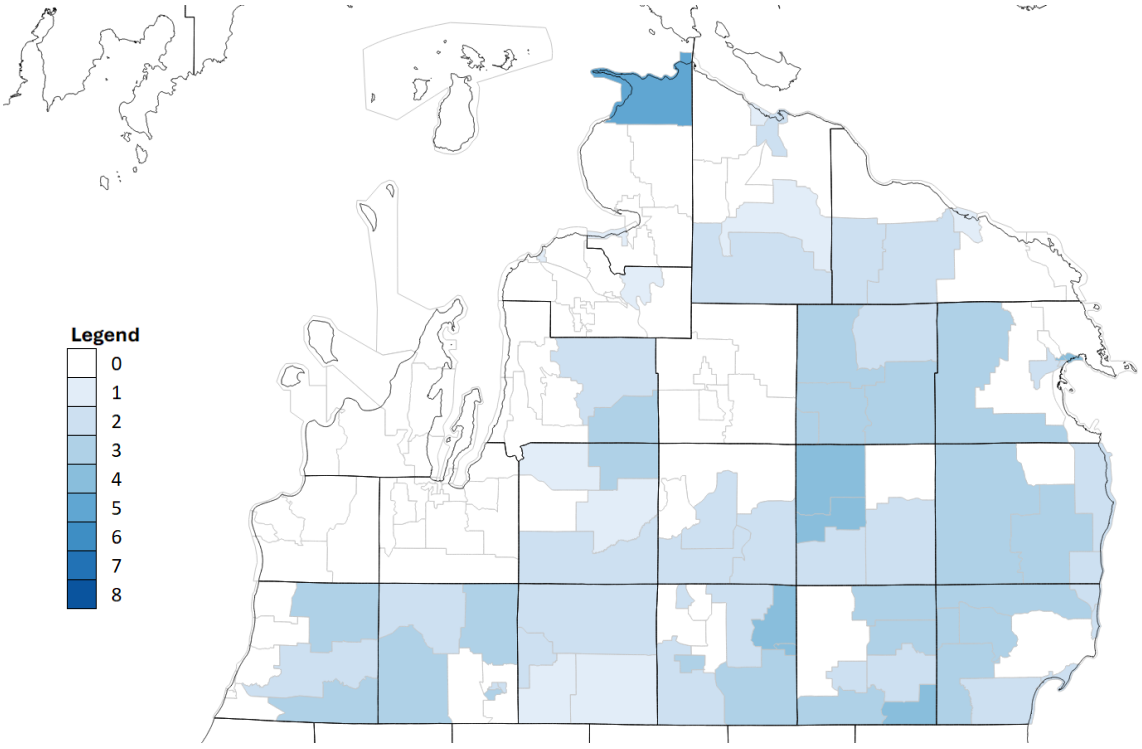

Figure 28 – North Region, Total Disadvantaged Categories Exceeded by Census Tract

North Region has 156 census tracts, ranging from zero (0) to 10.0 pedestrian crashes per year, with an average of 1.04. Seventeen (17) reported zero crashes (10.9 percent). Five (5) of the ten (10) highest tracts in the region are within Grand Traverse County, including the top three (3).

With regards to bicycle crashes, North Region ranges from zero (0) to 5.0 reported crashes per year, averaging 0.47. 60 tracts reported zero (0) crashes (38.5 percent). Six (6) of the ten (10) highest tracts are within Grand Traverse County (including the five (5) highest), with Alpena County having two (2).

Per 1,000 residents, North Region averages 0.32 pedestrian crashes per 1,000 residents, ranging from zero (0) to 3.07. For bicycle crashes, the average is 0.14, with a range of 0.0 to 1.53.

72 tracts in North Region are identified as disadvantaged per the CEJST data. These tracts average 0.31 pedestrian crashes per 1,000 residents and 0.11 bicycle crashes.

Grand Region

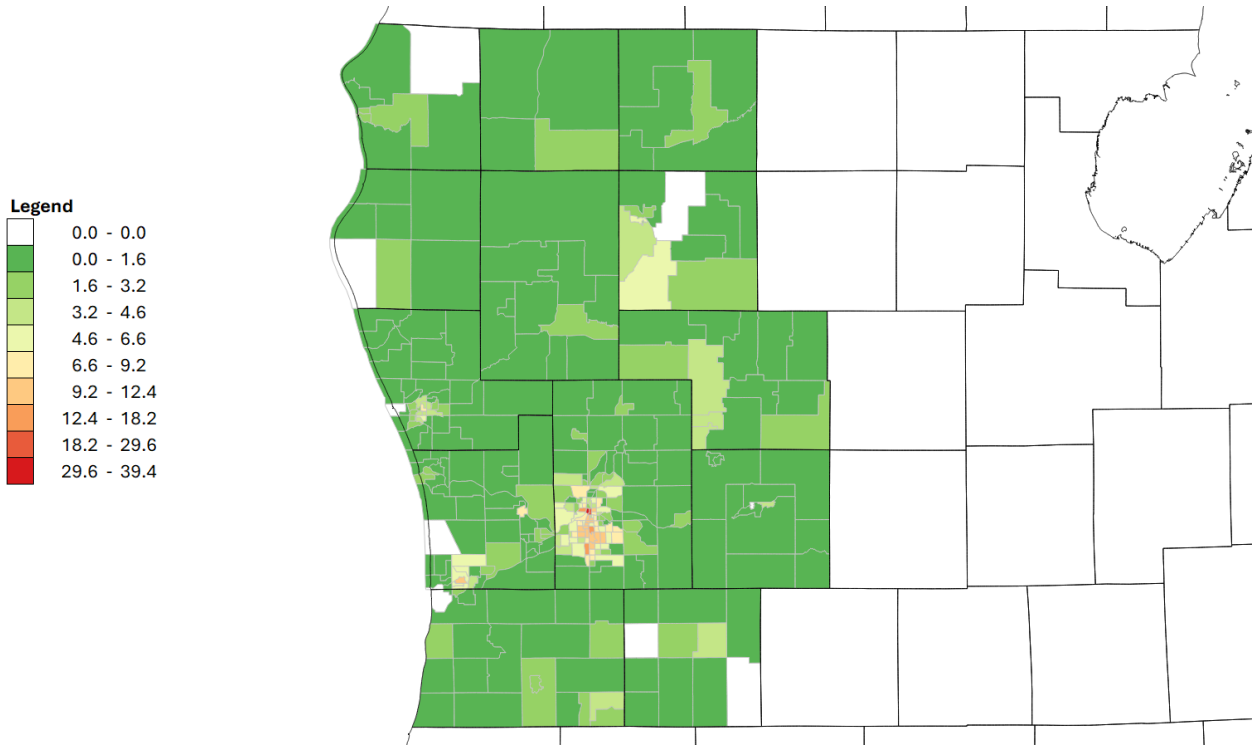

Figure 29 - Grand Region, Average Yearly Pedestrian Crashes by Census Tract

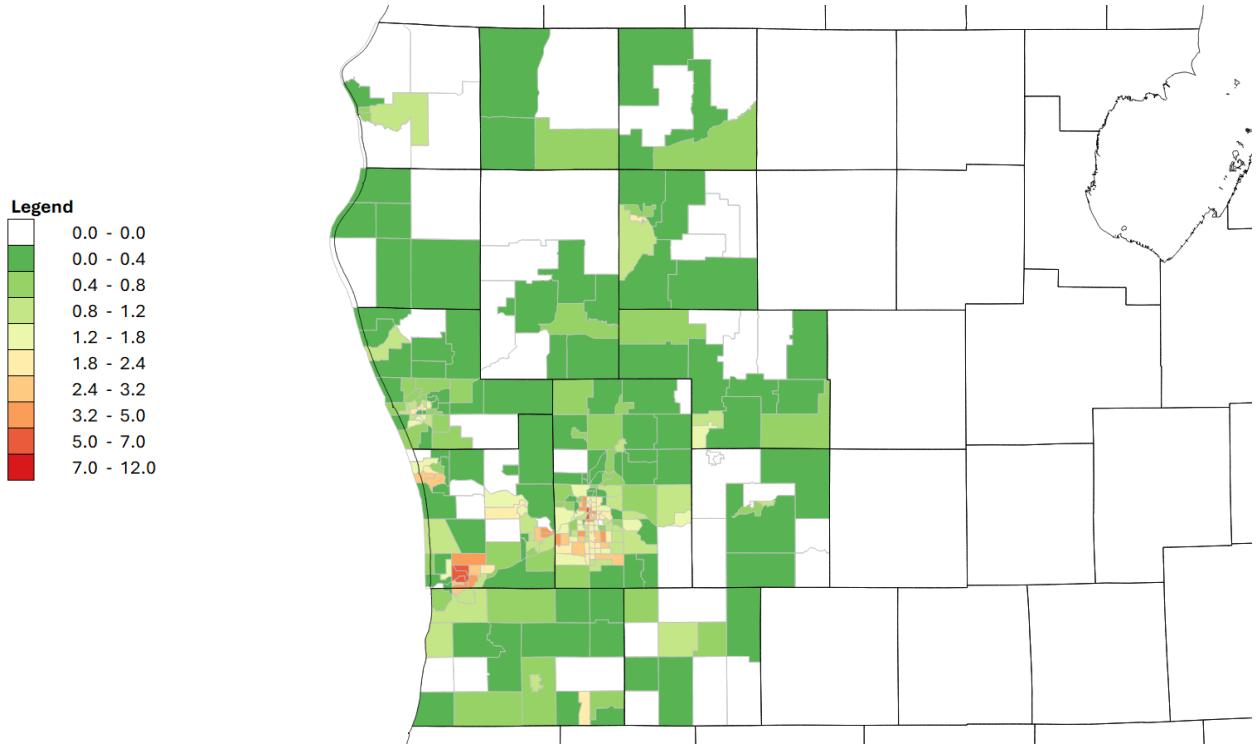

Figure 30 - Grand Region, Average Yearly Bicycle Crashes by Census Tract

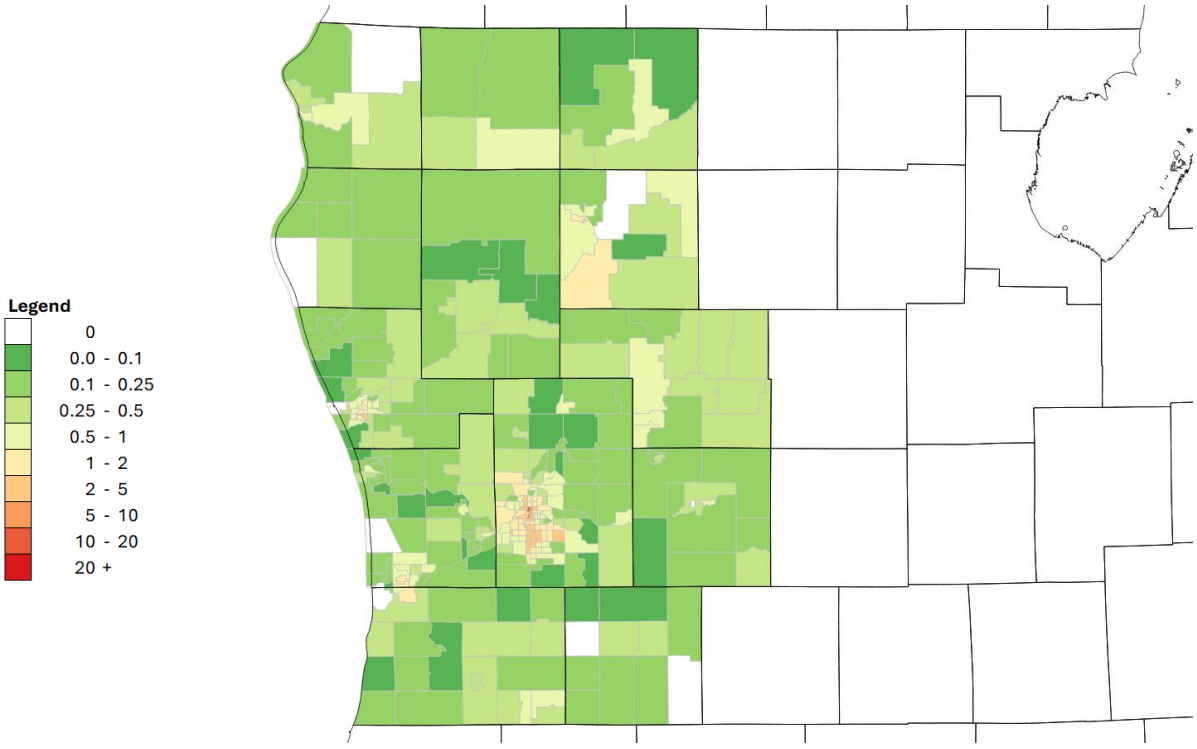

Figure 31 - Grand Region, Average Yearly Pedestrian Crashes per 1,000 Residents

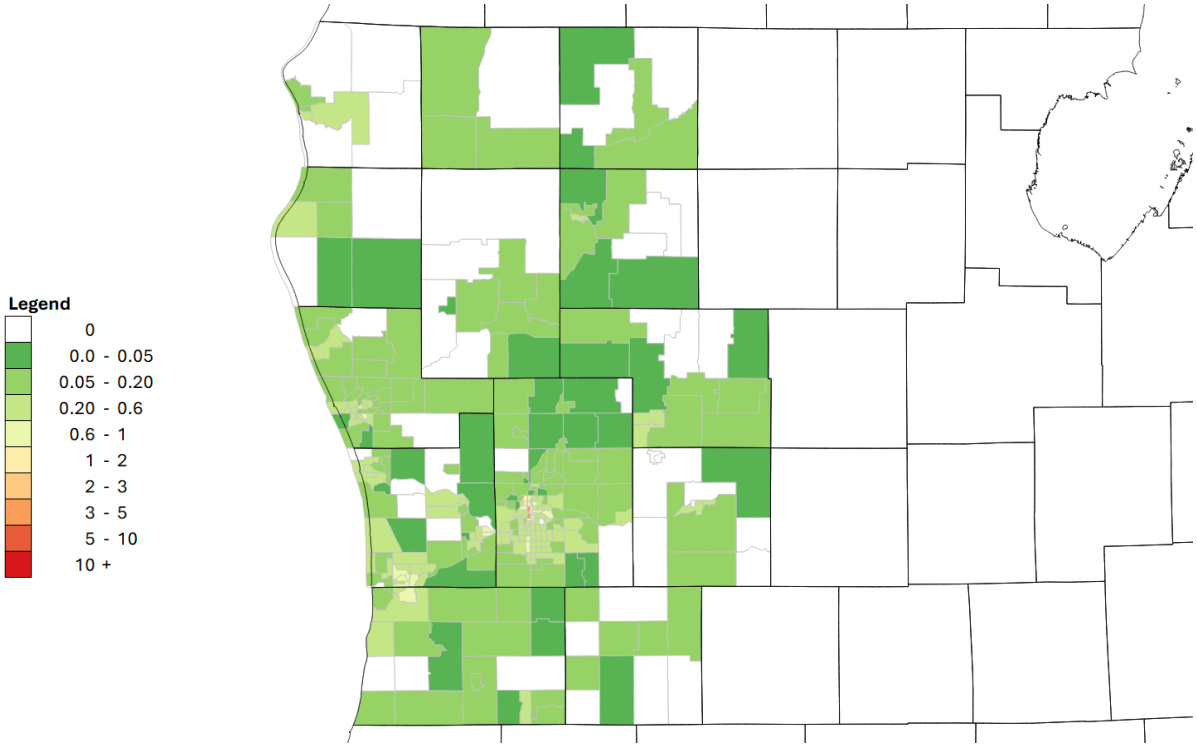

Figure 32 - Grand Region, Average Yearly Bicycle Crashes per 1,000 Residents

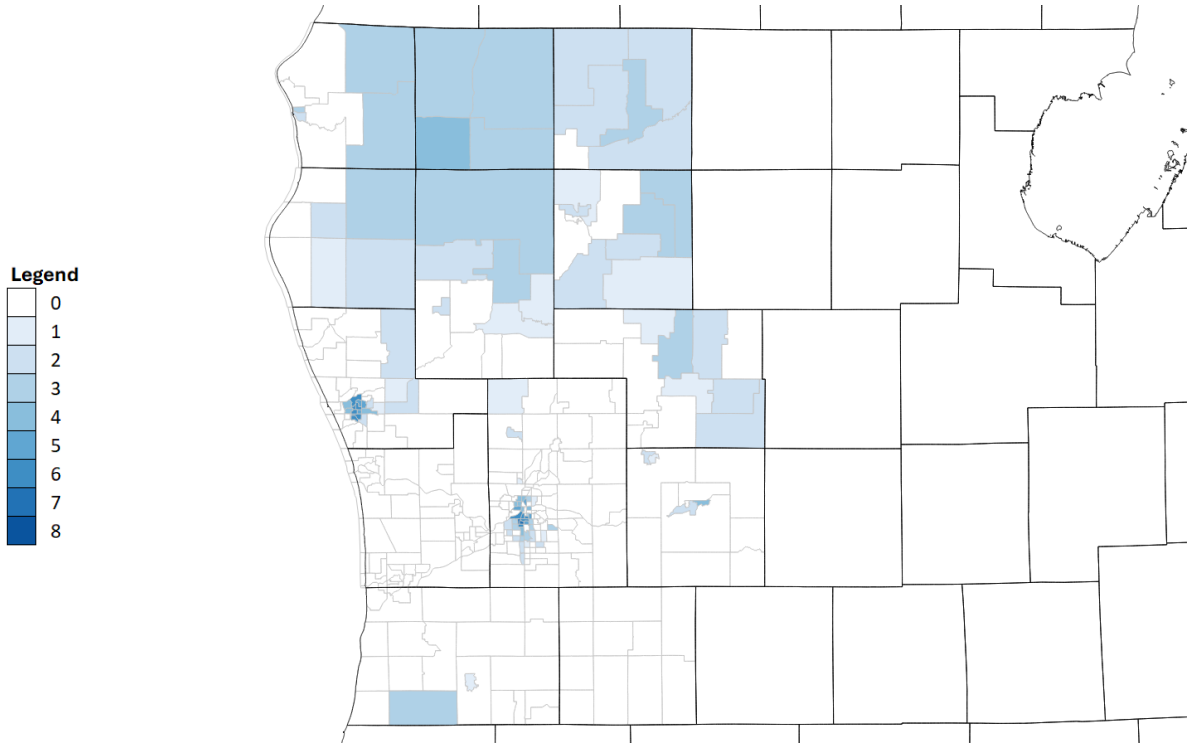

Figure 33 – Grand Region, Total Disadvantaged Categories Exceeded by Census Tract

Grand Region has 331 census tracts, ranging from zero (0) to 39.4 pedestrian crashes per year, with an average of 2.93. At 39.4 crashes, Grand Region has the census tract with the highest number of average pedestrian crashes in the state. Ten (10) reported zero crashes (3.0 percent). Kent County has the fourteen (14) highest tracts in the region, as well as 55 of the highest 66.

With regards to bicycle crashes, Grand Region ranges from zero (0) to 6.8 reported crashes per year, averaging 1.02. 48 tracts reported zero (0) crashes (14.5 percent). Kent and Ottawa Counties each have five (5) of the top ten (10), with the highest tract in Kent County.

Per 1,000 residents, Grand Region averages 0.71 pedestrian crashes per 1,000 residents, ranging from zero (0) to 17.51. For bicycle crashes, the average is 0.24, with a range of 0.0 to 3.31.

100 tracts in Grand Region are identified as disadvantaged per the CEJST data. These tracts average 1.29 pedestrian crashes per 1,000 residents and 0.33 bicycle crashes.

Bay Region

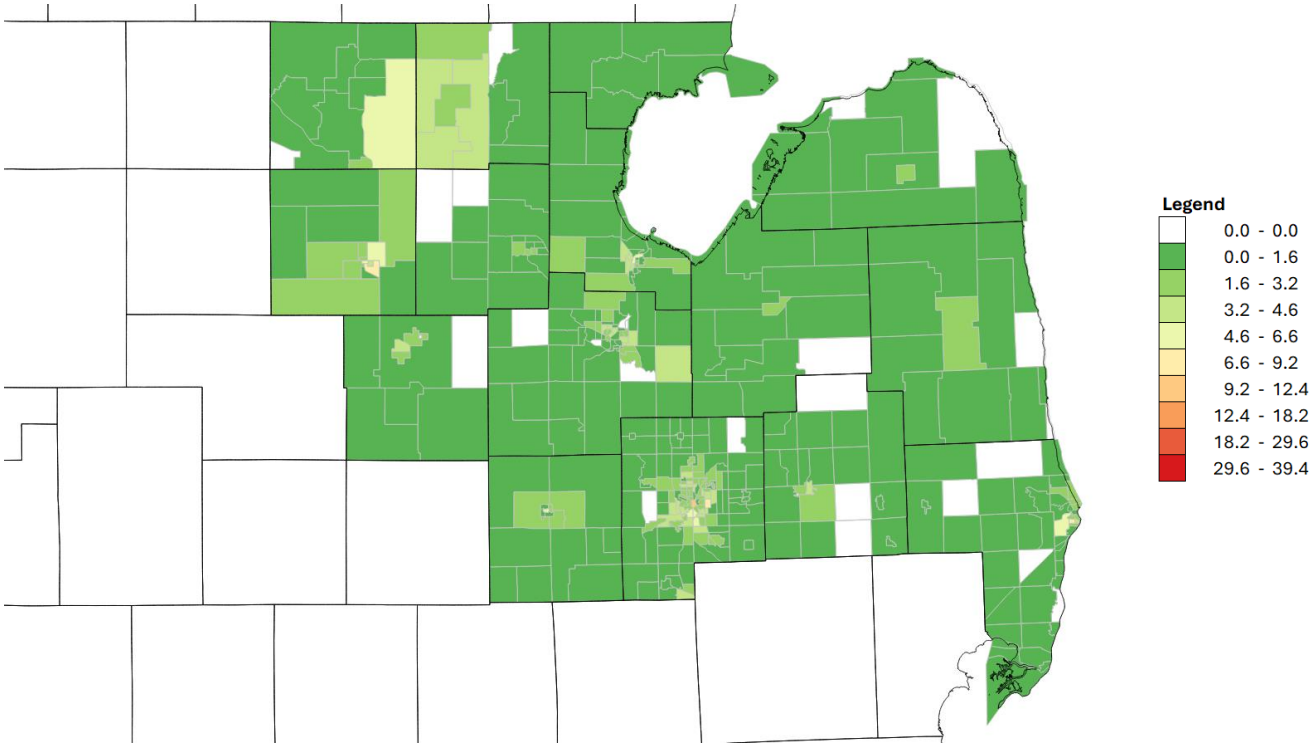

Figure 34 - Bay Region, Average Yearly Pedestrian Crashes by Census Tract

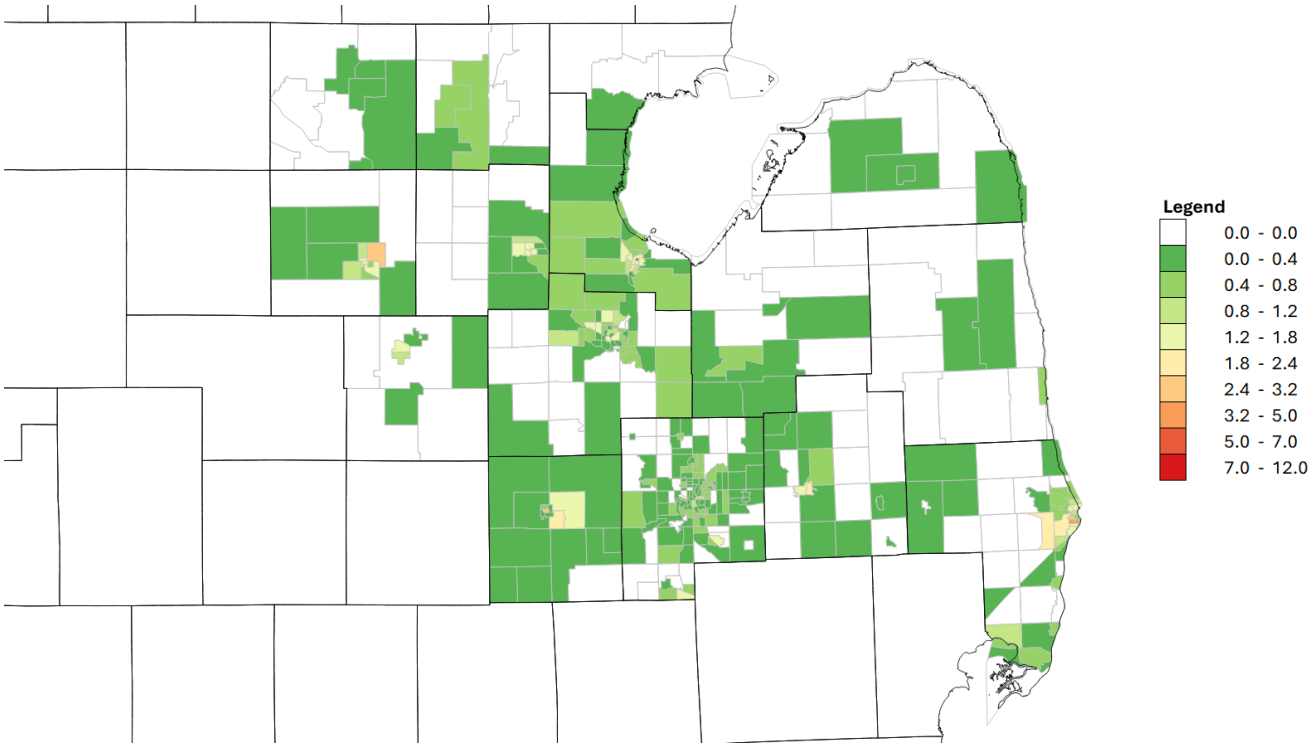

Figure 35 - Bay Region, Average Yearly Bicycle Crashes by Census Tract

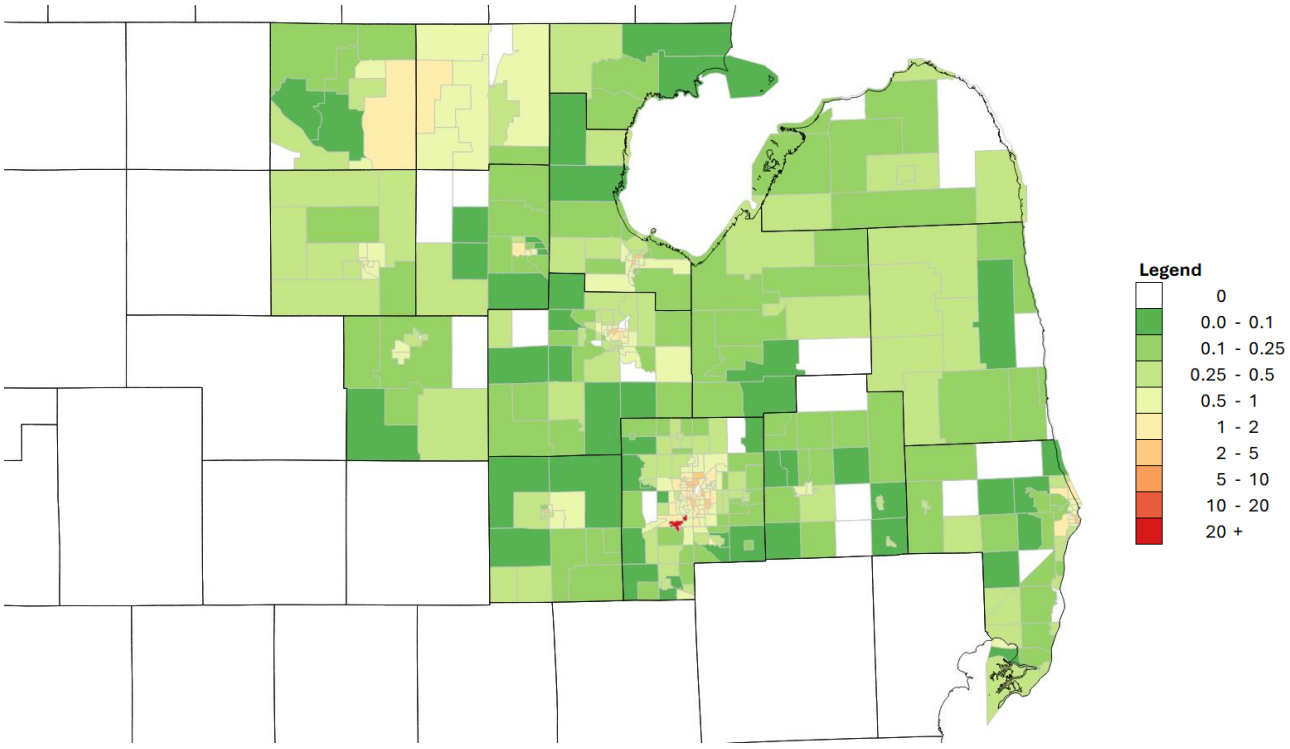

Figure 36 - Bay Region, Average Yearly Pedestrian Crashes per 1,000 Residents by Census Tract

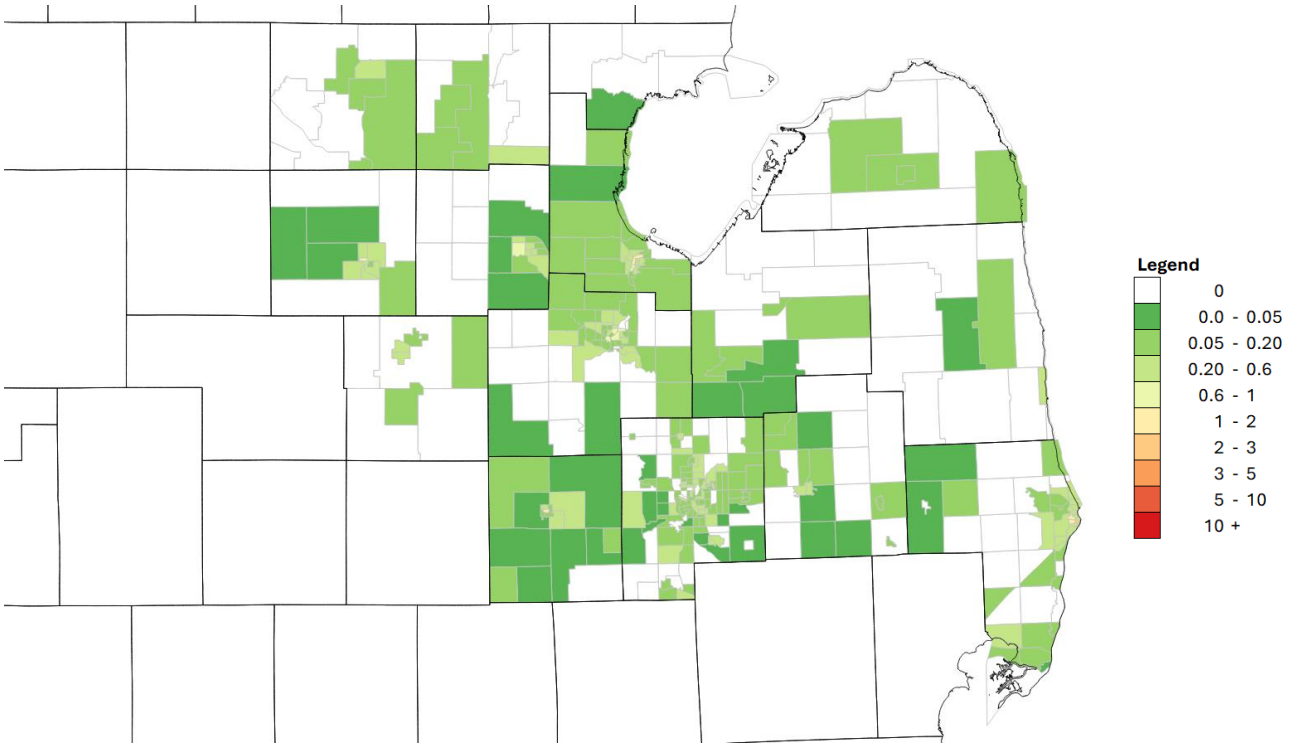

Figure 37 - Bay Region, Average Yearly Bicycle Crashes per 1,000 Residents by Census Tract

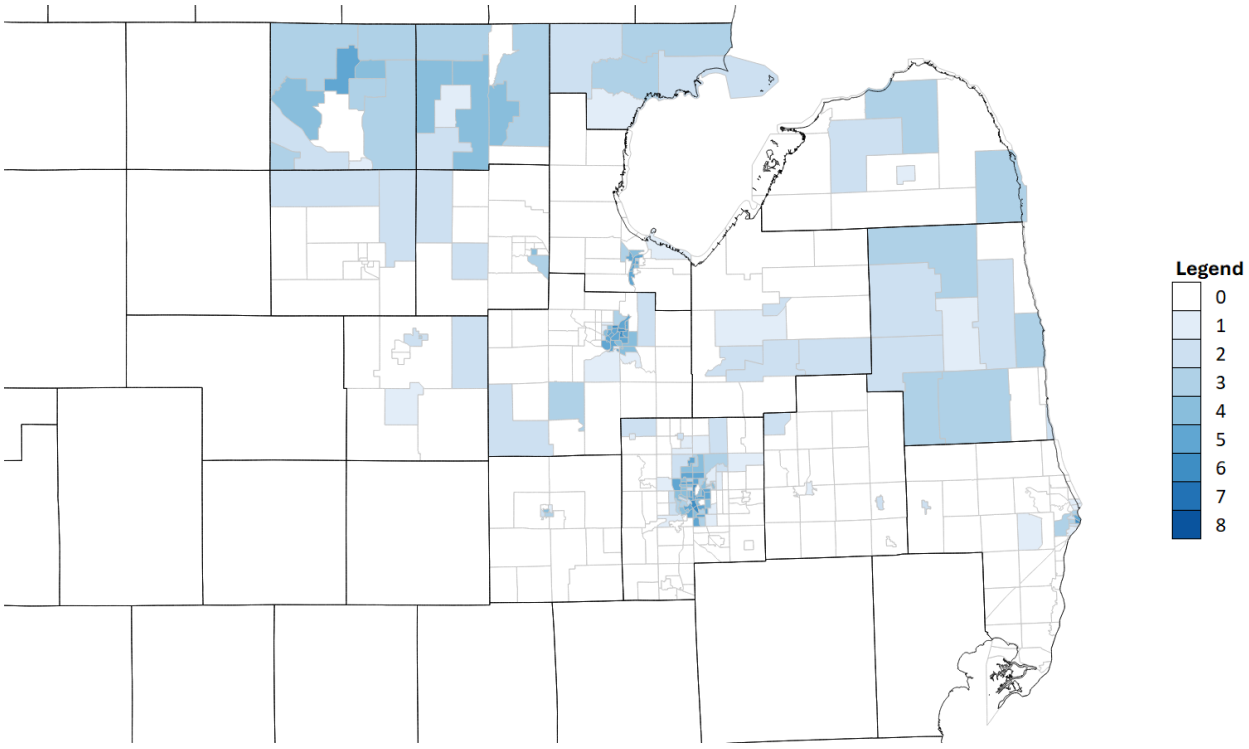

Figure 38 – Bay Region, Total Disadvantaged Categories Exceeded by Census Tract

Bay Region has 409 census tracts, ranging from zero (0) to 11.2 pedestrian crashes per year, with an average of 1.52. Twenty-six (26) reported zero crashes (6.4 percent). Genesee County has the two (2) highest tracts in the region (and three (3) of the highest ten (10)), Isabella County also has three (3) and St. Clair County has two (2).

With regards to bicycle crashes, Bay Region ranges from zero (0) to 4.8 reported crashes per year, averaging 0.44. 123 tracts reported zero (0) crashes (30.1 percent). St. Clair County has four (4) of the top ten (10) tracts, including the highest three (3).

Per 1,000 residents, Bay Region averages 0.62 pedestrian crashes per 1,000 residents, ranging from zero (0) to 42.86. For bicycle crashes, the average is 0.14, with a range of 0.0 to 2.53.

177 tracts in Bay Region are identified as disadvantaged per the CEJST data. These tracts average 0.83 pedestrian crashes per 1,000 residents and 0.20 bicycle crashes.

Southwest Region

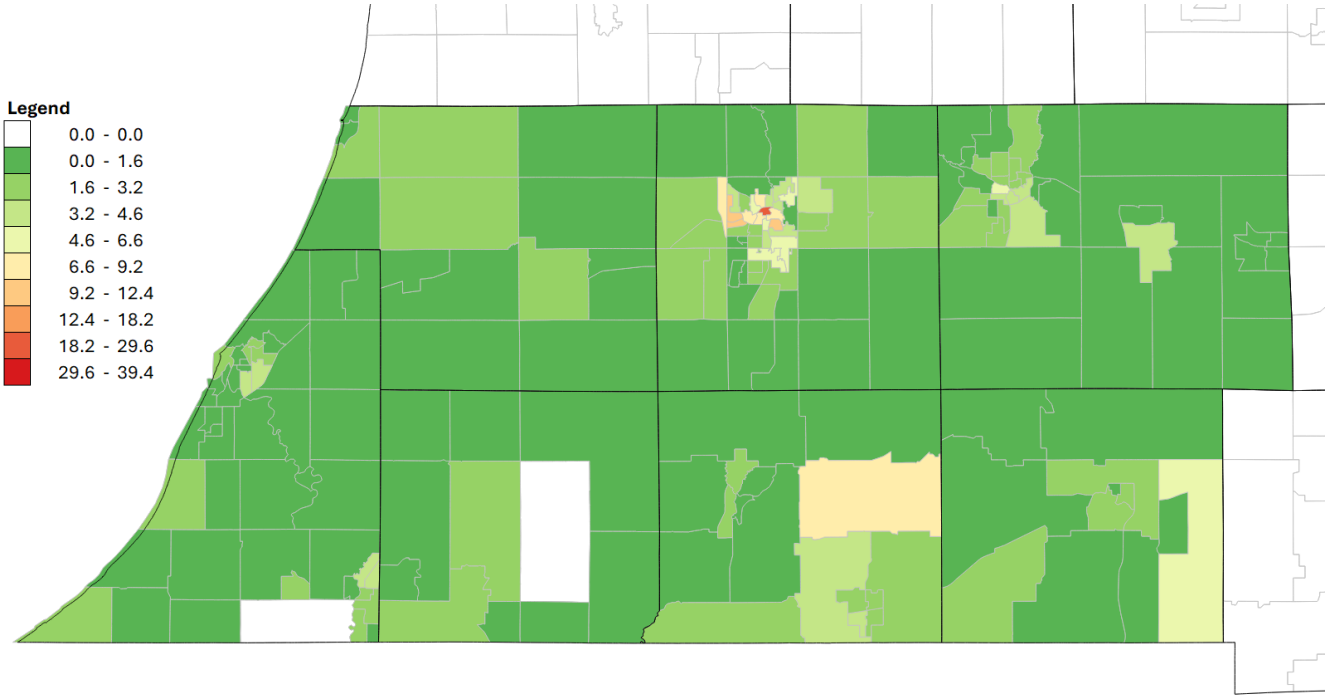

Figure 39 - Southwest Region, Average Yearly Pedestrian Crashes by Census Tract

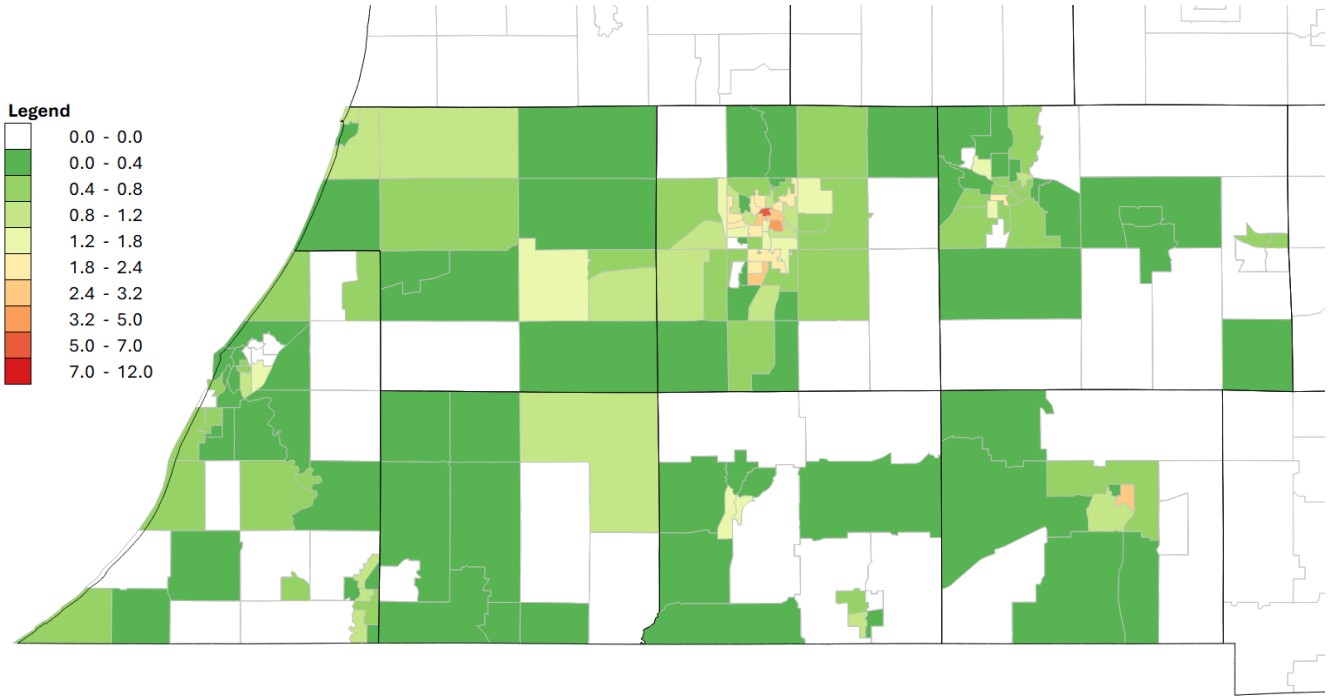

Figure 40 - Southwest Region, Average Yearly Bicycle Crashes by Census Tract

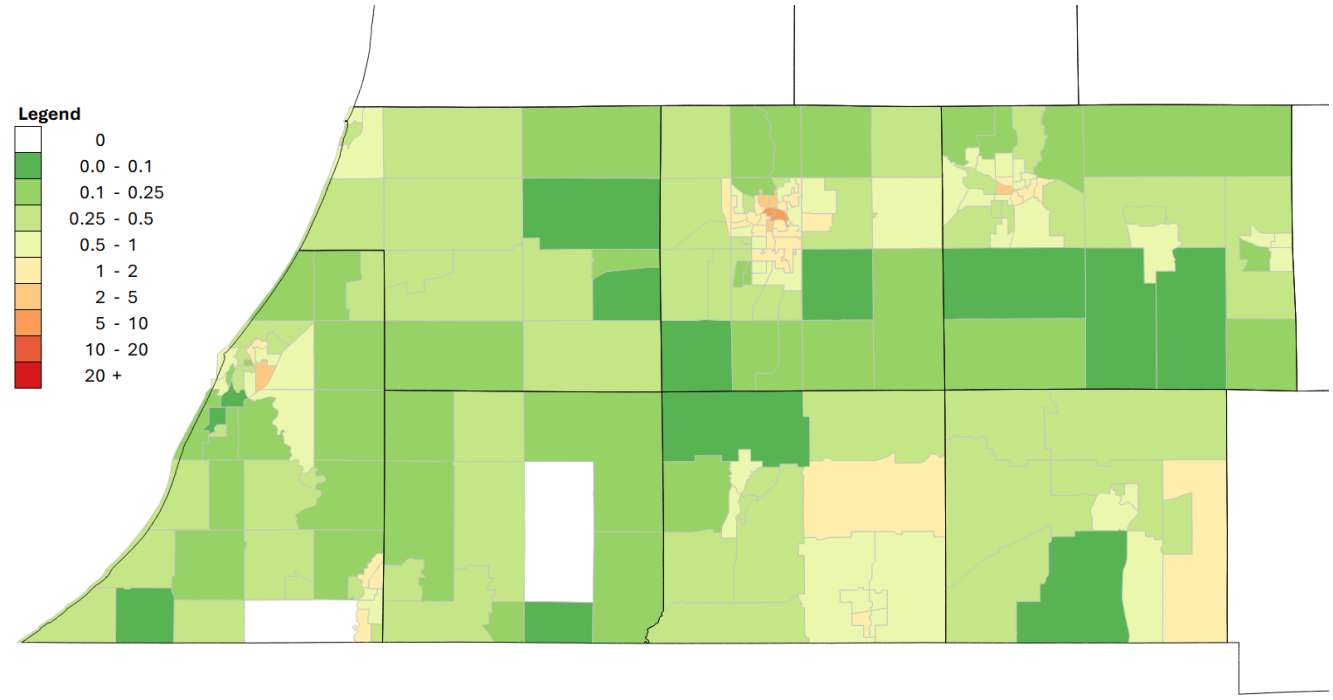

Figure 41 - Southwest Region, Average Yearly Pedestrian Crashes per 1,000 Residents by Census Tract

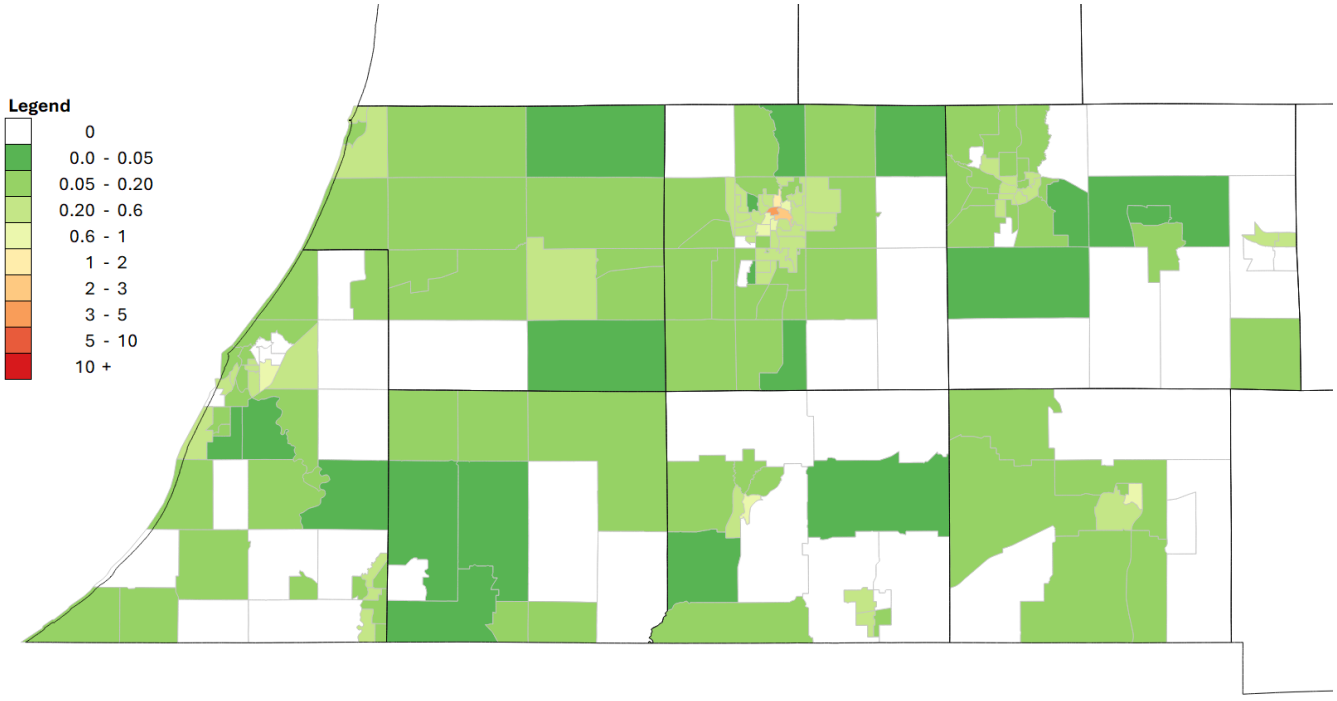

Figure 42 - Southwest Region, Average Yearly Bicycle Crashes per 1,000 Residents by Census Tract

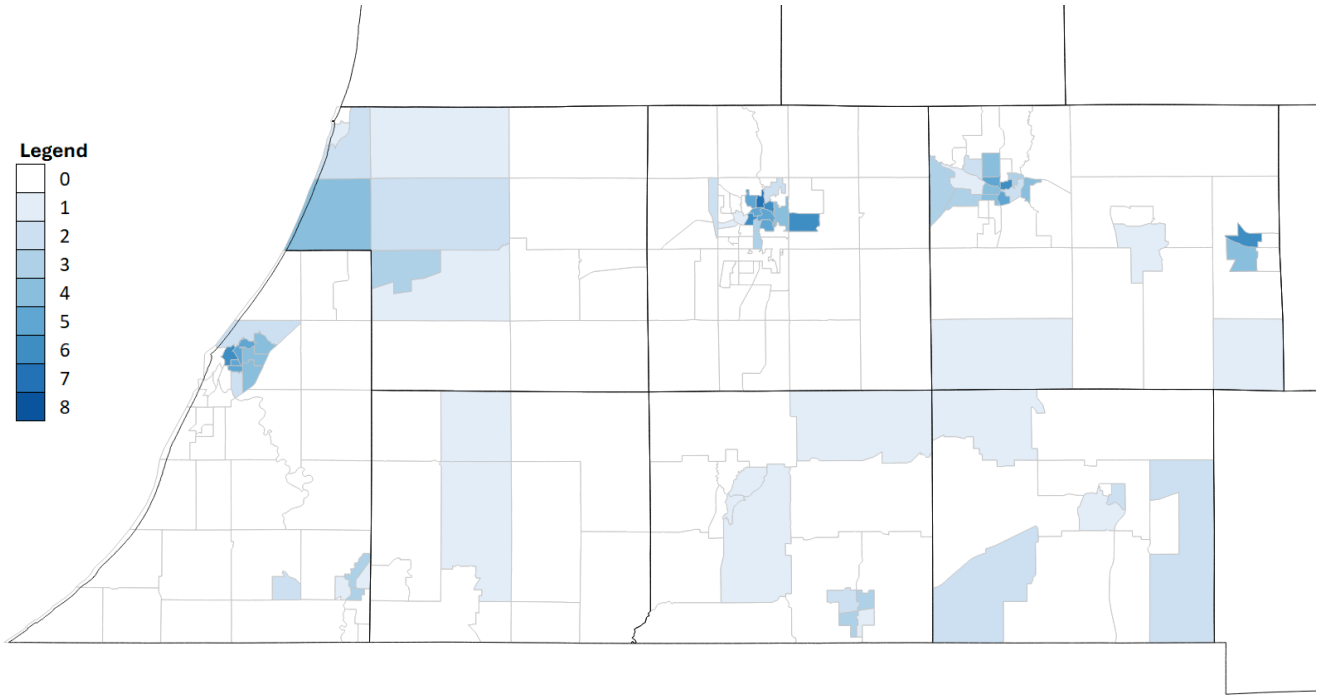

Figure 43 - Southwest Region, Total Disadvantaged Categories Exceeded by Census Tract

Southwest Region has 199 census tracts, ranging from zero (0) to 21.6 pedestrian crashes per year, with an average of 2.20. Only two (2) reported zero crashes (1.0 percent). Kalamazoo County has the nine (9) highest tracts in the region (and fourteen (14) of the highest sixteen (16)).

With regards to bicycle crashes, Southwest Region ranges from zero (0) to 7.0 reported crashes per year, averaging 0.65. 43 tracts reported zero (0) crashes (21.6 percent). Kalamazoo County has the three (3) highest tracts (and sixteen (16) of the highest eighteen (18) tracts.

Per 1,000 residents, Southwest Region averages 0.65 pedestrian crashes per 1,000 residents, ranging from zero (0) to 9.95. For bicycle crashes, the average is 0.20, with a range of 0.0 to 3.22.

69 tracts in Southwest Region are identified as disadvantaged per the CEJST data. These tracts average 1.13 pedestrian crashes per 1,000 residents and 0.33 bicycle crashes.

University Region

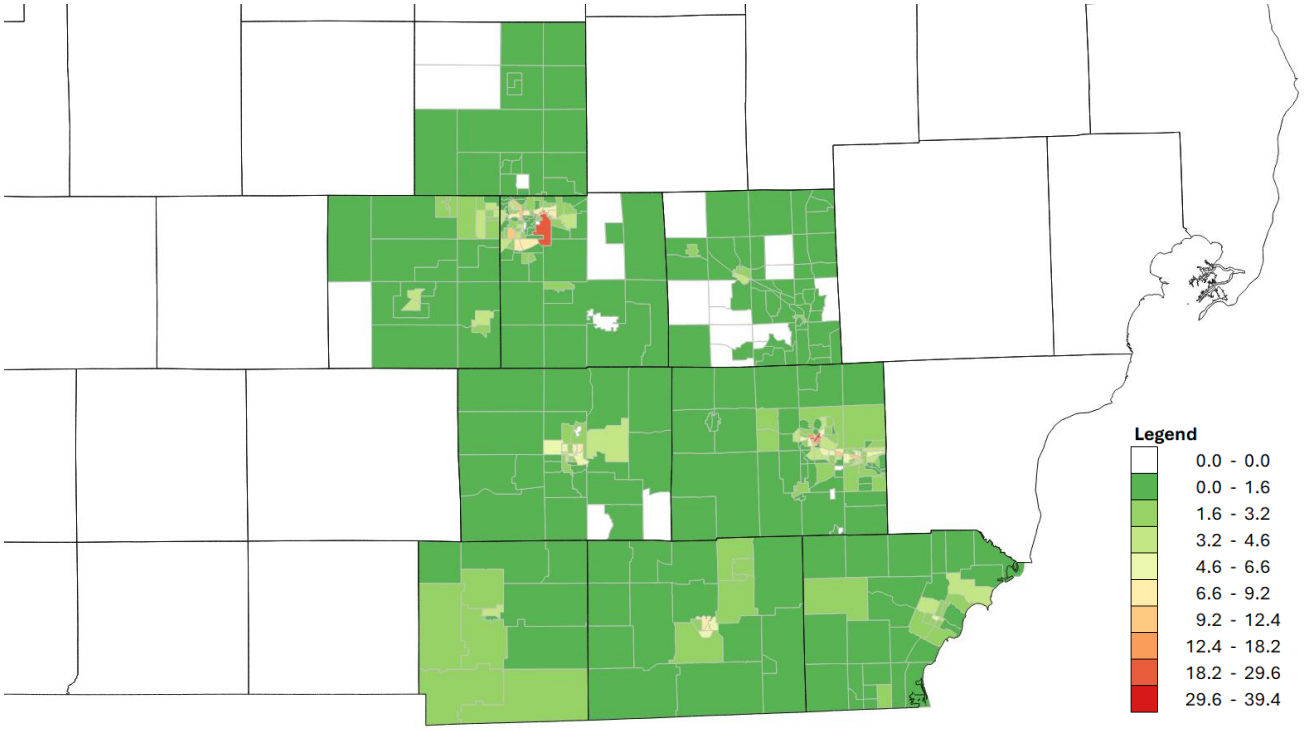

Figure 44 - University Region, Average Yearly Pedestrian Crashes by Census Tract

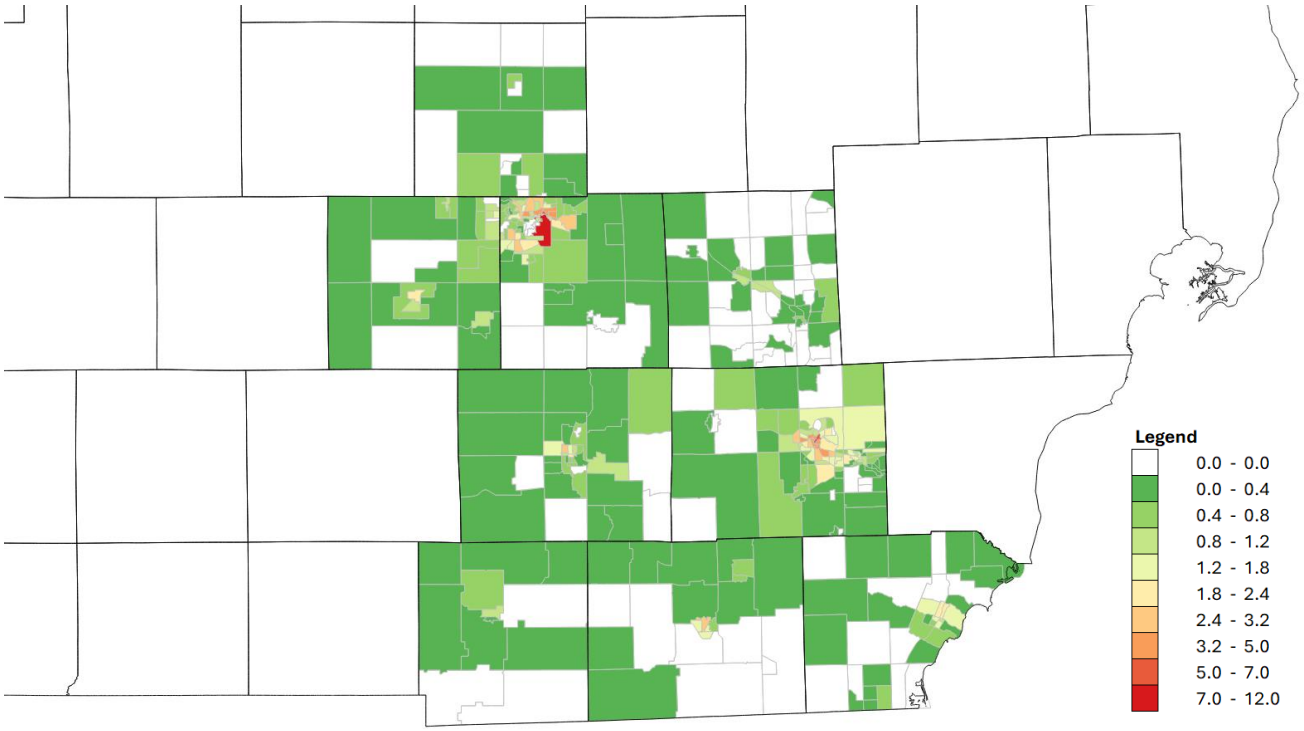

Figure 45 - University Region, Average Yearly Bicycle Crashes by Census Tract

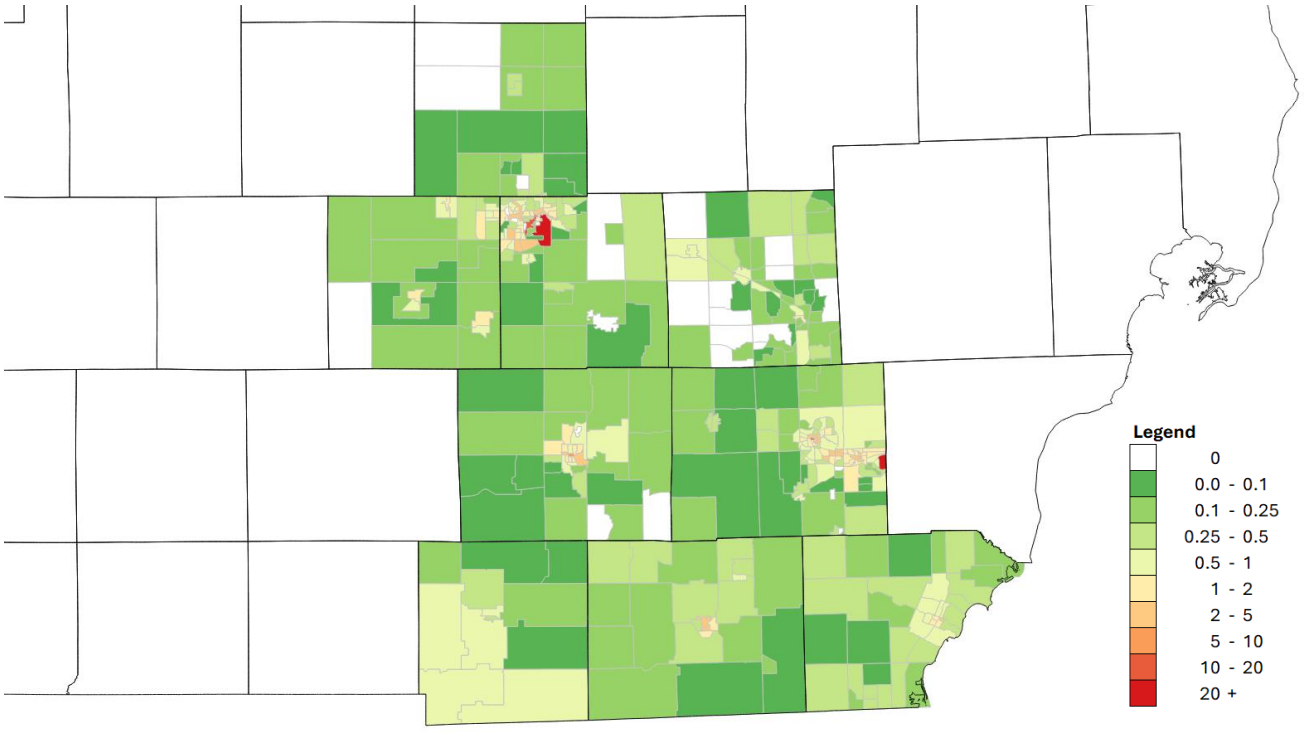

Figure 46 - University Region, Average Yearly Pedestrian Crashes per 1,000 Residents by Census Tract

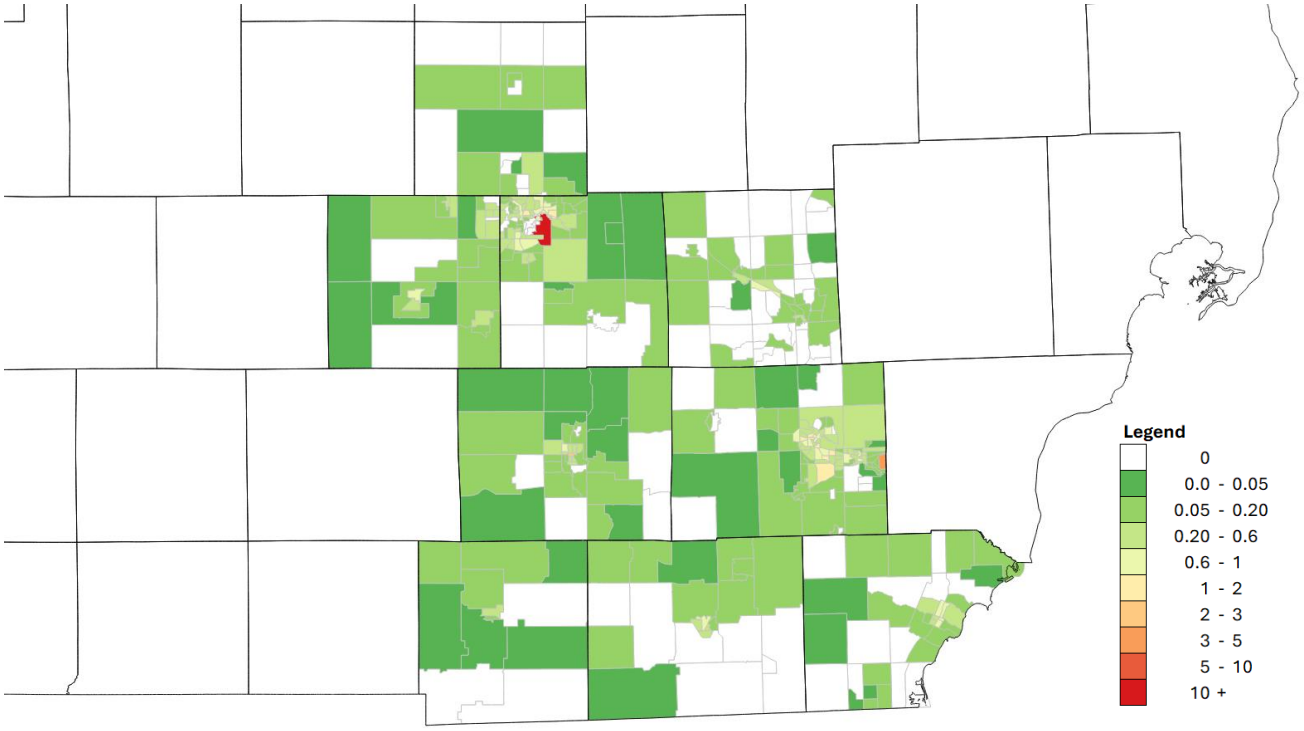

Figure 47 - University Region, Average Yearly Bicycle Crashes per 1,000 Residents by Census Tract

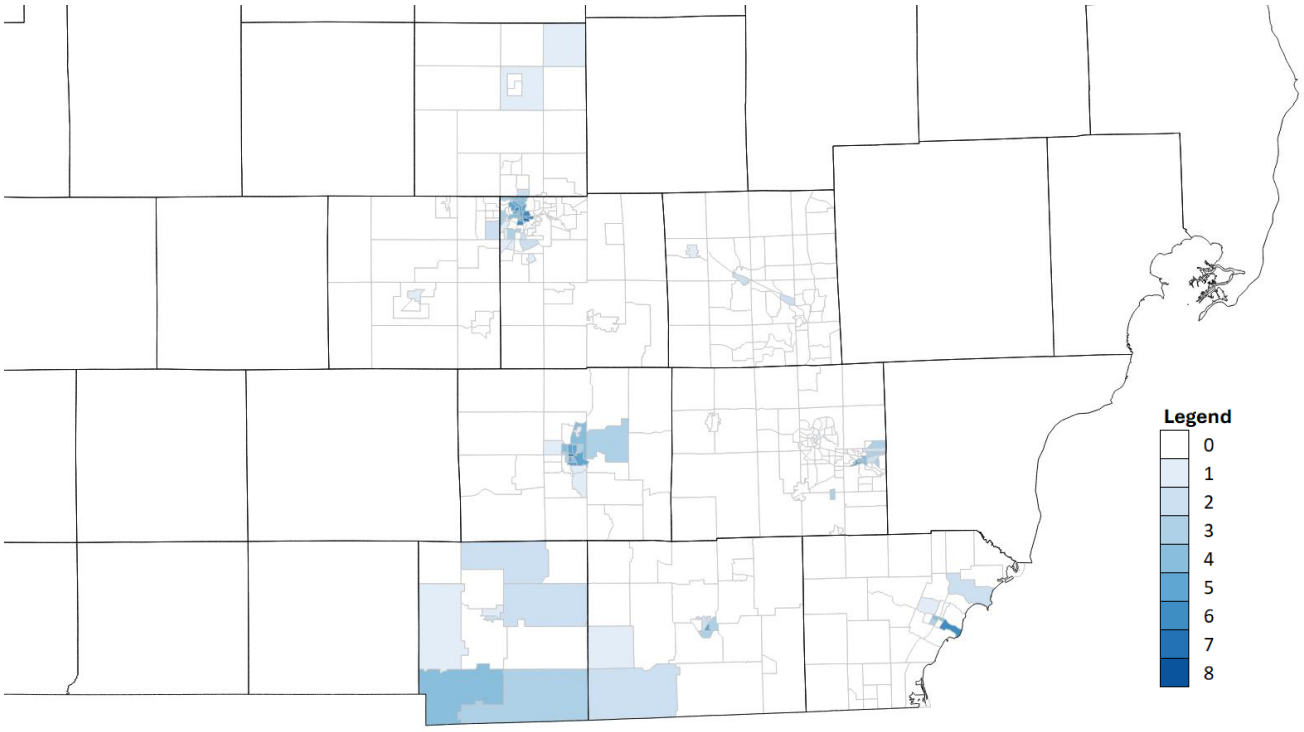

Figure 48 - University Region, Total Disadvantaged Categories Exceeded by Census Tract

University Region has 403 census tracts, ranging from zero (0) to 29.6 pedestrian crashes per year, with an average of 2.18. Only 25 reported zero crashes (6.2 percent). Washtenaw County has the two (2) highest tracts in the region (and eight (8) of the highest fifteen (15)), while Ingham County holds the other seven (7).

With regards to bicycle crashes, University Region ranges from zero (0) to 12.0 reported crashes per year, averaging 0.76. 96 tracts reported zero (0) crashes (23.8 percent). Ingham County has the two (2) highest tracts (and seven (7) of the highest seventeen (17) tracts), while Washtenaw County has the other ten (10) highest.

Per 1,000 residents, University Region averages 0.71 pedestrian crashes per 1,000 residents, ranging from zero (0) to 28.28. For bicycle crashes, the average is 0.27, with a range of 0.0 to 13.68.

80 tracts in University Region are identified as disadvantaged per the CEJST data. These tracts average 1.16 pedestrian crashes per 1,000 residents and 0.34 bicycle crashes.

Metro Region

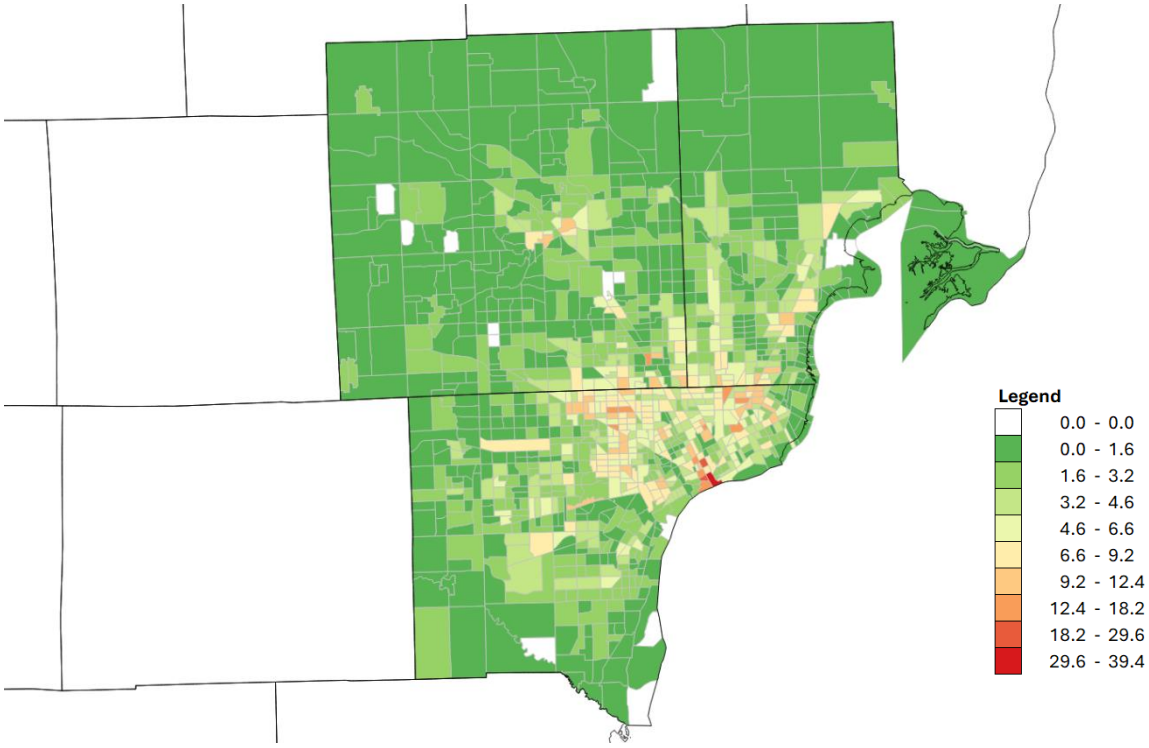

Figure 49 - Metro Region, Average Yearly Pedestrian Crashes by Census Tract

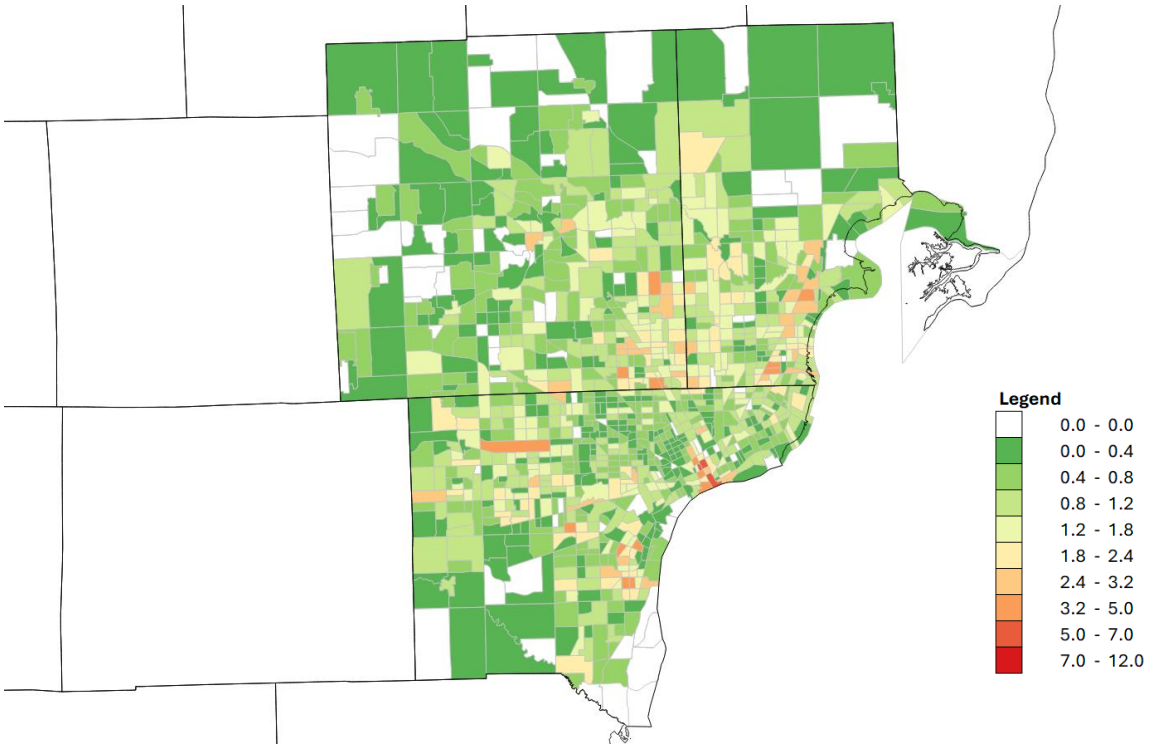

Figure 50 - Metro Region, Average Yearly Bicycle Crashes by Census Tract

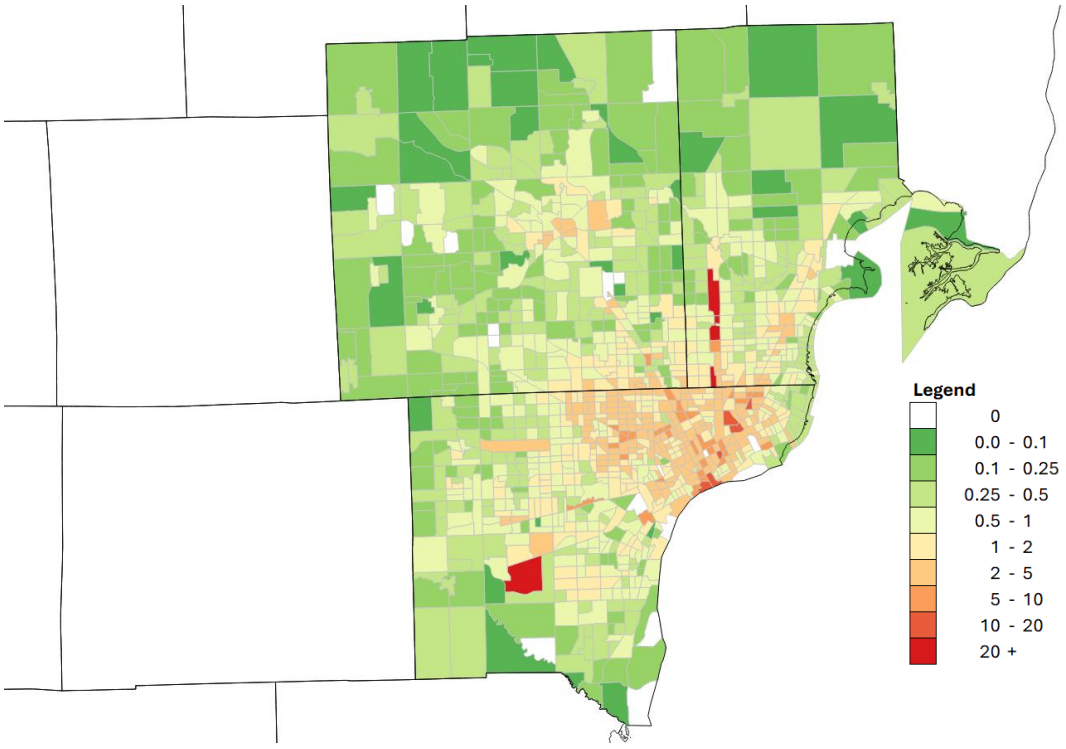

Figure 51 - Metro Region, Average Yearly Pedestrian Crashes per 1,000 Residents by Census Tract

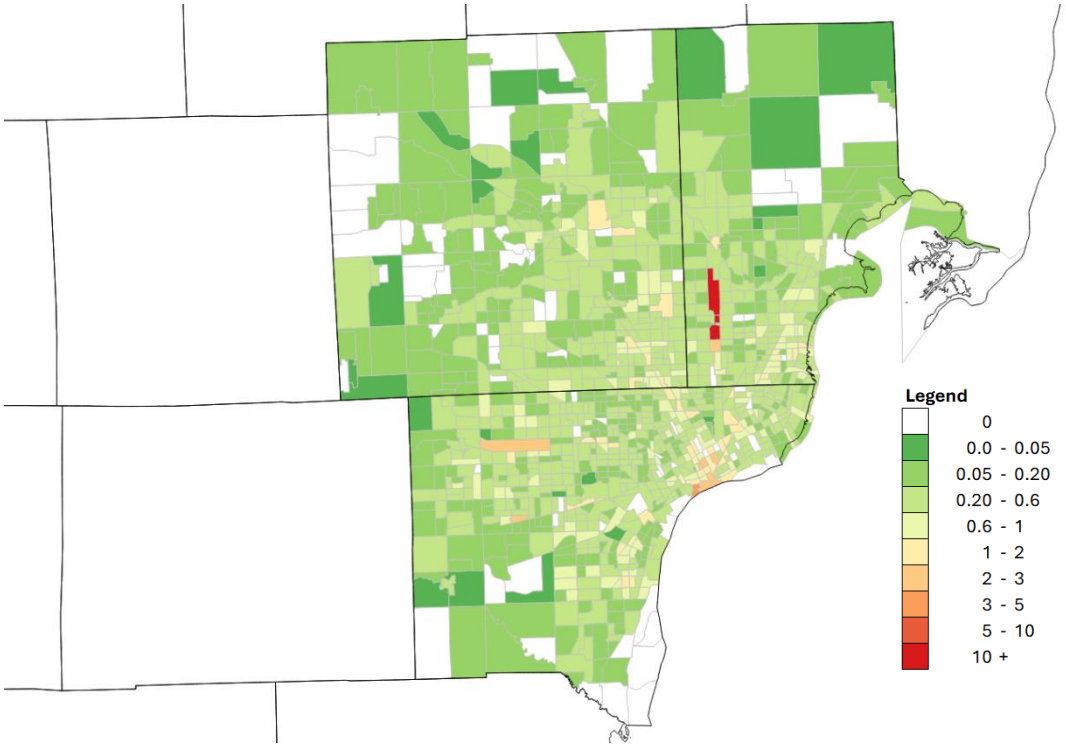

Figure 52 - Metro Region, Average Yearly Bicycle Crashes per 1,000 Residents by Census Tract

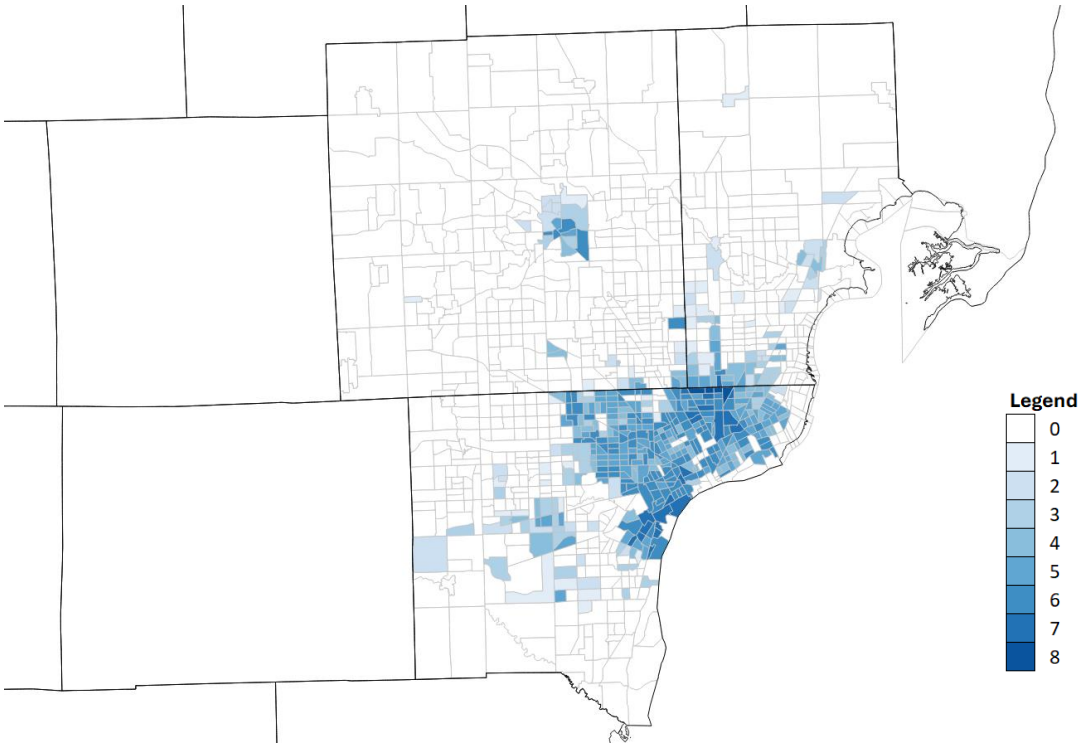

Figure 53 - Metro Region, Total Disadvantaged Categories Exceeded by Census Tract

Metro Region has 1,166 census tracts (42.1 percent of all tracts in the state), ranging from zero (0) to 38.4 pedestrian crashes per year, with an average of 3.19. Only 12 reported zero crashes (1.0 percent). Wayne County has the nine (9) highest tracts in the region (and twenty (20) of the highest 21).

With regards to bicycle crashes, Metro Region ranges from zero (0) to 6.8 reported crashes per year, averaging 0.96. 82 tracts reported zero (0) crashes (7.0 percent). Wayne County has the four (4) highest tracts (and ten (10) of the highest thirteen (13) tracts), while Oakland County has the other four (4) highest.

Per 1,000 residents, Metro Region averages 2.06 pedestrian crashes per 1,000 residents, ranging from zero (0) to 51.92. For bicycle crashes, the average is 0.36, with a range of 0.0 to 19.23.

453 tracts in Metro Region are identified as disadvantaged per the CEJST data. These tracts average 2.34 pedestrian crashes per 1,000 residents and 0.45 bicycle crashes.

STRATEGIES AND COUNTERMEASURES

Strategies may be implemented to affect various crash types and at various identified high-risk locations along the transportation network. Strategies may include countermeasures that make physical improvements to the roadways or policies aimed at effecting changes to funding, education, and public awareness. These are aimed at all five pillars of the Safe System Approach: Safe Road Users, Save Vehicles, Safe Speeds, Safe Roads, and Post-Crash Care.

Policies may require a coordinated effort to enact, with partners including Michigan's Executive, Legislative, and Judiciary bodies, as well as agencies including law enforcement (such as the Michigan State Police and local police forces), Metropolitan Planning Organizations (MPO), and engineering (such as the Michigan Department of Transportation).

These suggested strategies have been reviewed from various documents including Michigan and other states' Strategic Highway Safety Plans, Vision Zero Plans, and assessments. A list of strategies is in Table 15, while a list of potential countermeasures is included in Appendix B – VRU Countermeasures.

Table 15 - Potential Strategies and Policies Affecting Vulnerable Road Users

Program Area	Suggested Strategies and Policies
Program Management	Increase the rate at which Section 405(h) funds are being expended through the provision of proven countermeasures and the identification of funding sources that grantees can use to meet the 20 percent match requirement.
	Revise the UD-10 crash report form to reflect the current Model Minimum Uniform Crash Criteria data elements related to non-motorists.
Multidisciplinary Involvement	Work with the Governor's Traffic Safety Advisory Commission's Communications Committee to identify a strategy for promoting pedestrian and bicyclist safety statewide.
Legislation, Regulation and Policy	Incorporate the full pedestrian and bicyclist safety guidance of the Uniform Vehicle Code into the Michigan Vehicle Code and preempt conflicting local pedestrian and bicyclist safety ordinances to the Michigan Vehicle Code.
	Adopt legislation requiring the use of approved bicycle helmets by bicyclists 16 years of age or younger.
	Adopt legislation requiring a driver to yield to pedestrians legally crossing the roadway at other than signalized intersections.
	Adopt legislation prohibiting the riding of a bicycle while under the influence of drugs or alcohol.
	Review policies for setting speed limits and consider alternative methods such as USLIMITS2 that work in conjunction with state law.
Law Enforcement	Incorporate the full pedestrian and bicyclist safety guidance of the Uniform Vehicle Code into the Michigan Vehicle Code and preempt

Program Area	Suggested Strategies and Policies
	conflicting local pedestrian and bicyclist safety ordinances to the Michigan Vehicle Code.
	Give as much emphasis to pedestrian education and enforcement as is currently given to bicycle education and enforcement.
	Reinstitute the Law Enforcement Liaison program to promote traffic safety initiatives with emphasis on pedestrian and bicyclist safety.
Highway and Traffic Engineering	Conduct pedestrian and bicyclist Road Safety Audits.
	Identify and implement smart work zone technologies to reduce vehicle intrusion into active work zones and improve the safety of construction staff and the motoring public.
	Encourage roadway agencies to utilize the findings of the crash analysis in the identification and implementation of VRU improvement projects on their roadway network.
	Encourage roadway agencies to utilize the Pedestrian and Bicycle Safety Models for Michigan to predict high-risk areas for non-motorized users in their jurisdiction.
	Train local governments on the use of National Association of City Transportation Officials guidelines for the design of bicycle infrastructure facilities.
Technology	Support legislation and research into vehicle technologies which improve detection of vulnerable road users and either inform the driver or automatically take steps to reduce the likelihood of a collision.
	Implement V2X technologies that inform pedestrians and bicyclist of proximity to vehicles.
	Adopt traffic signal policies that prioritize vulnerable road users such as Leading Pedestrian Intervals and video detection.
Communication Program	Task the Office of Highway Safety Planning with developing and implementing a statewide, branded pedestrian and bicyclist safety campaign that allows for customization to accommodate local needs.
Outreach Program	Task the Office of Highway Safety Planning with developing and implementing a statewide, branded pedestrian and bicyclist safety campaign that allows for customization to accommodate local needs.
Driver Education and Licensing	Increase the number of classroom hours for driver education to align with the current Novice Teen Driver Education and Training Administrative Standards.
Evaluation Program	Revise the UD-10 crash report form to reflect the current Model Minimum Uniform Crash Criteria data elements related to non-motorists.
	Continue to evaluate changes and update manuals, guidance, and other documents to reflect an emphasis on multimodal planning, design, Complete Streets, and Vulnerable Road Users.
	MDOT to evaluate the locations of concern as identified by Western Michigan University for possible improvements.

Program Area	Suggested Strategies and Policies
	Integrate available traffic records data to support problem identification, strategic planning, resource deployment, public education and injury prevention efforts related to pedestrian and bicyclist injuries.
Emergency Medical Services	Dedicate funding to provide for the continued development of Michigan's trauma system.
	Integrate Emergency Medical Services and Trauma Registry information with crash data and hospital discharge data to support problem identification, strategic planning, resource deployment, public education and injury prevention efforts related to pedestrian and bicyclist injuries.
	Evaluate hospital and emergency center locations particularly in light of rural hospital closures.

CONCLUSIONS AND RECOMMENDATIONS

The preceding section delved into where and when crashes occurred, and what factors were associated with the increased number of crashes and pointed to high-risk areas to focus on with heightened emphasis.

Focused improvements on arterial roadways are likely to have the greatest impact on reducing the number of pedestrian and bicycle crashes in Michigan, as **principal and minor arterials represent 10.5 percent of centerline miles and 53.3 percent of pedestrian crashes and 49.4 percent of bicycle crashes.**

The volume of traffic and its proximity is correlated with an increased number of pedestrian and bicycle crashes.

Areas with high unemployment and large numbers of individuals far below the Federal Poverty Line have higher numbers of pedestrian and bicycle crashes per capita. Higher median household incomes and higher values of owner-occupied housing units are linked to lower pedestrian crashes per capita.

Census tracts that exceed four (4) or more threshold categories have 3.9 times higher pedestrian crashes per capita than those with three (3) or fewer, as well as 2.2 times higher bicycle crashes per capita.

The ten (10) percent of census tracts with the highest number of pedestrian crashes account for 12,768 pedestrian crashes between the years of 2018 and 2022 (50.4 percent of the 25,342 total pedestrian crashes during that time). These census tracts contain 3.5 percent of the state's total mileage of public roadways, and only 1.4 percent of the state's centerline miles of interstates, freeways, and arterials.

Future data collection efforts that collect the number of lanes and traffic volumes for each facility will aid in predicting crashes – as well as the potential effects of various countermeasures – using tools such as the Highway Safety Manual.

High-risk locations beyond those identified by Western Michigan University solely based on crash concentrations, will be identified through future outreach and engagement. These locations shall consider the identified variables and characteristics in this assessment which have an influence on VRU crash occurrence and at locations which resonant with local communities.

Countermeasures, strategies, and policies may be implemented aimed at reducing the frequency and severity of crashes, and particularly those impacting vulnerable road users.

The ultimate goal of Michigan's Towards Zero Deaths initiative is to eliminate fatalities and serious injuries on Michigan's roadways. The continual progress in reducing the frequency and severity of crashes will be monitored for progress.

APPENDIX A – VRU CRASHES BY BY COUNTY

Pedestrian Crashes, 2018-2022						Bicycle Crashes, 2018-2022			
Rank	County	Yearly Avg. Crashes	County	Crashes Per 1,000 Residents		County	Yearly Avg. Crashes	County	Crashes Per 1,000 Residents
1	Wayne	1,428.8	Wayne	0.811		Wayne	330.2	Ingham	0.237
2	Oakland	433.2	Kent	0.623		Oakland	166.8	Grand Traverse	0.233
3	Kent	400.8	Gladwin	0.593		Macomb	140.2	Ottawa	0.203
4	Macomb	350.2	Ingham	0.590		Kent	120.4	Washtenaw	0.197
5	Washtenaw	203.4	Kalamazoo	0.576		Washtenaw	72.0	Alpena	0.189
6	Genesee	176.2	Washtenaw	0.556		Ingham	68.6	Kalamazoo	0.188
7	Ingham	170.8	St. Joseph	0.493		Ottawa	57.6	Wayne	0.187
8	Kalamazoo	150.6	Mecosta	0.481		Kalamazoo	49.2	Kent	0.187
9	Ottawa	75.6	Genesee	0.430		Genesee	31.4	Macomb	0.161
10	Saginaw	65.0	Calhoun	0.428		St. Clair	24.2	Delta	0.155
11	Muskegon	59.4	Macomb	0.403		Muskegon	23.0	St. Clair	0.152
12	Berrien	57.8	Isabella	0.401		Grand Traverse	21.4	Marquette	0.143
13	Calhoun	57.6	Bay	0.397		Saginaw	20.2	Bay	0.139
14	Jackson	57.2	Wexford	0.393		Jackson	17.2	Oakland	0.133
15	Monroe	47.6	Grand Traverse	0.386		Berrien	15.8	Emmet	0.133
16	St. Clair	45.4	Berrien	0.373		Bay	14.6	Muskegon	0.133
17	Bay	41.6	Branch	0.367		Monroe	14.4	Isabella	0.124
18	Grand Traverse	35.4	Jackson	0.360		Calhoun	13.8	Wexford	0.121
19	Lenawee	35.2	Clare	0.359		Allegan	13.0	Branch	0.119
20	Eaton	34.6	Lenawee	0.357		Eaton	12.4	Van Buren	0.117
21	St. Joseph	30.0	Hillsdale	0.349		Lenawee	10.0	Eaton	0.114
22	Livingston	30.0	Oakland	0.346		Marquette	9.6	Allegan	0.113
23	Allegan	29.0	Montcalm	0.345		Isabella	8.8	Shiawassee	0.111
24	Isabella	28.4	Muskegon	0.343		Van Buren	8.8	Iosco	0.111
25	Marquette	22.0	Saginaw	0.337		Shiawassee	7.6	Jackson	0.108
26	Montcalm	21.8	Marquette	0.329		Midland	7.6	Saginaw	0.105
27	Mecosta	20.8	Monroe	0.318		Livingston	7.6	Calhoun	0.103
28	Van Buren	20.4	Eaton	0.317		St. Joseph	5.8	Berrien	0.102
29	Shiawassee	19.8	Mason	0.305		Lapeer	5.8	Lenawee	0.102
30	Branch	16.0	Shiawassee	0.289		Delta	5.6	Roscommon	0.101
31	Hillsdale	16.0	St. Clair	0.285		Alpena	5.4	Manistee	0.098
32	Lapeer	15.8	Keweenaw	0.282		Branch	5.2	Monroe	0.096
33	Gladwin	15.0	Mackinac	0.277		Emmet	4.4	St. Joseph	0.095
34	Ionia	14.2	Van Buren	0.271		Montcalm	4.4	Dickinson	0.094
35	Wexford	13.0	Ottawa	0.266		Wexford	4.0	Mackinac	0.092

Pedestrian Crashes, 2018-2022						Bicycle Crashes, 2018-2022			
Rank	County	Yearly Avg. Crashes	County	Crashes Per 1,000 Residents		County	Yearly Avg. Crashes	County	Crashes Per 1,000 Residents
36	Midland	12.4	Manistee	0.262		Mecosta	3.8	Benzie	0.091
37	Clare	11.0	Lake	0.255		Hillsdale	3.6	Midland	0.091
38	Clinton	10.6	Iosco	0.253		Clinton	3.2	Mason	0.090
39	Cass	10.2	Allegan	0.252		Barry	3.0	Mecosta	0.088
40	Barry	9.8	Houghton	0.248		Iosco	2.8	Cheboygan	0.086
41	Gratiot	9.2	Missaukee	0.240		Houghton	2.8	Lake	0.085
42	Sanilac	9.2	Otsego	0.238		Gratiot	2.8	Gladwin	0.079
43	Houghton	9.0	Alpena	0.238		Mason	2.6	Hillsdale	0.079
44	Mason	8.8	Charlevoix	0.236		Chippewa	2.6	Houghton	0.077
45	Newaygo	8.6	Osceola	0.232		Cass	2.6	Genesee	0.077
46	Tuscola	8.2	Huron	0.228		Roscommon	2.4	Schoolcraft	0.074
47	Delta	7.4	Gratiot	0.224		Manistee	2.4	Montcalm	0.070
48	Huron	7.2	Sanilac	0.222		Dickinson	2.4	Menominee	0.069
49	Emmet	7.0	Ionia	0.221		Cheboygan	2.2	Chippewa	0.069
50	Alpena	6.8	Roscommon	0.218		Newaygo	2.2	Kalkaska	0.069
51	Chippewa	6.6	Iron	0.214		Gladwin	2.0	Charlevoix	0.069
52	Manistee	6.4	Leelanau	0.213		Tuscola	2.0	Gratiot	0.068
53	Iosco	6.4	Emmet	0.212		Ionia	2.0	Lapeer	0.066
54	Charlevoix	6.2	Gogebic	0.208		Charlevoix	1.8	Leelanau	0.065
55	Otsego	5.8	Delta	0.204		Benzie	1.6	Antrim	0.060
56	Osceola	5.4	Ogemaw	0.201		Menominee	1.6	Otsego	0.057
57	Roscommon	5.2	Cass	0.198		Leelanau	1.4	Missaukee	0.053
58	Oceana	5.0	Oscoda	0.193		Antrim	1.4	Osceola	0.052
59	Leelanau	4.6	Antrim	0.190		Otsego	1.4	Cass	0.051
60	Antrim	4.4	Oceana	0.189		Clare	1.4	Barry	0.050
61	Cheboygan	4.4	Lapeer	0.179		Kalkaska	1.2	Clare	0.046
62	Ogemaw	4.2	Newaygo	0.179		Osceola	1.2	Newaygo	0.046
63	Dickinson	3.8	Chippewa	0.174		Mackinac	1.0	Crawford	0.043
64	Missaukee	3.6	Schoolcraft	0.174		Lake	1.0	Clinton	0.041
65	Gogebic	3.2	Crawford	0.173		Oceana	1.0	Livingston	0.040
66	Mackinac	3.0	Cheboygan	0.173		Sanilac	1.0	Oceana	0.038
67	Lake	3.0	Kalkaska	0.172		Missaukee	0.8	Tuscola	0.038
68	Kalkaska	3.0	Barry	0.163		Schoolcraft	0.6	Iron	0.036
69	Menominee	3.0	Livingston	0.159		Crawford	0.6	Ontonagon	0.034
70	Benzie	2.6	Arenac	0.158		Ogemaw	0.6	Luce	0.031
71	Iron	2.4	Luce	0.157		Huron	0.6	Ionia	0.031
72	Crawford	2.4	Presque Isle	0.156		Iron	0.4	Ogemaw	0.029
73	Arenac	2.4	Alcona	0.154		Ontonagon	0.2	Sanilac	0.024

Pedestrian Crashes, 2018-2022						Bicycle Crashes, 2018-2022			
Rank	**County**	**Yearly Avg. Crashes**	**County**	**Crashes Per 1,000 Residents**		**County**	**Yearly Avg. Crashes**	**County**	**Crashes Per 1,000 Residents**
74	Presque Isle	2.0	Tuscola	0.154		Luce	0.2	Baraga	0.024
75	Oscoda	1.6	Alger	0.152		Baraga	0.2	Alger	0.022
76	Alcona	1.6	Midland	0.149		Alger	0.2	Alcona	0.019
77	Schoolcraft	1.4	Dickinson	0.149		Alcona	0.2	Huron	0.019
78	Alger	1.4	Benzie	0.148		Presque Isle	0.2	Presque Isle	0.016
79	Luce	1.0	Clinton	0.136		Arenac	0.2	Arenac	0.013
80	Keweenaw	0.6	Menominee	0.129		Gogebic	0.2	Gogebic	0.013
81	Baraga	0.6	Baraga	0.071		Keweenaw	0.0	Keweenaw	0.000
82	Montmorency	0.6	Ontonagon	0.067		Montmorency	0.0	Montmorency	0.000
83	Ontonagon	0.4	Montmorency	0.065		Oscoda	0.0	Oscoda	0.000

APPENDIX B – VRU COUNTERMEASURES

Concerns	Crash Type	Crash Severity	Relative Cost	Road Feature	VRU	CMF	Opportunities	Sources	
Intersection conflicts with pedestrians	Vehicle/ Pedestrian	All	$	Signalized Intersection	Pedestrian	0.912	Countdown pedestrian signals	CMF Clearinghouse	Best Design Practices in Michigan
Accessible Pedestrian related concerns	Vehicle/ Pedestrian	All	$	Signalized Intersection	Pedestrian	0.3	Pedestrian countdown signals with visual/audio cues (Accessible Pedestrian Signals)	Miami-Dade Vision Zero	Best Design Practices in Michigan
Younger Drivers	Vehicle/ Pedestrian, Vehicle/ Bicycle	All	NA	None specified	Pedestrian/ Bicyclist	NA	Improve young driver training by including information concerning laws pertaining to VRUs in the curriculum	Michigan's Strategic Highway Safety Plan (https://www.michigan.gov/msp/-/media/Project/Websites/msp/ohsp/1_March-2023/2023_2026_MI_SHSP_v7.pdf)	
Legislation	Vehicle/ Pedestrian, Vehicle/ Bicycle	All	NA	None specified	Pedestrian/ Bicyclist	NA	Review and develop legislation that aligns with improving VRU safety	Michigan's Strategic Highway Safety Plan (https://www.michigan.gov/msp/-/media/Project/Websites/msp/ohsp/1_March-2023/2023_2026_MI_SHSP_v7.pdf)	
Intersection conflicts with pedestrians	Vehicle/ Pedestrian	All	$	Signalized Intersection	Pedestrian	0.65	Add exclusive pedestrian phasing (Scramble or Barn Dance)	CMF Clearinghouse	Best Design Practices in Michigan
Thru vehicles conflicting with pedestrians	Vehicle/ Pedestrian	All	0	Signalized Intersection	Pedestrian	0.49	Increase length of signal phases to allow pedestrians more crossing time	CMF Clearinghouse	Best Design Practices in Michigan
Mid-block crossing conflicts	Vehicle/ Pedestrian	All	$$	Mid-block	Pedestrian	0.87	Install pedestrian fencing	CMF Clearinghouse	
Turning vehicle conflicts	Vehicle/ Pedestrian	All	0	Signalized Intersection	Pedestrian	0.81	Leading pedestrian interval (LPI)	CMF Clearinghouse	Best Design Practices in Michigan
Mid-block crossing conflicts	Vehicle/ Pedestrian	All	$$	Mid-block	Pedestrian	0.567	Install a pedestrian hybrid beacon (PHB or HAWK)	CMF Clearinghouse	Best Design Practices in Michigan
Mid-block crossing conflicts	Vehicle/ Pedestrian	All	$$	Mid-block	Pedestrian	0.526	Install rectangular rapid flashing beacon (RRFB)	CMF Clearinghouse	Best Design Practices in Michigan
Intersection/mid-block conflicts with pedestrians	Vehicle/ Pedestrian	All	$	Signalized/Unsignalized Intersection	Pedestrian	0.6	Install high-visibility crosswalk	CMF Clearinghouse	
Mid-block crossing conflicts	Vehicle/ Pedestrian	All	$$	Mid-block	Pedestrian	0.54	Install raised median with marked crosswalk markings	CMF Clearinghouse	
Mid-block crossing conflicts	Vehicle/ Pedestrian	A, B, C	$$	Mid-block (2 lanes)	Pedestrian	0.55	Install raised pedestrian crosswalks for low-speed roadways	CMF Clearinghouse	Best Design Practices in Michigan
Mid-block crossing conflicts	Vehicle/ Pedestrian	All	$	Mid-block	Pedestrian	0.82	Pedestrian crosswalk at mid-block locations	CMF Clearinghouse	Best Design Practices in Michigan
Mid-block crossing conflicts	Vehicle/ Pedestrian, Vehicle/ Bicycle	K	$$	Mid-block	Pedestrian/ Bicyclist	0.14	Median treatment (fencing, median brick planters, pedestrian islands)	CMF Clearinghouse	
Speeding	All	All	$$	None specified	Pedestrian/ Bicyclist	0.68	Install speed management and traffic calming strategies (mini-circles, chicanes, speed tables/humps, traffic diversion)	Miami-Dade Vision Zero	
Speeding	Vehicle/ Bicycle	All	$$	Signalized	Bicyclist	0.28	Speed restriction devices (e.g. red light cameras (if permitted by law, speed hump)	CMF Clearinghouse	

Concerns	Crash Type	Crash Severity	Relative Cost	Road Feature	VRU	CMF	Opportunities	Sources	
Bicycle related conflicts along travel way	Vehicle/ Bicycle	All	$$	Travel Lane	Bicyclist	0.605	Convert blended vertical element bike lane to flexible delineator post bike lane	CMF Clearinghouse	
Bicycle related conflicts along travel way	Vehicle/ Bicycle	All	$$	Travel Lane	Bicyclist	0.37	Install bicycle boulevard	CMF Clearinghouse	
Turning vehicle conflicts	Vehicle/ Bicycle	All	$	Signalized Intersection	Bicyclist	0.69	Provide protected left-turn phase	CMF Clearinghouse	
Bicycle related conflicts along travel way	Vehicle/ Bicycle	All	$$	Travel way	Bicyclist	0.77	Increase lane width by 1 ft	CMF Clearinghouse	
Turning vehicle conflicts	Vehicle/ Pedestrian	All	0	Signalized Intersection	Pedestrian	0.58	Convert permissive or permissive/protected to protected only left-turn phasing	Miami-Dade Vision Zero	
Turning vehicle conflicts	Vehicle/ Pedestrian	All	$	Signalized Intersection	Pedestrian	0.59	Add signal for right-turn/eliminate right-turn on red	Miami-Dade Vision Zero	Best Design Practices in Michigan
Intersection conflicts with pedestrians	Vehicle/ Pedestrian	All	$	Signalized Intersection	Pedestrian	0.66	Remove unwarranted vehicle signals	Miami-Dade Vision Zero	
Mid-block crossing conflicts	Vehicle/ Pedestrian	All	0	Mid-block	Pedestrian	0.75	Add advance 'STOP/YIELD HERE FOR PEDESTRIANS' signage and pavement markings	Miami-Dade Vision Zero	Best Design Practices in Michigan
Mid-block crossing conflicts	Vehicle/ Pedestrian	All	$	Mid-block	Pedestrian	0.75	In-street sign 'YIELD to Pedestrians' (one sign/gateway)	Miami-Dade Vision Zero	Best Design Practices in Michigan
Speeding	All	All	$	None specified	Pedestrian/ Bicyclist	0.94	Reduce posted speed limit if recommended by a speed study	Miami-Dade Vision Zero	
All VRU related conflicts	All	All	$	None specified	Pedestrian/ Bicyclist	0.63	Improve sight distance at driveways and at intersections (remove obstructions)	Miami-Dade Vision Zero	
All VRU related conflicts	Vehicle/ Pedestrian, Vehicle/ Bicycle	All	$$ - $$$	None specified	Pedestrian/ Bicyclist	0.63	Repurpose/eliminate travel lane	Miami-Dade Vision Zero	
Nighttime, rural unlit roads	Vehicle/ Pedestrian	A, B, C	$$	None specified	Pedestrian	0.3	Install lighting	CMF Clearinghouse	Best Design Practices in Michigan
Nighttime, rural unlit roads	Vehicle/ Bicycle	A, B, C	$$	None specified	Bicyclist	0.4	Install lighting	CMF Clearinghouse	Best Design Practices in Michigan
Nighttime	Vehicle/ Pedestrian	K	$$	Intersection	Pedestrian	0.19	Provide intersection illumination	CMF Clearinghouse	
Nighttime	Vehicle/ Pedestrian	A, B, C	$$	Intersection	Pedestrian	0.41	Provide intersection illumination	CMF Clearinghouse	
Nighttime	Vehicle/ Pedestrian	All	$$	Rural Intersection	Pedestrian	0.56	Provide intersection illumination	CMF Clearinghouse	
Intersection conflicts with pedestrians	Vehicle/ Pedestrian	All	$	Intersection	Pedestrian	0.39	Convert unsignalized intersection to 4-way stop, where warranted	Miami-Dade Vision Zero	
Turning vehicle conflicts	All	All	$$	Intersection	Pedestrian	0.68	Tighten curb radii (traffic calming)	Miami-Dade Vision Zero	
Long crossing distances/ transit stops	All	All	$-$$$	Intersection/Mid-block	Pedestrian/ Bicyclist	0.68	Curb extensions/ Transit boarding curb extensions or boarding islands (bulb-outs or bump-outs)	Miami-Dade Vision Zero	Best Design Practices in Michigan
Bicycle related conflicts at Intersection	Vehicle/ Bicycle	All	>$$$	Intersection	Bicyclist	0.83	Replacement of traditional intersection with roundabout including cycle lanes	CMF Clearinghouse	
Pedestrian related conflicts at Intersection	Vehicle/ Pedestrian	All	>$$$	Intersection	Pedestrian	0.27	Convert intersection to roundabout	CMF Clearinghouse	Best Design Practices in Michigan

Concerns	Crash Type	Crash Severity	Relative Cost	Road Feature	VRU	CMF	Opportunities	Sources	
Pedestrian related conflicts at Intersection	All	All	>$$$	Intersection	Pedestrian	0.29	Convert unsignalized intersection to a roundabout	Miami-Dade Vision Zero	
Pedestrian related conflicts at Intersection	All	All	>$$$	Signalized Intersection	Pedestrian	0.34	Convert signalized intersection to a roundabout	Miami-Dade Vision Zero	
Pedestrian/ Bicyclist related conflicts at bus-stops	All	All	0	None specified	Pedestrian/ Bicyclist	0.53	Restrict on-street parking near crossings and near bus stops	Miami-Dade Vision Zero	
Access management concerns	All	All	$$	Corridor wide	Pedestrian/ Bicyclist	0.69	Driveway consolidation or relocation	Miami-Dade Vision Zero	
Access management concerns	Vehicle/Pedestrian	All	$$	Corridor wide	Pedestrian	0.81	Limit access to driveway, restrict turning-movements and cross-traffic into driveways and minor roads	Miami-Dade Vision Zero	
Bicycle related conflicts at Intersection	Vehicle/Bicycle	All	0	Signalized Intersection	Bicyclist	0.55	Adjust signal for additional bike crossing time/signal timing for bicyclists	Miami-Dade Vision Zero	Best Design Practices in Michigan
Driveway & right-turn conflicts	Vehicle/Bicycle	All	$	Corridor wide	Bicyclist	0.61	Green colored pavement marking in conflict area (driveway, right turn)	Miami-Dade Vision Zero	
Crossing concerns	Vehicle/Pedestrian, Vehicle/Bicycle	All	$	Mid-block	Pedestrian/ Bicyclist	0.81	Install bike crossing or combined pedestrian-bike crossing	Miami-Dade Vision Zero	
Bicyclist in travel lane concerns	Vehicle/Bicycle	All	$$ - $$$	Corridor wide	Bicyclist	0.4	Install a bike facility	Miami-Dade Vision Zero	
Bicyclist in travel lane concerns	Vehicle/Bicycle	All	$$$	Travel Lane	Bicyclist	0.27	Raised bike facility	Miami-Dade Vision Zero	
All VRU related conflicts	All	All	$$$	Travel Lane	Pedestrian/ Bicyclist	0.63	Road diet (Convert 4-lane undivided road to 2-lane plus turning lane)	Miami-Dade Vision Zero	Best Design Practices in Michigan
Mid-block crossing conflicts	Vehicle/Pedestrian	All	$	Mid-block	Pedestrian	0.82	Advance warning for motorists (blinking warning)	VDOT Pedestrian Safety Action Plan	
All VRU related conflicts	All	All	$	Corridor wide	Pedestrian/ Bicyclist	0.71 - 0.79	Improved conspicuity of signs	VDOT Pedestrian Safety Action Plan	
Turning vehicle conflicts	All	All	$	Intersection	Pedestrian	0.32 - 0.36	No left turns	VDOT Pedestrian Safety Action Plan	Best Design Practices in Michigan
Pedestrian crossing concerns	All	All	$	Corridor wide	Pedestrian	0.85 - 0.96	Pedestrian warning signs	VDOT Pedestrian Safety Action Plan	
Speeding	All	All	$	Corridor wide	Pedestrian/ Bicyclist	0.93 - 0.95	Radar speed display/dynamic speed feedback signs	VDOT Pedestrian Safety Action Plan	
Speeding	All	All	$	Crossing	Pedestrian	0.76	Transverse rumble strips	VDOT Pedestrian Safety Action Plan	
Turning vehicle conflicts	All	All	$	Crossing	Pedestrian	0.86 - 1	Flashing Yellow Arrow (FYA) for left turns	VDOT Pedestrian Safety Action Plan	Best Design Practices in Michigan
Nighttime conditions	All	All	$$	Corridor wide	Pedestrian/ Bicyclist	0.68 - 0.92	Segment/Intersection/Crosswalk lighting	VDOT Pedestrian Safety Action Plan	
Crossing distance	Vehicle/Pedestrian	All	$-$$	Mid-block/Intersection	Pedestrian	0.75	Install refuge islands/raised median	Toolbox of Countermeasures and Their Potential Effectiveness for Pedestrian Crashes - Safety | Federal Highway Administration (dot.gov)	Best Design Practices in Michigan
Visibility	All	All	$$	Intersection	Pedestrian	0.4 - 0.56	Install/modify design of channelized right turn lane	VDOT Pedestrian Safety Action Plan	Best Design Practices in Michigan

Concerns	Crash Type	Crash Severity	Relative Cost	Road Feature	VRU	CMF	Opportunities	Sources	
Speeding	All	All	$$	Intersection	Pedestrian/ Bicyclist	0.12 - .45	Neighborhood traffic circles	VDOT Pedestrian Safety Action Plan	
All VRU related conflicts	All	NA	$$$	Travel Lane	Pedestrian/ Bicyclist	NA	Bridge retrofit (preferably to provide a shared use path)	NCHRP Synthesis 604	
Pedestrian crossing concerns	Vehicle/Pedestrian	All	$	Signalized Intersection	Pedestrian	0.66	Install pedestrian signal	Toolbox of Countermeasures and Their Potential Effectiveness for Pedestrian Crashes - Safety | Federal Highway Administration (dot.gov)	Best Design Practices in Michigan
Turning vehicle conflicts	Vehicle/Pedestrian	All	$	Signalized Intersection	Pedestrian	0.718	Change permissive left-turn phasing to protected only or protected/permissive	CMF Clearinghouse	Best Design Practices in Michigan
Bicycle related conflicts at Intersection	Vehicle/Bicycle	NA	$	Signalized Intersection	Bicyclist	NA	Bicycle signals	Best Design Practices in Michigan	MDOT Research 1572
Bicycle related conflicts at Intersection	Vehicle/Bicycle	NA	$	Signalized Intersection	Bicyclist	NA	Bicycle signal detection	Best Design Practices in Michigan	MDOT Research 1572
Bicycle related conflicts at Intersection	Vehicle/Bicycle	NA	$	Signalized Intersection	Bicyclist	NA	Intersection bicycle crossing pavement markings	Best Design Practices in Michigan	MDOT Research 1572
Bicycle related conflicts at Intersection	Vehicle/Bicycle	NA	$	Signalized Intersection	Bicyclist	NA	Bicycle boxes	Best Design Practices in Michigan	
Bicycle related conflicts at Intersection	Vehicle/Bicycle	NA	$	Signalized Intersection	Bicyclist	NA	Two-stage bicycle turn boxes	Best Design Practices in Michigan	MDOT Research 1572
Turning vehicle conflicts	Vehicle/Pedestrian	ABC	$	Signalized Intersection	Pedestrian/ Bicyclist	0.82	Centerline hardening	NYC DOT - Turn Calming Program	Best Design Practices in Michigan
Bicycle related conflicts at Intersection	Vehicle/Bicycle	NA	$	Signalized Intersection	Bicyclist	NA	Protected and dedicated intersections	Best Design Practices in Michigan	
Pedestrians crossing mid-block	Vehicle/Pedestrian	NA	$$-$$$	Mid-block	Pedestrian	NA	Midblock signal	Best Design Practices in Michigan	
Crossings mid-block	Vehicle/Pedestrian	All	$$$	Mid-block	Pedestrian/ Bicyclist	0.14	Grade separated crossings	Toolbox of Countermeasures and Their Potential Effectiveness for Pedestrian Crashes - Safety | Federal Highway Administration (dot.gov)	Best Design Practices in Michigan
Pedestrians walking along roadway	Vehicle/Pedestrian	All	$$$	Travel Lane	Pedestrian	0.12	Install sidewalk	Toolbox of Countermeasures and Their Potential Effectiveness for Pedestrian Crashes - Safety | Federal Highway Administration (dot.gov)	Best Design Practices in Michigan
Pedestrians walking along roadway	Vehicle/Pedestrian	All	$$$	Travel Lane	Pedestrian	0.29	Provide paved shoulder	Toolbox of Countermeasures and Their Potential Effectiveness for Pedestrian Crashes - Safety | Federal Highway Administration (dot.gov)	Best Design Practices in Michigan
Pedestrians walking along roadway	Vehicle/Pedestrian	KABC	$$	Travel Lane	Pedestrian	0.97	Improve pavement friction (skid treatment with overlay)	Toolbox of Countermeasures and Their Potential Effectiveness for Pedestrian Crashes - Safety | Federal Highway Administration (dot.gov)	
All VRU related conflicts	Vehicle/Pedestrian	All	0	Corridor wide	Pedestrian/ Bicyclist	0.77	Increase enforcement	Toolbox of Countermeasures and Their Potential Effectiveness for Pedestrian Crashes - Safety | Federal Highway Administration (dot.gov)	
All VRU related conflicts	All	NA	$$$	Corridor wide	Pedestrian/ Bicyclist	NA	Shared use paths and sidepaths	Best Design Practices in Michigan	

Concerns	Crash Type	Crash Severity	Relative Cost	Road Feature	VRU	CMF	Opportunities	Sources	
Bicycle related conflicts in travel lanes	Vehicle/Bicycle	NA	$$	Corridor wide	Bicyclist	NA	Shared lane markings (Sharrows)	Best Design Practices in Michigan	
Bicycle related conflicts in travel lanes	Vehicle/Bicycle	All	$$	Travel Lane	Bicyclist	0.42	Install bicycle lane	CMF Clearinghouse	Best Design Practices in Michigan
Bicycle related conflicts in travel lanes	Vehicle/Bicycle	NA	$$-$$$	Travel Lane	Bicyclist	NA	Buffered bicycle lands	Best Design Practices in Michigan	
Bicycle related conflicts in travel lanes	Vehicle/Bicycle	NA	$$	Travel Lane	Bicyclist	NA	Contra-flow bicycle lanes	Best Design Practices in Michigan	MDOT Research 1572
Bicycle related conflicts in travel lanes	Vehicle/Bicycle	NA	$$	Travel Lane	Bicyclist	NA	Left-side bicycle lanes	Best Design Practices in Michigan	MDOT Research 1572
Bicycle related conflicts in travel lanes	Vehicle/Bicycle	All	$$$	Travel Lane	Bicyclist	0.37	Separated bicycle lanes (cycle tracks)	CMF Clearinghouse	Best Design Practices in Michigan
All VRU related conflicts	All	NA	$$$	Corridor wide	Pedestrian/ Bicyclist	NA	Transit accommodation	Best Design Practices in Michigan	
Bicycle related conflicts in travel lanes	Vehicle/Bicycle	NA	$	Corridor wide	Bicyclist	NA	Bicycle wayfinding	Best Design Practices in Michigan	
Red light running resulting in pedestrian crashes	Vehicle/Pedestrian	KABC	$$	Signalized Intersection	Pedestrian	0.71	Improve signal visibility	CMF Clearinghouse	https://wmich.edu/transportationcenter/schneider
Pedestrian crossing concerns	Vehicle/Pedestrian	NA	$	Intersection	Pedestrian	NA	Advance stop bars	https://wmich.edu/transportationcenter/schneider	MDOT Research 1572
Visibility of pedestrians crossing	Vehicle/Pedestrian	All	$$-$$$	Intersection	Pedestrian	0.71	Pork chop island	MDOT Research 1572	
Bicycle related conflicts at Intersection	Vehicle/Bicycle	NA	$	Signalized Intersection	Bicyclist	NA	Bike Box	MDOT Research 1573	
All VRU related conflicts	Vehicle/Pedestrian, Vehicle/Bicycle	KABC	$$$	Corridor wide	Pedestrian/ Bicyclist	0.9	Four-lane to two-lane road conversion	NHTSA ped/bike countermeasures	
All VRU related conflicts	Vehicle/Pedestrian, Vehicle/Bicycle	KABC	$$$	Corridor wide	Pedestrian/ Bicyclist	0.81	Three-lane to two-lane road conversion	NHTSA ped/bike countermeasures	
Speeding in school zone	Vehicle/Pedestrian, Vehicle/Bicycle	KABC	$$	Corridor wide	Pedestrian/ Bicyclist	0.82	Speed safety cameras (SSC) in school zone if permitted by legislation	NHTSA ped/bike countermeasures	
Speeding in school zone	Vehicle/Pedestrian, Vehicle/Bicycle	KABC	$$	Corridor wide	Pedestrian/ Bicyclist	0.95	Speed safety cameras (SSC) near school zone if permitted by legislation	NHTSA ped/bike countermeasures	

APPENDIX C – FISCAL YEAR 2024 PROPOSED VRU IMPROVEMENTS

Year	Job Number	Job Type	Phase	Major Route (Report)	Location (Report)	Work Description (Report)	Let Date	Financial System	Scheduled Obligation Date	Budget Amt (Fed, State)
2024	218289	Local	CON	Alpine Ave NW	Multiple Routes, Various Locations, City of Grand Rapids	Install Rectangular Rapid Flashing Beacons	06/07/2024	VRU	04/12/2024	$248,000
2024	218142	Local	CON	Countywide	Multiple Routes, Various Locations, Macomb County	Signal Modernization and dilemna zone detection	06/07/2024	VRU	04/12/2024	$51,540
2024	218144	Local	CON	Countywide	Multiple Routes, Various Locations, Macomb County	Signal Modernization, box span, backplates, and dilemma zone	06/07/2024	VRU	04/12/2024	$53,808
2024	215578	Local	CON	City wide	Multiple Routes, Multiple Locations, City of Pontiac	Countdown Pedestrian Signals	03/01/2024	VRU	01/05/2024	$200,000
2024	218022	Local	CON	City wide	Multiple Routes, Various Locations, City of Northville	Countdown Pedestrian Signals	03/01/2024	VRU	01/05/2024	$112,950
2024	218045	Local	CON	Baldwin Ave	Multiple Routes, Various Locations, City of Pontiac	Road Diet (4-3 Lane Conversion), Signal modernization	03/01/2024	VRU	01/05/2024	$49,064
2024	218283	Local	CON	W 9 Mile Rd	Multiple Routes, Various Locations, City of Farmington Hills	Signal modernization, ped countdown signals, pavement markings	01/05/2024	VRU	11/09/2023	$34,284
2024	218368	Local	CON	Freedom Rd	Freedom Road and Folsom Road, City of Farmington Hills	Rectangular Rapid Flashing Beacon, sidewalk, and high-emphasis crosswalks	06/07/2024	VRU	04/12/2024	$213,737
2024	218128	Local	CON	Vernier Rd	Vernier Road at Mack Road and Sunningdale Park, City of Gross Pointe Woods	Signal Modernization, New Signal and Pedestrian Crossing, Signing	07/12/2024	VRU	05/17/2024	$61,824
2024	218374	Local	CON	E McNichols Rd	Multiple Routes, Various Locations, City of Detroit	Signal modernization, ped countdown signals, pavement markings	06/07/2024	VRU	04/12/2024	$43,340
2024	218376	Local	CON	W McNichols Rd	Multiple Routes, Various Locations, City of Detroit	Signal modernization, ped countdown signals, pavement markings	06/07/2024	VRU	04/12/2024	$41,314
2024	218379	Local	CON	E Empire Ave	Empire Avenue from M-139 to Crystal Avenue, Berrien County	Shoulder widening and HMA overlay	06/07/2024	VRU	04/12/2024	$369,000
2024	218043	Local	CON	W Kalamazoo Ave	Multiple Routes, Various Locations, City of Kalamazoo	Signal Optimization	03/01/2024	VRU	01/05/2024	$65,600
2024	218256	Local	CON	Clinton Rd	Lansing Ave, Clinton Road, Backus Street, Monroe Street, City of Jackson	Non-Motorized Improvements and 4 to 3 Lane Conversion	06/07/2024	VRU	04/12/2024	$522,607
2024	218279	Local	CON	Lansing Ave	Lansing Avenue Corridor and Ganson at Jackson Street, City of Jackson	Traffic signal modernization and 4 to 3 Lane Conversion	06/07/2024	VRU	04/12/2024	$27,541
2024	218227	Local	CON	N Michigan Ave	Clinton Street at Michigan Avenue, Clinton Street to Pauline Street	Signal Modernization and Rectangular Rapid Flashing Beacon	03/01/2024	VRU	01/05/2024	$429,316
2024	213764	Local	CON	Citywide	Multiple Routes, Various Locations, city of Ann Arbor	Countdown pedestrian signals		VRU	04/05/2024	$19,964
2024	218005	Local	CON	City wide	Multiple Routes, Various Locations, City of Ann Arbor	Countdown Pedestrian Signals	03/01/2024	VRU	01/05/2024	$97,200
2024	218229	Local	CON	Miller Rd	Miler Avenue at 4 Locations, City of Ann Arbor	Rectangular Flashing Beacons	06/07/2024	VRU	04/12/2024	$254,880
2024	122664	Trunkline	CON	US-131	Over Amtrak and KL Avenue	Bridge Replacement	12/01/2023	VRU	11/06/2023	$356,287
2024	200202	Trunkline	CON	US-12	US-12 from west of Platt Rd to west of US-23 interchange	Operational improvements	12/01/2023	VRU	10/06/2023	$270,000
2024	210989	Trunkline	CON	I-94 W	Conner Creek Greenway (Iron Belle Trail) over I-94	New Structure	11/01/2024	VRU	08/30/2024	$3,003,768
2024	214087	Trunkline	PE	M-21	Gould St to State Rd in Owosso	Installing 5' wide sidewalk along N and S sides of M-21 from Gould St to St	12/06/2024	VRU	10/06/2023	$103,540
2024	214087	Trunkline	ROW	M-21	Gould St to State Rd in Owosso	Installing 5' wide sidewalk along N and S sides of M-21 from Gould St to St	12/06/2024	VRU	10/27/2023	$100,000
2024	204959	Trunkline	CON	Old 131	Old US-131 between 8 Mile to Golfview Drive	Shoulder Widening and Shoulder Corrugations	01/05/2024	VRU	11/09/2023	$3,380,000
2024	218641	Trunkline	EPE	M-29	M-29 (23 Mile Road) over I-94	Construct pedestrian pathway	12/05/2025	VRU	05/01/2024	$25,000
2024	218641	Trunkline	PE	M-29	M-29 (23 Mile Road) over I-94	Construct pedestrian pathway	12/05/2025	VRU	06/03/2024	$154,200
2024	209389	Trunkline	CON	M-59	from US-24 to Loop	Pedestrian Refuge and lane reduction	09/06/2024	VRU	07/12/2024	$1,019,296
2024	209389	Trunkline	ROW	M-59	from US-24 to Loop	Pedestrian Refuge and lane reduction	09/06/2024	VRU	10/11/2023	$49,375
2024	218672	Trunkline	CON	US-31	Belvedere Avenue to Mercer Boulevard	Pedestrian Enhancement Crossings	08/02/2024	VRU	07/05/2024	$557,800
2024	218672	Trunkline	PE	US-31	Belvedere Avenue to Mercer Boulevard	Pedestrian Enhancement Crossings	08/02/2024	VRU	10/09/2023	$44,720
2024	218818	Trunkline	EPE	M-96	M-96 Columbia from Helmer to Michigan	Vulnerable Road User Road Safety Audit		VRU	02/01/2024	$24,687
2024	218784	Trunkline	CON	Regionwide	Various Crosswalk Locations in Southwest Region	Installation of Pedestrian Crosswalk Improvements	08/02/2024	VRU	06/07/2024	$1,105,136
2024	209424	Trunkline	CON	M-35	from Jimtown Road northerly to Wells State Park entrance.	Increase paved shoulder width from 3' to 8'.	11/01/2024	VRU	08/30/2024	$1,485,000
2024	218707	Trunkline	CON	M-99	Multiple Locations along M-99 and M-50	Pedestrian Islands	08/02/2024	VRU	06/07/2024	$205,399
2024	218707	Trunkline	PE	M-99	Multiple Locations along M-99 and M-50	Pedestrian Islands	08/02/2024	VRU	10/02/2023	$44,437