Michigan Department of Transportation

Michigan 2045 Mobility

A transportation plan for a connected future #MM45

Adopted by the State Transportation Commission Nov. 4, 2021

Contents

Dear Fellow Michiganders:

The Michigan Department of Transportation (MDOT), with significant support and input from the public and a broad array of associations and business interests across the state, has set an ambitious vision for transportation in Michigan. The Michigan Mobility 2045 (MM2045) state long-range transportation plan presents the state's vision for Michigan's existing and future transportation systems and identifies goals and strategies to guide long-term, multimodal transportation investments for the next 25 years.

Building upon Michigan's long-standing tradition of innovation, the MM2045 plan is the first in the country to combine several federally required planning documents (i.e., freight and rail plans) into one long-range transportation plan. MDOT also initiated the creation of a comprehensive statewide active transportation plan and a statewide transit strategy to align and advance progress for these modes alongside those that are federally required.

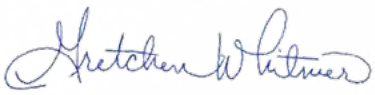
A vibrant and sustainable multimodal transportation system is vital to Michigan's future economic viability and competitiveness. It is also essential that Michigan's future transportation network is resilient while continuing to address the safe and easy movement of people and goods throughout the state. I believe all Michiganders can support a robust, reliable, and resilient transportation network. MM2045 lays out how MDOT and transportation agencies throughout Michigan can continue striving toward this vision while positioning the state for inevitable changes across the entire transportation landscape.

MM2045 will provide direction to transportation policymakers for years to come and will provide a framework to build upon as new technologies and new travel preferences shape Michigan transportation. This plan will also help transportation agencies and partners address the many challenges and transformative changes facing the state for years to come.

This plan reflects extensive public and stakeholder engagement with representation and participation from all parts of Michigan. Involvement in this plan was diverse and inclusive of representatives from many backgrounds and interest areas to develop a plan that serves all citizens of the state.

I want to express my sincere appreciation to all the individuals and organizations who contributed to this plan. Working together as one Michigan, we will continue to innovate and improve our state's multimodal transportation systems, ensuring a reliable and safe transportation network for all users.

Very respectfully yours,



Gretchen Whitmer
Governor of Michigan

Dear Michiganders,

MDOT is pleased to deliver Michigan's new state long-range transportation plan, MM2045. MM2045 establishes the long-term direction and vision for the future of Michigan's multimodal transportation network for all users. It is the first step in the planning and program development process, which ultimately provides the strategies that establish transportation investment decisions and projects.

MM2045 is a family of plans that, along with the long-range transportation plan, integrates the components of a state freight plan, a state rail plan, a statewide active transportation plan, and a statewide transit strategy. It has brought together stakeholders, partnering agencies, subject-matter experts, and Michigan residents to develop a forward-thinking vision statement and coordinated goals and strategies that are future-focused and multimodal in nature.

The future of transportation offers many opportunities for new and innovative advancements, utilizing technology and the redefining of multiple modes of transportation that seemed unfathomable 10 years ago. Utilization of on-demand vehicles (e.g., Uber or Lyft), e-bikes, and bus rapid transit has grown and will continue to evolve into the future. MM2045 provides the foundation for Michigan to provide new, pioneering opportunities while continuing to preserve and maintain current infrastructure. It seeks to find a balance between near-term needs while preparing for long-term, technology-based multimodal investments for the next 25 years. The MM2045 vision provides the framework while the goals, objectives and strategies describe how this vision can be achieved.

This plan also provides the foundation for every project that MDOT or other transportation agencies implement to provide safe, timely, and reliable transportation choices. Every project, whether it's a road building project, a transit initiative, a high-speed rail advancement, a freight corridor improvement, or a recreational trail or active transportation pathway can be linked back to the vision, goals, and strategies of MM2045.

Finally, this plan reflects extensive public and stakeholder engagement. People from all 83 counties of the state have participated in providing input on the plan's priorities, vision, and strategies. We strongly thank the citizens of Michigan for their input and involvement in developing this plan and we look forward to working with everyone in the implementation stages of MM2045. All MM2045 documents and supplemental materials may be found on the MM2045 website at www.MichiganMobility.org.

Sincerely,

Paul C. Ajegba, P.E.
Director

Michigan Mobility 2045 (MM2045) Contributors

State Transportation Commission

Todd Wyett, Chairman

Michael D. Hayes, Vice Chair

Stephen F. Adamini

Richard W. Turner

Helen Zeerip

Gregory C. Johnson

MDOT Executive Team

Paul C. Ajegba, P.E., Director

Tony Kratofil, P.E., Chief Operations Officer

Laura J. Mester, C.P.A., Chief Administrative Officer

Terri Slaughter, Chief Culture, Equity, and Inclusion Officer

MM2045 Project Sponsors

Todd White, Director, Bureau of Transportation Planning

David E. Wresinski, Past Director, Bureau of Transportation Planning

Mike Trout, Director, Office of Aeronautics

Jean Ruestman, Administrator, Office of Passenger Transportation

Sharon Edgar, Past Administrator, Office of Passenger Transportation

Brad Wieferich, Director, Bureau of Development

Erick Kind, Region Engineer, Grand Region

Peter Anastor, Director, Office of Rail

Timothy Hoeffner, Past Director, Office of Rail

Craig B. Newell, Administrator, Statewide Transportation Planning Division

Denise B. Jones, Past Administrator, Statewide Transportation Planning Division

Eric Mullen, Administrator, Asset Management and Policy Division

MM2045 Project Management Team

Bradley M. Sharlow, AICP, Project Manager

Kyle Haller, AICP, Deputy Project Manager

Niles Annelin, Assistant Project Manager – Policy and Plan Implementation

Elisha Wulff, Assistant Project Manager – Freight

Sara Moore, Assistant Project Manager – Rail

Joshua DeBruyn, AICP, Assistant Project Manager – Active Transportation

Janet Geissler, Co-Assistant Project Manager – Passenger Transportation

Ellen Kent, Co-Assistant Project Manager – Passenger Transportation

Kelly Travelbee, Assistant Project Manager – Goals/Strategies/ Performance Development

Anu Sikka, Project Support

James Dell, Project Support

Ryan Ellison, Project Support

Pam Sebenick, Project Support

Amara Vogt, Project Support

MM2045 Task Team Leads

Garth Banninga

Margaret Barondess

Richard Bayus

Dan Belcher

Karen Faussett

Michele Fedorowicz, AICP

Jesse Frankovich

Chris Hundt

Kevin McKnight

Monica Monsma

Kyle Nelson

Heidi Phaneuf

Zachary Rable, AICP

Anita Richardson

Timothy Ryan

Administrative Support

Ebony Anderson

Ashley Arras

Janese Bouters

Kristen Halfmann

Suzie Karls

Alicia Morrison

Jana Nicol

MDOT Office of Communications

Courtney Bates

Jeff Cranson

Randy Debler

Tim Fischer

Michael Frezell

Corey Petee

Bill Phillips

Scott Sarka

MDOT Region Planners

Vincent Bevins

Michael Davis

Julie Edwards

Dennis Kent

Tyler Kent

Amy Lipset

Kari Martin

Patty O'Donnell

Steve Redmond

Jay Reithel

Brian Sanada

James Schultz

MM2045 Core Team

Jacob Armour

Bryan Armstrong

James Ashman

Mallory Avis

Kelly Bartlett

Katie Beck

Mike Belligan

Mark Bott

Heather Bowden

Deb Brown

Andy Brush

Bryan Budds

Wendi Burton

Collin Castle

Lina Chapman

Bertha Chester

Steve Cook

Eric Costa

Rebecca Curtis

Hong Dang

Fran Deatrick

John Engle

Andy Esch

Jason Firman

Kris Foondle

Colin Forbes

Edward Fowler

Matthew Galbraith

Mark Geib

Amy Gill

Ryan Gladding

Jason Gutting

Jesse Gwilliams

Maria Habba

David Hartman

Kevin Hohf

Karen Howe

Shun-Chuen Huang

Al Johnson

Kim Johnson

Nikkie Johnson

Dean Kanitz

Michael Kapp

Larry Karnes

Daniela Khavajian

Cindy Krupp

Brandon Lambrix

Todd Lassen

Tracie Leix

Tim Lemon

Rob Lippert

Lisa Lubahn

Robert Maffeo

Tarun Malhotra

Jeff Martin

Amy Matisoff

Steve Minton

Michele Mueller

Eric Mullen

Lee Nederveld

Brad Peterson

Eileen Phifer

Matt Pitlock

Jon Roberts

Susan Rozema

Valerie Shultz

Steve Shaughnessy

Linn Smith

Claire Stevens

James Sturdevant

Roy Taylor

Julie Van Portfliet

Michelle Weber-Currie

MM2045 Stakeholder Team

Craig Atwood – County Road Association, Allegan County Road Commission

Nicole Baumer – Tri-County Regional Planning Commission

Tyler Bevier – Bay Area Transportation Authority

Christopher Bolt – Jackson County Department of Transportation, Transportation Asset Management Council

Ashley Bradshaw – Michigan Department of Health and Human Services

Ron Brenke – American Council of Engineering Companies

J. Thomas Bruff – Southeast Michigan Council of Governments

Andrea Brown – Michigan Association of Planning

Trevor Brydon – Southeast Michigan Council of Governments

Ryan Buck – Washtenaw Area Transportation Study

Vince Carahaly – Michigan Association of Regions, South Central Michigan Planning Commission

Judith-Kay Chase – Michigan Association of Railroad Passengers

Beth Colosimo – Michigan Economic Development Council, Commission for Logistics and Supply Chain Collaboration

Cory Connolly – Michigan Energy Innovation Business Council

Mathew Cooke – Networks Northwest

Michelle Crook – Michigan Department of Natural Resources

Aaron Dawson – Federal Highway Administration

Andrea Dewey – Federal Highway Administration

Will Dyer – Federal Railroad Administration

Andrea Faber – Grand Valley Metropolitan Council

Patricia Fedewa – Michigan Transportation Riders United

Kelley Frake – Michigan Department of Civil Rights

Michael Frederick – Michigan Association of Regions

Suzann Flowers – Washtenaw Area Transportation Study

Karlee Gruetzner – Michigan Department of Civil Rights, Division of Deaf, Deaf-Blind and Hard of Hearing

Karin Gyger – Michigan Department of Insurance and Financial Services

Sean Hammond – Michigan Environmental Council

Clark Harder – Michigan Public Transportation Association

Judson Herzer – Michigan Department of Labor and Economic Opportunity

Elisa Hoekwater – Macatawa Area Transit – MAX Express

Justin Horvath – Shiawassee County Economic Development Partnership

Christina Ignasiak, Federal Highway Administration

Ken Jimkoski – Michigan Association of Transportation Systems (MASSTrans), Huron Transit Corporation

Joanna Johnson – County Road Association, Transportation Asset Management Council

Laurel Joseph – Grand Valley Metropolitan Council

Jamie Junior – Detroit Area Warriors on Wheels

Karen Kafantaris – American Association of Retired Persons

Erin Kuhn – Michigan Association of Regions, West Michigan Shoreline Regional Development Commission

John P. LaMacchia II – Michigan Municipal League

Alayna Lail – Michigan Department of Civil Rights, Division of Deaf, Deaf-Blind and Hard of Hearing

Shawnese Laury – Michigan Bureau of Services for Blind Persons, Michigan Department of Labor and Economic Opportunity

John Lindenmayer – League of Michigan Bicyclists

Joshua Lunger – City of Grand Rapids

Justin Lyons – City of Ferndale

Michelle Martinez – Michigan Environmental Justice Coalition

Matthew McCauley – Networks Northwest

Gary Mekjian – Transportation Asset Management Council

Jessica Moy – Michigan Department of Treasury, Michigan Infrastructure Council

Tim Mroz – The Right Place

Sarah Panken – Michigan Fitness Foundation

Trevor Pawl – Michigan Economic Development Corp.

Andy Pickard – Federal Highway Administration

Jeff Price – Federal Railroad Administration

Tongbin (Teresa) Qu – Michigan State University

Dawn Rodman – Michigan Department of Health and Human Services

Jody Roethle – Shiawassee County Economic Development Partnership

Fred Schlemmer – Alco Transportation, Commission for Logistics and Supply Chain Collaboration

Peter Schwartz – Federal Railroad Administration

Dana Sherry – Gov. Whitmer's Office

Andrew Sibold, Federal Highway Administration

Donald Stypula – Michigan Association of Regions

Jan de la Torre – Michigan Department of Health and Human Services

Carolyn Ulstad – Macatawa Area Coordinating Council

Annie Urasky – Michigan Department of Civil Rights, Division of Deaf, Deaf-Blind and Hard of Hearing

Rachelle VanDeventer – Michigan Infrastructure and Transportation Association

Susan Weber – Federal Transit Administration

Kuilin Zhang – Michigan Technological University

MM2045 Project Consultants

WSP

Todd Davis

Jeanne Stevens

Joe Bryan

Joe Gurskis

Shane Peck

Jared Gulbranson

Eric Hanss

Alex King

Bridget Wieghart

Sophie Cohen

Robin Christians

Kathryn DeForrest

Michael Babin

Allyson Powers

Scudder Smith

Sebastian Guerrero

Shashank Pulikanti

Adam Miliszewski

Dan Silverman

Ben Stupka

Matt Wendling

Michael Flood

Stephanie Brown

High Street

Jeff Carroll

Erin Dean

Peter Hylton

Alice Beattie

EBP

Naomi Stein

Kyle Schroeckenthaler

Stephen Fitzroy

Adam Blair

Wade Trim

Lori Pawlik

Charles Smith

Arthur Mullen

The Prewitt Group

Renee Prewitt

CHAPTER 1

Introduction to Michigan Mobility 2045

Michigan's State Long-Range Transportation Plan (MM2045) is an essential element of Michigan's transportation planning and program development process. The public- and stakeholder-driven plan provides a foundation for developing Michigan's transportation programs, including MDOT's Five-Year Transportation Program (5YTP) and the statewide, rural and metropolitan transportation improvement programs, and presents the social and economic cases for transportation investment in Michigan. Michigan's social and economic prosperity depends on transportation investments. MM2045 is driven by a diverse, equitable, and inclusive process to provide the long-term direction for Michigan's transportation network.

What is Michigan Mobility 2045?

A state long-range transportation plan (SLRTP) defines the long-term direction for the future of a state's transportation network for all users. MM2045 provides that direction for Michigan with an aspirational multimodal vision, comprehensive goals/objectives, and actionable strategies to achieve that vision. It looks at past trends, new, innovative initiatives, and at collaborative partnerships to lay out the direction that Michiganders, transportation stakeholders, and decision-makers aim to move toward by 2045. Ensuring safety and mobility, with an increasing focus on multimodal integration, requires conscious policy decisions and investment priorities that should be guided by an understanding of the needs, goals, and available resources.

Long-range transportation plans include financial components that demonstrate how the recommended transportation plan can be implemented and identifies strategies to carry out the plan. Adding to the challenge of long-range transportation planning are the immediate needs related to climate change mitigation, preservation, safety, congestion, advancements in technology like connected and automated vehicles, modal choice, quality of life, and resiliency — all occurring in a fiscally constrained environment. Michigan's transportation

How Does MM2045 Help Michigan?

- Organizes the efforts of the Michigan Department of Transportation (MDOT) and its partners around a common vision and goals shaped by public needs to move the state forward as technology and needs change over time.
- Fosters partnerships across the hundreds of public, nonprofit, and private owners and operators of Michigan's transportation system necessary to get the job done.
- Demonstrates how to get there so that the public can understand decision-making and hold transportation agencies accountable to their commitments.
- Explains how additional revenue will grow Michigan's economy, advance equity, adapt to climate change, and improve health and quality of life today and into the future.
- Educates the public and decision-makers about coming changes in transportation and their effects.

agencies and partners must work together to prioritize their transportation needs and investments across all travel modes and invest transportation dollars wisely.

Also, long-range transportation plans are the first step in the planning and program development process, which ultimately provides the strategies that establish transportation investment decisions and projects. Every project or initiative developed by MDOT or other transportation agencies is derived from the long-term direction and vision of the SLRTP. Michigan transportation agencies have a history of developing innovative, forward-thinking projects, including the US-23 Flex Route, the diverging diamond interchanges in Auburn Hills and Grand Rapids, the Q-Line in Detroit, the Grand Rapids Bus Rapid Transit routes, preparing for high-speed rail between Chicago and Detroit, and the Iron Belle Trail. Each of these initiatives can be linked back to the SLRTP Vision, Goals, and Strategies.

A First-in-the-Country Plan

As the transportation system in Michigan is owned, operated, and maintained by many public and private entities, MDOT took steps forward to make this long-range transportation plan a true "state of Michigan" plan, rather than one focusing primarily on MDOT infrastructure. More than 600 public agencies are responsible for roads and bridges, while approximately 80 transit providers and many public and private entities provide infrastructure and operations for rail, ports, aviation, and active transportation services.

At the same time, federal legislation requires several statewide plans. MDOT has fully integrated these plans into one multimodal effort.

> **MM2045 is the first SLRTP in the country to fully integrate state freight and rail plans into a unified long-range transportation plan.**

In addition, MM2045 incorporates Michigan's first statewide active transportation plan and statewide transit strategy (as summarized in ***Figure 1***). Finally, MM2045 incorporated goals and investment priorities from the 2017 Michigan Aviation System Plan (MASP) throughout the SLRTP development process to truly incorporate all modes.

In summary, MM2045 includes transportation assets eligible for federal funding owned by local governments (counties, cities, villages) and private owners (freight rail and ports) across all modes (see ***Figure 2***) . This all-encompassing approach connects the plan across various transportation agencies to further understand and integrate the different modes more holistically as they relate to Michigan's transportation vision and goals. By integrating these efforts, MM2045 is one comprehensive "family of plans" that establishes a cohesive transportation vision for all of Michigan.

Through the effort of bringing all these plans and modes together, it became apparent that each mode of transportation aspire to provide safe, reliable, accessible, equitable, high-quality choices for passengers and freight alike. Each mode is at a different point on the journey to reach that vision.

Figure 1. **MM2045 Family of Plans**

***Figure 2.* Transportation Infrastructure Included in MM2045**

Roads
Michigan's federal-aid system

MDOT-owned:
34,960
lane miles

Locally owned:
92,950
lane miles

Bridges

11,000 plus
bridges more than 20 feet long

Transit

More than 80
transit providers operating local and intercity buses, demand-response services, and ferries

Rail

3,600
miles of private and state-owned freight and passenger rail corridors

Aviation
All airports

18
commercial airports

219
licensed, public-use airports

Ports

More than 30
ports

For example, if getting to the MM2045 Vision is experienced as a trip across the Lower Peninsula from Lake Michigan to Lake Huron, each mode has a different path to travel and a different distance to cover (see ***Figure 3***). Michigan's roads form a robust and mature statewide system. The present focus is primarily to preserve the existing system and to make operation enhancements to address congestion and reliability bottlenecks. Statewide, robust data sets for roads and bridges are complemented by mature forecasting tools and analytical databases to understand the needs, costs, and gaps to meet those needs.

***Figure 3.* Modal Planning Comparison**

Other modes, unfortunately, are not as far along. For example, passenger rail and public transportation providers have data on their existing systems and understand the costs to operate and maintain those systems. However, there are clear gaps in network coverage. These modes are not accessible to all at the statewide level.

Non-highway modes (including freight rail and marine) also deal with first/last-mile connection issues, along with having a sufficient workforce (e.g., drivers, mechanics and operators) to provide the necessary services as a whole for all users.

The least developed system is active transportation. There is currently not a clear understanding of the statewide coverage of active transportation facilities (e.g., trails, sidewalks, bike lanes, shoulders). As a result, the path to the MM2045 vision can't be fully mapped out. Therefore,

before the active transportation mode can identify future needs and costs, it needs an inventory of existing locations and the conditions of those assets.

The Purpose Behind MM2045

MM2045 provides the framework for a long-term direction that is multimodal, integrated, safe, and accessible for all users in Michigan with a focus on assets eligible for federal aid. While acknowledging the state's current priorities for preservation, safety and other needs, it points the state's transportation agencies in the direction to be prepared for new technologies, focusing on collaborative partnerships and initiatives, and builds on existing efforts to encourage greater incentives to move forward. It provides recommendations for what Michigan needs to do now to reach its ambitious future vision. MM2045 encourages transportation agencies to move beyond traditional jurisdictional ownership and siloed decision-making and points Michigan toward a technology-driven, choice-oriented transportation system with the following overall purposes:

- Set the long-term direction for transforming Michigan's transportation system to be what it needs to be in the year 2045.
- Improve the understanding of the relationships between passenger and freight movements and their mobility and accessibility challenges and needs.
- Transform the system to meet Michigan's goal to reach carbon neutrality by 2050 and rise to the global challenge of climate change.
- Promote multimodal integrated decision-making.
- Overcome jurisdictional ownership challenges.
- Enhance transportation partnerships.
- Invest and work inclusively on transportation projects that serve diverse communities and provide equitable access for all users
- Prepare the system to be more resilient, redundant, and technology-ready.
- Determine long-term transportation funding gaps to develop and maintain Michigan's transportation system. In addition, recognize gaps in skilled workers, resources, and data to make effective decisions for the future.
- Educate readers of the plan to modal issues that are unique and similar, and how each mode is at a different starting point.

MM2045 demonstrates that meeting Michigan's mobility and access needs requires a partnership that involves all levels of government and private entities. The effort to better understand partners' needs has led to efforts to establish more data-sharing, provide consistent data collection across agencies, and collect data that is currently not tracked.

Despite the COVID-19 pandemic, this transportation plan included an expansive outreach and public involvement process utilizing a variety of new methods. The Public and Stakeholder Participation Report provides more detail on the engagement conducted for this plan.

How is the MM2045 plan structured?

As the first integrated plan for the entire state of Michigan, MM2045 is structured differently than past SLRTPs. In this plan, content is presented in five parts grouped by topics that cover all modes of transportation. In addition, there are more modes in MM2045 than in past plans due to the plan's integrated approach. These modes include:

- Roads and bridges (locally and state-owned)
- Freight (truck, air cargo, marine, and pipeline)
- Rail (passenger and freight)
- Aviation
- Active Transportation (formerly nonmotorized)
- Transit

MM2045 integrates all current federal requirements for the SLRTP, freight plan, and rail plan into a unified document to move all modes of transportation towards a shared vision. Compliance matrices for each plan as well as the ten federal planning factors can be found in the Federal Compliance Matrices. Further detail on public input that informed the creation of MM2045 and detailed rail information can be found in the Public and Stakeholder Participation Report and State Rail Plan Supplement, respectively. The MM2045 Active Transportation Plan: A Bold Vision lays out the policy direction for Michigan's active transportation system. Finally, Michigan's first Statewide Transit Strategy provides a pathway for Michigan's transit providers to adapt to current challenges, take advantage of evolving opportunities, and plan for a more connected and collaborative future.

MM2045 is structured into the following five major parts to present the message of statewide transportation for all of Michigan.

Looking to the Future (why plan?) presents the current and forecasted socioeconomic and technology trends and applies various future scenarios to extrapolate potential factors that could affect transportation decision-making. Anticipated transportation revenues are another critical consideration when discussing the future: what is currently available, what is the forecasted gap, and what are potential financial strategies for bridging the gap?

Shaping the Future discusses the overall vision for transportation in Michigan out to 2045, and then expands to include overall goals and objectives. The importance of partnerships is then discussed to illustrate the multiple owners and the complexity of decision-making across all the modes. Partnerships are needed to develop Michigan's future mobility and accessibility, which is important to Michigan's prosperity. Lastly, this section presents how Michigan's transportation future will impact communities, the environment, and the overall health of Michiganders.

Network and System Needs presents maps of Michigan's modal networks and Strategic Multimodal Corridors as well as federally required performance measures. Additional state performance measures are also presented in this section.

Network and System Needs presents the overall modal needs across Michigan's transportation network by topic. The purpose for this is to demonstrate that transportation modes do not operate independently, but rather as a complex interconnected system that relies on investment in the following areas:

- System preservation and maintenance
- Capacity and right sizing
- Safety and security
- Management and operations
- Accessibility and connectivity
- Resiliency

How We Get There illustrates the specific strategies, implementation steps, and, in the case of freight and rail, specific projects to achieve the Vision, Goals, and Objectives of MM2045.


4603
4603
AMTRAK

Looking to the Future (why plan?)

Chapter 2 — Socioeconomic and Technology Trends, Forecasts, and Scenarios

Chapter 3 — Revenue Forecast

CHAPTER 2

Socioeconomic and Technology Trends, Forecasts, and Scenarios

Ongoing and emerging trends influence how Michigan's transportation stakeholders will invest in the transportation system and what strategies and policies they will enact to achieve a more equitable, prosperous, and sustainable future.

Michigan's population and economy are changing in response to long-term and emerging trends that could significantly affect travel patterns and demand across all modes of transportation. Population and jobs are projected to grow gradually over the next 25 years and will likely increase travel demand, particularly in urban areas. Several push-pull factors, such as an aging population, structural changes in the economy, and the further implementation of new technologies, will shape the character of that growth in meaningful ways. Importantly, the COVID-19 pandemic has accelerated some of these changes.

All the signs point to diversification in the way people and goods move around Michigan, and a more complex and precise coordination between the various modes, land uses, and policies is needed to harness the best returns over the long run. MDOT, metropolitan planning organizations (MPOs), county road commissions, and municipalities will need to work more closely together to build complete, connected transportation and communication networks that underpin 21st century mobility. They will also need to monitor and plan for the uncertain outcomes of the economic shifts, technological innovations, and global events like climate change that will define the next 25 years.

Impacts of COVID-19

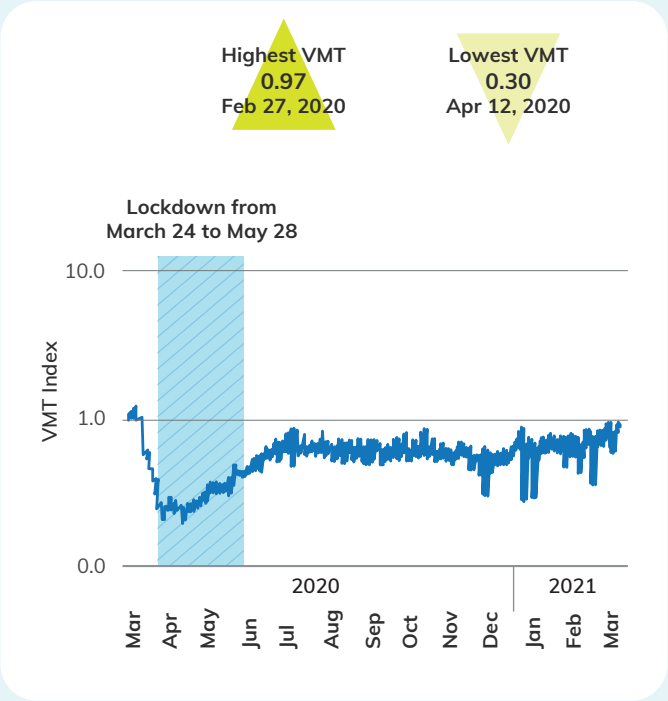
MM2045 was developed in the midst of the COVID-19 pandemic. The scale of Michigan's collective loss will take years to determine. So too will the impacts on the state's economy and travel patterns. The process of forecasting is defined by uncertainty. Fine-grained conclusions — of commodity flows and regional travel growth — may lack the satisfactory-level of certainty. General trends, however, serve as good indicators of Michigan's future.

From what can be discerned currently, it appears the pandemic has accelerated ongoing trends toward urbanization, more-flexible travel patterns, e-commerce, and changes in the supply chain. Michigan's vehicle miles traveled (VMT) has largely recovered to pre-pandemic levels[1] and the economy is expected to fully recover within five years,[2] but passenger travel and freight patterns may look quite different than they did pre-pandemic.

1 Bureau of Transportation Statistic, INRIX, and the National Renewable Energy Laboratory, 2021. "Daily Vehicle Travel During the COVID-19 Public Health Emergency." Accessed June 24, 2021. https://www.bts.gov/covid-19/daily-vehicle-travel

2 Research Seminar in Quantitative Economics. 2020. "The U.S. and Michigan Outlook for 2020-2022." May 15. Accessed June 1, 2020. https://lsa.umich.edu/content/dam/econ-assets/Econdocs/RSQE%20PDFs/CREC_RSQE_May2020.pdf.

***Figure 4.* Passenger Vehicle-Miles Traveled in Michigan during COVID-19 Pandemic (2020)**



Source: Bureau of Transportation Statistics, INRIX, NREL, "Daily Vehicle Travel During the COVID-19 Public Health Emergency." Note: Indexed to expected vehicle-miles traveled based on prior-year patterns.

Passenger trips dropped sharply in March and April 2020 but have rebounded as workers transition from working from home back to their regular work location (see ***Figure 4***). Travel has and will likely remain spread more evenly throughout the day, dampening peak drive-time congestion.

Passenger VMT is well on the way to full recovery, but the future of transit and passenger rail ridership is more uncertain. Some professional workers may telecommute indefinitely while others may choose to travel by other modes, including biking, which has spiked nationally in urban areas over the course of the pandemic.[3] The COVID-19 pandemic illustrated just how critical transit was to getting Michigan's essential workers to the front lines even during the worst days of the pandemic. As the state's transit providers consider how to bring riders back, they are also considering how they might change their service schedules to better accommodate essential workers. With urban and older populations anticipated to increase, Michigan cannot risk a long-term, incomplete recovery.

The COVID-19 pandemic dramatically accelerated the rise of e-commerce and exposed supply chain risks to the broader population. The supply chain and logistics sectors were unprepared for unprecedented shifts in consumer demand toward essential household goods, labor shortages — particularly in food production — and the extreme increase in online shopping rates. Despite the initial difficulties, suppliers and manufacturers have accelerated the diversification of sources of supply and agile scheduling to improve resilience.

On the positive side, public understanding of the importance of supply chains and appreciation for freight has risen dramatically. The term "supply chain" itself has entered the common vernacular. This could lead to an improved opportunity for freight-friendly policies and freight-driven investment, and reinforce the value placed on resiliency and modal redundancy. It is also possible that attitudes bred by social distancing may linger, improving the acceptance of automation, for example.

The COVID-19 pandemic brought some new developments that may have lasting effects. With more near- and on-shoring coming, freight carriers involved in overseas trade will face rising financial risks. National supply chains may be prioritized and partially regulated because of security concerns.

Source: Suburban Mobility Authority for Regional Transportation

3 Streetlight Data. 2021. Autumn COVID Bicycle Trends: Biking Renaissance Update for America's Top 100 Metros

People and Jobs

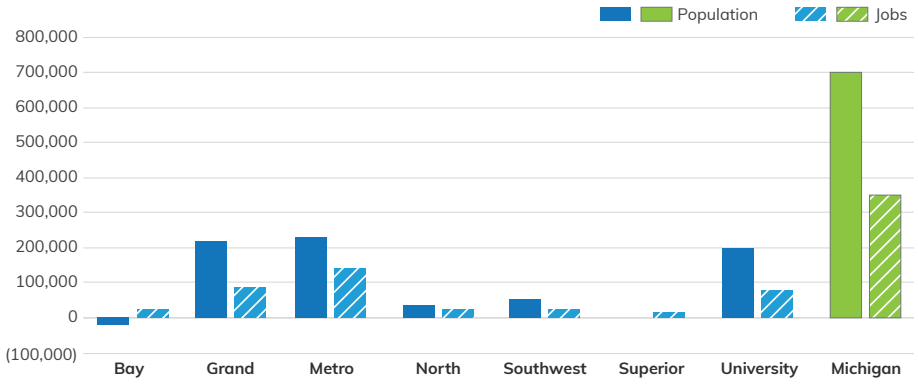
Job and population growth, particularly in urban areas, will increase travel demand.

Most areas of the state will see job and population growth, and the increased passenger and freight activity that comes with it, over the next 25 years.[4] Gains will be particularly pronounced in the Detroit (Metro Region), Ann Arbor (University Region) and Grand Rapids (Grand Region) metropolitan regions, which is consistent with longer-running economic shifts away from the more dispersed manufacturing, mining, and agricultural sectors, to the service and highly automated advanced manufacturing jobs that benefit from being concentrated in metro regions (see ***Figure 5*** and ***Figure 6***). By 2045, the Detroit area will account for more than half of the state's gross domestic product.

Increasing demand in urban areas and sluggish growth in less dense areas will require strategic reductions and expansions of roads, bridges, and rail corridors and expansion of mobility options like transit, biking, and walking to best meet Michigan residents' travel needs with constrained resources (for more on right-sizing, see ***Chapter 2***).

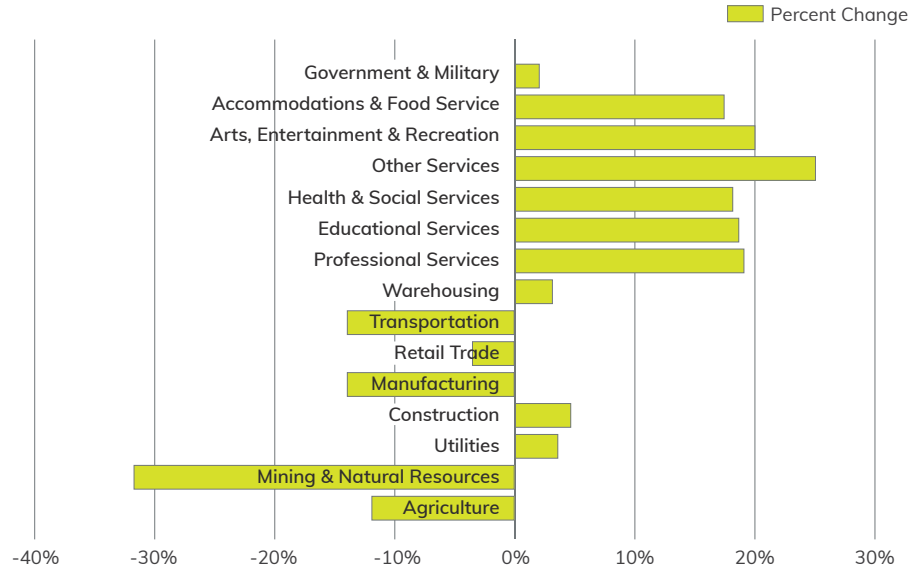
***Figure 5.* Change in Population and Employment, by Region, 2015-2045**

For a map of MDOT regions see ***Figure 21***.



MDOT Statewide Passenger and Freight Travel Demand Model (TDM), 2018

***Figure 6.* Change in Employment, by Industry, 2015-2045**



MDOT Statewide Passenger and Freight Travel Demand Model (TDM), 2018

4 The socioeconomic data discussed in this chapter are the same data that underlie MDOT's Statewide Passenger and Freight Travel Demand model (TDM). The TDM uses these data to drive passenger and freight trip generation estimates and other variables within traffic analysis zones (TAZs), which are unique sub-county geographies. The socioeconomic data are derived from multiple sources, including the U.S. Bureau of Economic Analysis, U.S. Census Bureau, REMI TranSight economic model, and manual adjustments made by MDOT. The analysis does not incorporate the results of the 2020 Decennial Census, which was not available during the production of MM2045, and may differ from projections using 2020 Census products.

To accommodate demographic change and promote health and equitable access to opportunity, non-auto mobility options will become even more important in the years to come.

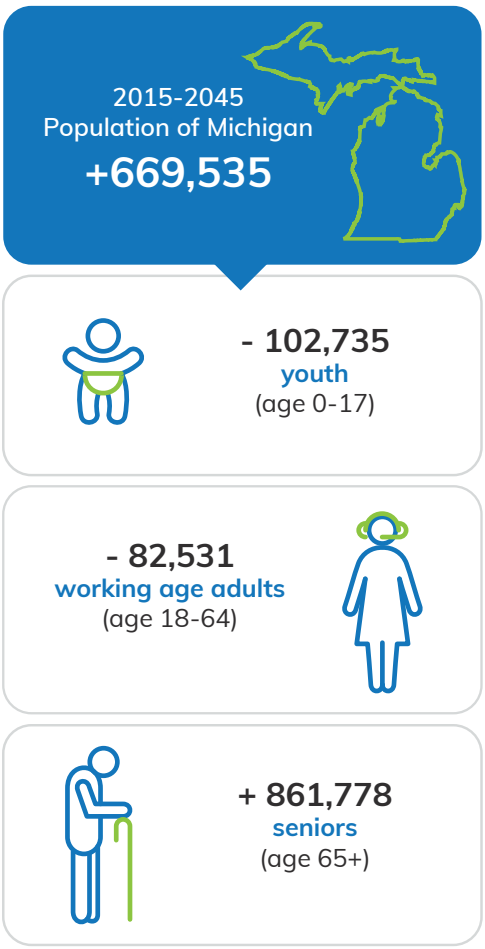
While existing transit, walking, biking, and emerging shared modes like bike-sharing and ridehailing lack the forecasting models and methods that trucking, rail, and auto travel benefit from, larger demographic and economic trends coupled with latent demand suggest rising activity over the next 25 years.

By 2045, Michigan's age 65-and-older population is expected to increase significantly, accounting for the bulk of the state's 7 percent projected growth (see ***Figure 7***).[5] To age in place independently, older Michiganders will need access to on-demand paratransit service, rides to medical appointments, walkable communities, and other alternatives to driving. In part due to aging but also in part to generational preferences and urbanization, the number of households without a vehicle is projected to bump up from 7.9 percent to 9.1 percent by 2045 with increases across all regions of the state.

As metropolitan areas become denser and destinations grow closer together, more opportunities for transit, walking, biking, and shared mobility could blunt increases in single-occupancy vehicle trips and result in positive impacts on safety, emissions, and congestion.

Many Michigan residents have health conditions that increase the need for, but could also benefit from, improvements to the state's transportation system. Obesity, heart disease, asthma, and smoking rates are all higher in Michigan than nationally. The state also has a higher prevalence of physical disabilities that affect people's mobility.[6] Access to healthy foods is also low, especially in urban areas.[7] Investments that support active transportation help address poor health conditions, while an increase in transportation options expands access to health care and healthy foods.

Figure 7. Demographic Change 2015-2045



5 25-year projections are based on Michigan's TDM with a base year of 2018. The analysis does not incorporate the results of the 2020 Decennial Census, which was not available during the production of MM2045. Projections using 2020 Census Products may result in different results.

6 Michigan Department of Health and Human Services. 2017. Michigan Behavioral Risk Factor Survey.

7 US Department of Agriculture. 2015. Food Access Research Atlas. Accessed June 4, 2020. https://www.ers.usda.gov/data-products/food-access-research-atlas/.

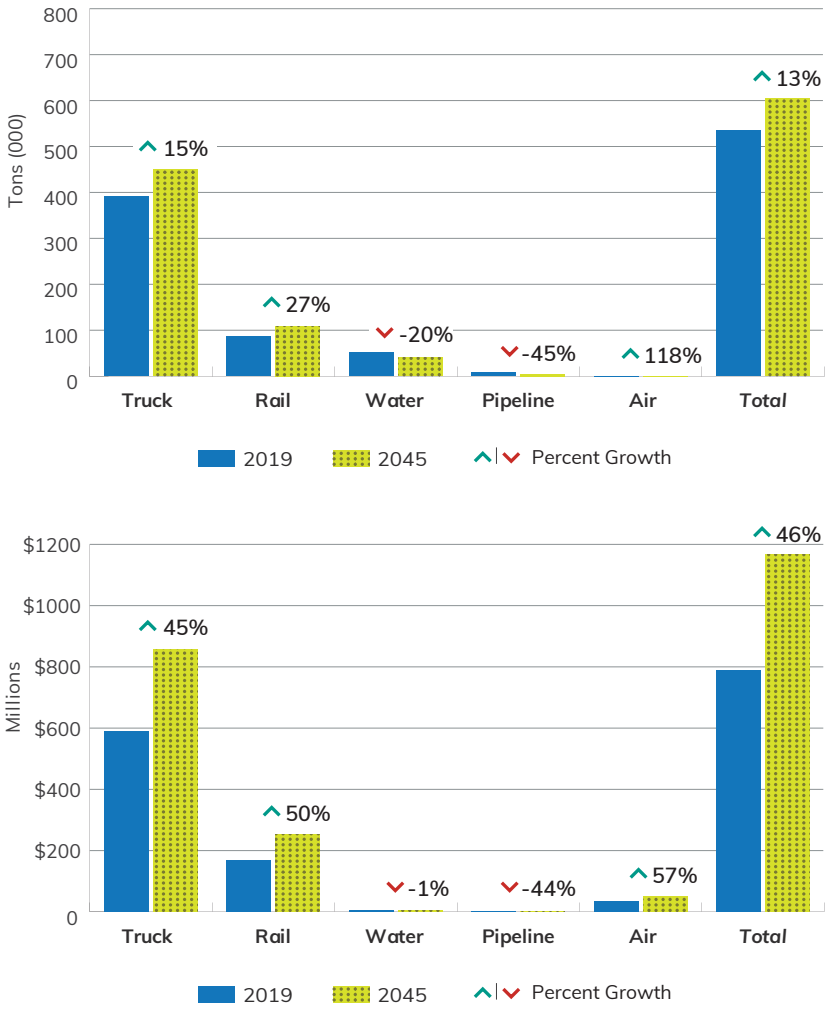
Freight

Freight volumes will grow on Michigan's roads.

Michigan's economy is forecasted to grow over the next 25 years with gains spread across the state. Even though some sectors and regions could experience a decline or stagnation in jobs, productivity is anticipated to increase across the board, and with it, freight volumes on the state's roads and rail lines. Total tonnage carried by all freight modes is projected to grow 13 percent from 2019 to 2045 with the total value of freight shipments growing 46 percent. Traffic passing through Michigan, chiefly between Canada and other parts of the United States, is a major driver of growth. Climbing 83 percent by tonnage and 91 percent by value, pass-through traffic will generate more than 70 percent of the tonnage added to the Michigan freight system through 2045 and more than 40 percent of the value.

Trucking will remain the dominant freight mode, continuing to handle about three-quarters of freight volume by tonnage and value in 2045. Projections indicate that rail will grow faster than trucking overall as shipments passing through Michigan rise rapidly. Michigan's fastest modal growth is forecast in air cargo, climbing 57 percent in shipment value. However, there are large expected declines in freight moved by water and pipeline due to lower volumes in energy products like petroleum fuel and building materials (see ***Figure 8***).

Figure 8. **Growth in Tons and Value: Truck, Rail, Water, Air, and Pipeline, 2019-2045**



Source: IHS Markit Transearch

Total tonnage carried by truck is projected to increase by 15 percent from 2019 to 2045, with about half the tonnage growth coming from pass-through traffic. This suggests that the state's highway infrastructure will experience rising pressure from freight movements across the network over the next two decades, particularly on routes connecting to Canadian gateways. Key bottlenecks on the highway freight system could get worse, with cascading delays to supply chains.

Overall, freight rail tonnage is expected to increase by 27 percent between 2019 and 2045, with most of the growth coming from pass-through volume. Some rail lines not involved in such traffic may become vulnerable to closure due to lack of use. The value of goods moved by rail is less concentrated in pass-through traffic and will grow 50 percent, as auto shipments, particularly between Michigan and Mexico, replace coal traffic. In addition to the background economic growth and diversification of freight corridors mentioned earlier, greater volumes of consumer goods may go by rail as shippers look to economize and work around labor shortages in the trucking industry.

Despite such sources of new business, the decommissioning of coal-fired power plants and precision scheduled railroading practices could bring significant declines in traffic and revenue to local rail lines. Some lines risk discontinuation, and while potential changes in rail ownership may expand short-line rail service in the state,

preservation of at-risk rail lines and spurs could be needed to protect opportunities for future development and support resiliency in the transportation network.

The supply chain will diversify and so will freight transportation routes.

Funding to preserve and expand the freight system after years of under-investment is essential to Michigan's ability to recapture and grow the manufacturing industry. Freight investment only becomes more important as Michigan's supply chains act to reduce risk and relocate production.

Many industries are rethinking their supply chains to mitigate disruption, take advantage of emerging modes of production, and respond to consumer preferences. Severe weather events associated with climate change and global trade instability, among other considerations, are encouraging industries to diversify their sourcing and production both overseas and in the region. The state's importance as a gateway state to Canada will likely rise as more freight volumes flow across the continent, aided by the recent enactment of the U.S.-Mexico-Canada (USMCA) trade agreement. Michigan's connections to East Coast ports serving locations such as India will grow in prominence.

New domestic production in Michigan or elsewhere in the United States could replace some imports, particularly in industries that can be automated. Increased automation and small-batch production are making it economically feasible to bring some manufacturing jobs back from overseas. The advancement of additive manufacturing, such as 3-D printing, could also enable more local production.

On the whole, overseas, regional, domestic, and local goods coming from more sources will rely on a wider array of trucking and rail routes than they do today, possibly served by new intermodal terminals brought online to facilitate local goods movement and international commodity networks.

Figure 9. **Freight Rail Commodity Movements To/From Michigan (All Commodities)**

E-Commerce has heightened consumer expectations of freight and need for reliability.

Online shopping and same-day delivery have become common in the lives of many Michiganders. E-commerce market share was approaching 12 percent even before the COVID-19 pandemic struck, registering $602 billion in 2019 (per the U.S. Department of Commerce), and will continue a relentless climb. Disruptions from point of production down to the last-mile trip from distribution center to doorstep are now felt directly by consumers.

Given the sharp rise of business-to-consumer e-commerce models, smaller urban infill distribution centers necessary for same-day delivery will become more common as consolidated shipments to brick-and-mortar retailers drop. The small orders characteristic of online purchases plus the short time windows to complete delivery will cause retail volumes to fragment as well. For any given amount of freight, the number of separate shipments and destinations will be greater and a larger number of trucks will be used. In addition, delivery trucks will congregate in areas with concentrations of online orders, such as dense residential neighborhoods and college campuses. The effect will be more trucks on roads and congestion in areas that may not have been prone to it before. Goods will likely switch modes more often as shippers seek to optimize routing, incorporate redundancy into their supply chains, and handle returns, resulting in the need for more intermodal connections and an increase in local and regional trucking. From land use decisions to network planning, freight will become a larger concern for cities and townships across Michigan.

Satisfying high service standards will require resolving existing reliability challenges like highway bottlenecks and proactively tackling emerging risks. A dense network of increasingly automated regional and local distribution centers will place further pressure on existing local infrastructure as trucking, international marine, intermodal rail, and air freight rise to serve e-commerce demand.

To reduce risks of costly disruptions and missed deliveries, real-time information is needed to give businesses and shippers visibility into where products and components are in the supply chain so that corrective action can be taken sooner, and often with better choices. The tracking and performance optimization needs associated with the real-time monitoring of locomotive and freight car condition and the increase in consumer goods moving by rail will also heighten the need for big data in the years to come. Public and local agencies alike will need to work with the private sector to keep data flowing from truck to distribution center and all points in between.

Climate Change

> The severity of future impacts of climate change will depend largely on actions taken to reduce greenhouse gas emissions and to adapt to the changes that will occur.
>
> - Michigan Executive Directive 2019-21

The harmful effects of human-induced climate change necessitate an immediate and long-term focus on increasing the resiliency of Michigan's transportation infrastructure and services.

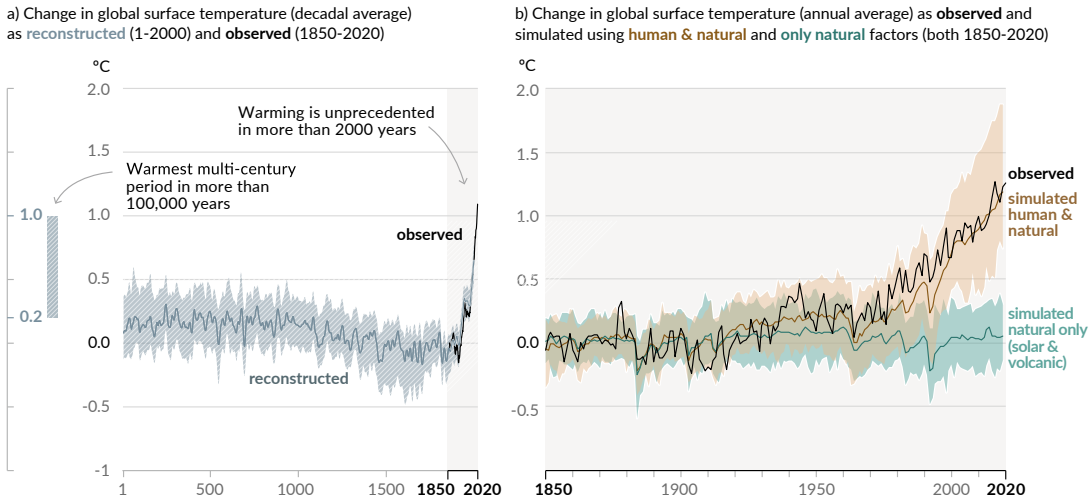
The latest global climate report from the Intergovernmental Panel on Climate Change (IPCC) strengthens the scientific community's conclusions that human activity has warmed the land and ocean, primarily through increased greenhouse gas emissions (see ***Figure 10***), among other critical climate impacts. The increase in the frequency and severity of heat waves, heavy precipitation, droughts, and other deleterious climatic events associated with rising temperatures are irreversible within the lifetime of people alive today. Forecasts indicate that the effects of climate change will intensify and worsen in the near-term.[8] Michigan is not immune: most of the state has warmed by 2 to 3 degrees Fahrenheit in the last century.[9] Severe weather events exacerbated by climate change have damaged and disrupted transportation infrastructure and property across the state, notably during the collapse of dams in Midland County in 2020 and major flooding in Detroit and surrounding suburbs in 2021. Simply put, the transportation system must be designed to regularly withstand events once seen as extreme or rare.

Deep reductions in greenhouse gas emissions, including those from the transportation sector, could stabilize the climate and head-off the most catastrophic long-term consequences of climate change, but time is running out.

8 National Aeronautics and Space Administration. 2021. *Global Climate Change, Vital Signs of the Planet—The Effects of Climate Change*. Accessed October 4, 2021: https://climate.nasa.gov/effects/

9 Environmental Protection Agency. 2016. *What Climate Change Means for Michigan*. Accessed October 4, 2021: https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-mi.pdf

***Figure 10.* Changes in Global Surface Temperature Relative to 1850-1900**



Source: IPCC. 2021. *Climate Change 2021: the Physical Science Basis – Summary for Policymakers*. Accessed October 4, 2021. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf

In response to the dramatic impacts of human-induced climate change on the health and prosperity of Michiganders, particularly marginalized people and indigenous communities, Gov. Gretchen Whitmer committed Michigan to the goals of the Paris Agreement to reduce greenhouse gas emission by at least 26-28 percent below 2005 levels by 2025. Reducing transportation-related emissions is a necessary component of Michigan's strategy. Altogether, cars, trucks, marine vessels, trains, and aircraft contribute 29 percent of total U.S. greenhouse gas emissions, the highest share of any sector.[10] Without significantly decreasing transportation emissions over the next two decades, Michigan will risk incurring greater and greater damage to its infrastructure, health, and economy as severe weather escalates in frequency, duration, and intensity. If carbon emissions are driven down now, there is still an opportunity to arrest the worst effects of climate change and begin long-term climate recovery.

Innovation and Technology

The way we move could change more dramatically and will require monitoring and management.

Electric vehicle sales are increasing in Michigan, connected and automated vehicle (CAV) development is advancing, and new micromobility services like bike- and

scooter-sharing are launching throughout the state. Based on the scenario planning conducted for MM2045, the projected impacts of these mobility changes may vary significantly.

In certain scenarios, the future availability of driverless CAVs could rapidly balloon VMT. Unburdened from minding the road, workers could choose to live much farther from their jobs and work from their passenger seats. Empty CAVs circling for their next ride could further congest streets unless off-street depots spring up, possibly managed by fleet companies. Although electrification would significantly reduce environmental impacts, such large increases in volumes could offset environmental benefits. Policymakers will need to consider how to balance these impacts with land use regulations and

10 United States Environmental Protection Agency. 2021. *Fast Facts on Transportation Greenhouse Gas Emissions*. Accessed October 4, 2021: https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions

alternate mobility options like flexible, automated transit vehicles. The rise in remote work, however, may temper such dramatic increases.

More services may be provided on-demand, operating on a service model rather than individual ownership. CAVs could follow a fleet-based model similar to ridehailing today. Cutting-edge dispatch software coupled with smaller, driverless shuttles could open up transit service to areas where it is currently economically infeasible, allowing travelers to summon a ride through their smartphone.

Source: Michigan Economic Development Corp.

Nearly all levels of advanced automation and electrification depend on public infrastructure. To keep the system moving safely and smoothly, CAVs must be able to talk to each other and to the connected traffic signals that anticipate and control their approaches. To keep vehicles from straying into nearby lanes, the streets need clear, well-maintained pavement markings. Electric CAVs, particularly driverless ones, will need to detect the nearest charging stations to continue service.

Recent spikes in fatal and severe crashes involving people walking and biking have erased decades of progress. While CAVs could usher in safer streets, they must be able to safely operate alongside people of all ages and abilities who are walking, rolling, and biking. Without advanced braking systems and pedestrian crash standards, some of the potential safety benefits of CAVs may not be realized.

New travel modes will increase competition for urban curb space, long given over to short- and long-term vehicle parking, emphasizing the need for forward-thinking curb management. CAVs and transit vehicles will need access to pick up and drop off passengers at their destinations. Carriers dropping off same-day deliveries will need temporary loading zones that they can quickly get into and out of to stay on schedule. Shared micromobility, like bike- and scooter-sharing, will place new demands on this space, both for travel in dedicated lanes as well as storage.

To facilitate the deployment of these new technologies and leverage their operational, societal, and environmental benefits, the types and scale of investment must increase. New cross-sector investments in electric-charging infrastructure, electric buses, Mobility as a Service (MaaS) platforms, CAV lanes, and vehicle-to-infrastructure technologies will be necessary. The data collected by connected vehicles and infrastructure will need to be securely shared and operationalized. Universal high-speed broadband will become a prerequisite for Michigan's future transportation system, and its roads and highways could become key conduits for fiber and communications corridors. Taken together, these technologies will require a reimagining of traditional user fees such as gas taxes to open up new opportunities to stabilize funding and mitigate potential negative consequences.

New technologies like CAV and connected infrastructure will positively affect freight movement in addition to passenger travel.

Costs come down when freight transportation is driverless, but costs are also reduced when transportation is safer and connected. Reliable, widespread communications networks will make it possible to pinpoint the location and movement of goods in real time and allow logistics professionals to reoptimize supply chain decisions in the face of new events.

The possibilities for optimization are unprecedented and they depend on visibility: the ability at all times to know the immediate status of goods and the condition of equipment, networks, and personnel. The difficulty is sustaining visibility end-to-end. Most freight shipments begin and end on local roads. Automakers are receiving parts from Michigan suppliers entirely on local roads multiple times per day. E-commerce providers are placing warehouses in the middle of consumer districts to permit fast, local delivery. Every advantage companies can derive from real-time optimization will improve the efficiency of their supply chain and their use of the transportation system. Moreover, the outcomes will be better if the private and public operations are interactive; for example, through signaling and work zone management systems.

Realizing these benefits will require public agencies to invest in and maintain the physical and digital

infrastructure that make it all function, and to harmonize and standardize this infrastructure across jurisdictional lines to ensure that it works everywhere. Whether it is connected supply chains or passenger travel, the next 25 years will bring an overarching need to reconceive partnerships between MDOT, MPOs, and private industry.

Training for the next generation of mobility jobs will be necessary to avoid disruptions to Michigan's economy.

Jobs in the mobility sector are projected to grow but will likely require new skills, such as design, computer science, and engineering. Entirely new jobs could also be created. Automation may reduce the need for truck and bus drivers, but it is uncertain when this may occur. New partnerships between transportation managers, the education sector, and private companies will be necessary to secure Michigan's role as a leader in mobility innovation while ensuring that today's auto manufacturing and transportation workforce can be retrained and reassigned to power an equitable transition to a future defined by automation.

Scenario Planning

As part of the MM2045 effort, MDOT conducted a quantitative scenario planning analysis, examining potential changes to the pace and spread of economic change and technological adoption of CAV and e-commerce, to guide future planning and decision-making. MDOT compared the forecasted conditions for four alternative futures (Renaissance, Tech Revolution, Gig Economy, and Stagnation - see ***Figure 11***) against the baseline growth discussed earlier in this chapter (Baseline future). The analysis identified conditions forecast to exist in all future scenarios as well as those conditions that showed significant variation across the scenarios to gauge the level of necessary investment (see ***Figure 12*** for projected network performance across all four scenarios). Furthermore, the analysis identified areas where more research is necessary.

Figure 11. **Future Transportation Scenarios for Michigan**

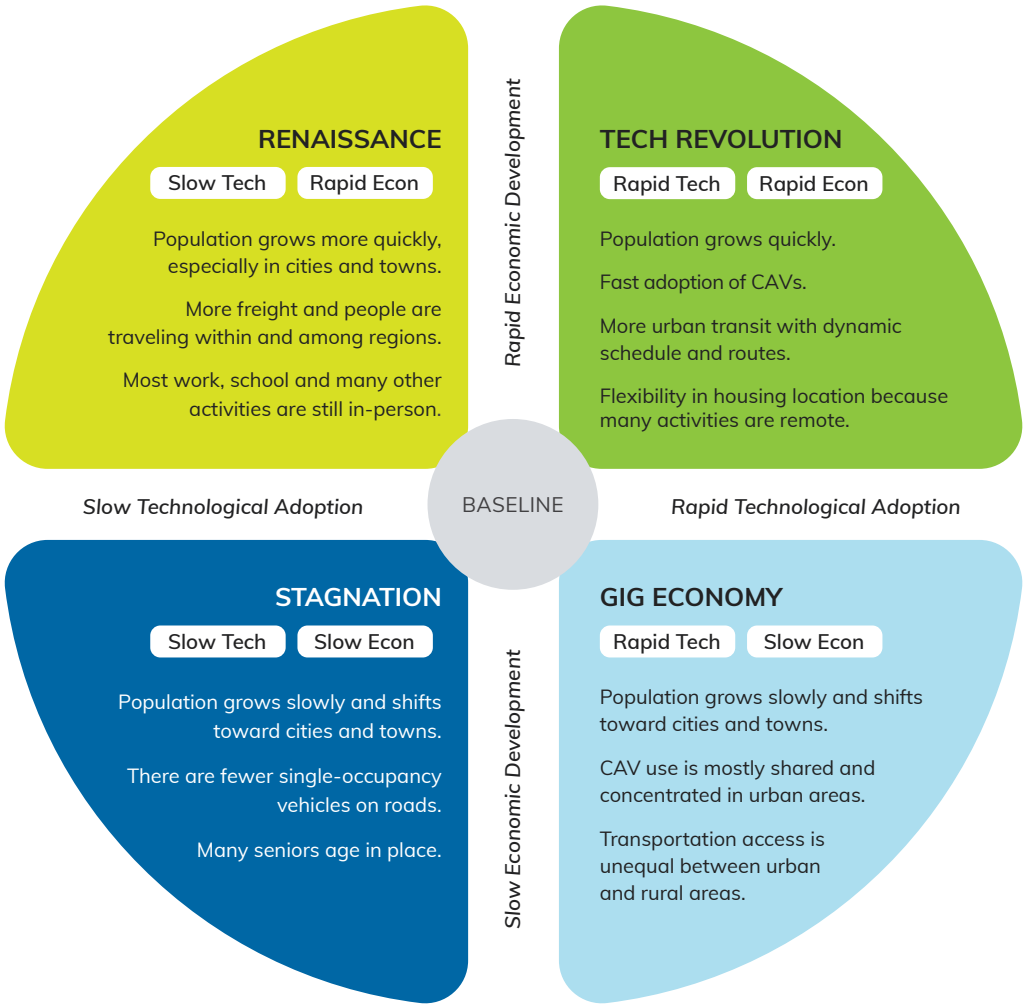
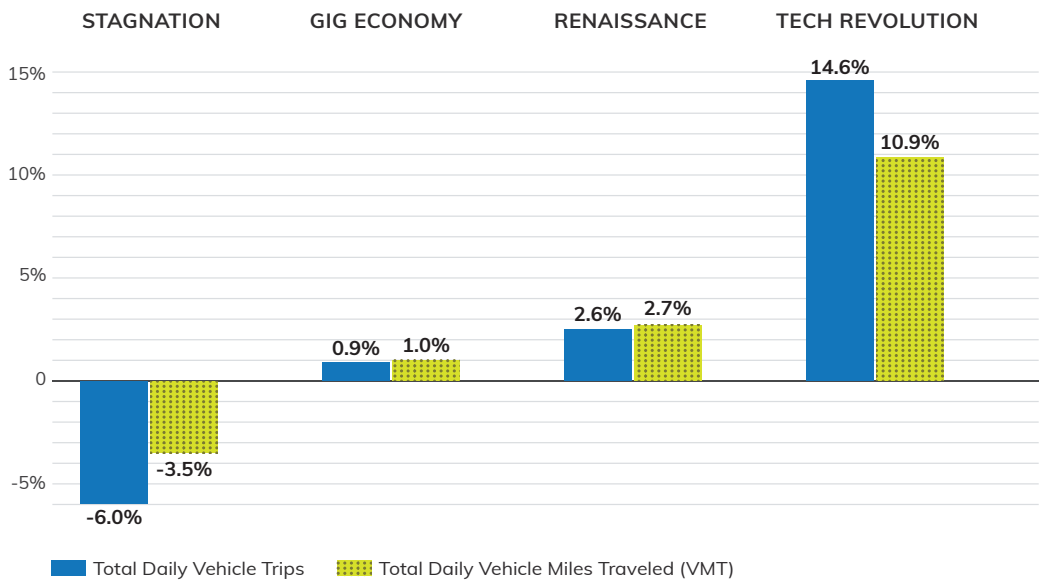


Figure 12. **Changes in Primary Travel Characteristics from Baseline in 2045**



Source: MDOT Statewide Passenger and Freight Travel Demand Model (TDM), 2020

Findings

Analysis of the different future transportation demand scenarios served to stress test the system to identify and prepare for potential challenges. The analysis yielded the following insights for long-range planning and monitoring by MDOT:

- CAV adoption may have an equally large impact on VMT as broad economic changes do. For example, since CAVs may encourage new trips that were previously not possible and fully-driverless CAVs traveling to pick up passengers could lead to zero occupancy vehicle trips, travel estimated in the Gig Economy future would exceed the Baseline future even though economic growth would be slower. Lower CAV adoption might mute travel growth from added economic activity as seen in the Renaissance future. This highlights the importance of continuing to monitor technology developments as well as economic and behavioral trends.
- At the statewide scale, Michigan's transportation network is largely uncongested and appears well positioned to handle even significant increases in travel from a strong economy or technological adoption. While this is true overall, existing bottlenecks and congestion hotspots could worsen (for example, under the forecast for the Tech Revolution future). Because congestion would not be widespread in the Baseline, slower growth in traffic would have negligible impacts on measures of statewide congestion. This suggests Michigan would not need to significantly pivot its asset management and modernization strategies if trends deviate from the Baseline future.
- Zero-occupancy CAVs could represent a substantial share of the travel market and may require dedicated planning to supply facilities such as depots. This could require significant private-sector coordination if companies provide fleets of automated cars for taxi-like service.
- Growth concentrated in urban areas and small cities and towns is less likely to add VMT and congestion to Michigan's road network because these locations offer alternatives to lengthy car trips — whether by other modes or just nearby destinations. This indicates it will be worthwhile to monitor the location preferences of households and businesses to understand their impact on future system needs.
- Widespread adoption of telecommuting substantially higher than pre-pandemic levels could result in significantly less commuter travel. Higher levels of telecommuting might also change where households live and in-person jobs cluster, further affecting the transportation system. While these trends may generally benefit transportation system performance, they are important to monitor.

CHAPTER 3

Revenue Forecast

Transportation revenues significantly shape the ability of Michigan's transportation stakeholders to respond to ongoing and emerging trends and realize the MM2045 Vision. Michigan's transportation system will require significant additional investment to meet the present and long-term needs of residents and businesses. Without additional, sustainable funding, Michigan's transportation infrastructure will continue to deteriorate, exacerbating delay and safety issues, increasing disruptions, and inhibit access to jobs, schools, and medicine. Investing in transportation infrastructure and mobility services can unlock Michigan's economic potential, advance the state's equity and livability goals, and set the state on the path to proactively anticipate the challenges and opportunities to come.

Revenue Sources

Transportation funding comes from multiple revenue streams, with the bulk of funding for the federal aid-eligible system coming from federal and state sources. Beyond the magnitude of revenue, funding policy shapes how Michigan can respond to needs across the system. Federal and state transportation revenues are largely prescribed for particular modes or uses under state and federal law, rather than broadly available for any transportation project.

Federally Funded Transportation Revenue

Michigan receives approximately $1.2 billion in federal funding each year through the Federal Aid Highways Program (FAHP). As required by Act 51 of 1951, Michigan divides those funds as 75 percent for activities on MDOT-owned roads and 25 percent for local roads. FAHP funds are received in specific programs, and each comes with its own requirements.

Some of the programs include the National Highway Preservation Program (NHPP) that funds routes on the National Highway System; Surface Transportation Block Grants (STBG) that funds a wide variety of projects, including road and bridges, transit and nonmotorized projects; Congestion Mitigation and Air Quality Improvement (CMAQ) Program that funds projects to improve air quality, including clean fuel transit and traffic signal timing projects; and the Transportation Alternatives Program (TAP) that supports nonmotorized projects, among others. Each category has an annual allocation for its program type that MDOT splits between local and MDOT programs for needs across Michigan. The Federal Highway Administration's (FHWA) National Highway Freight Program (NHFP) funds projects on the National Highway Freight Network (NHFN), including up to 10 percent for intermodal projects. This funding will be used by MDOT to implement the Freight Investment Plan listed in Chapter 17, ***Freight and Rail Service Investment Plans***.

State-Funded Transportation Revenue

Michigan also receives approximately $2.6 billion in state funding annually for transportation needs provided primarily by state gasoline taxes, vehicle registration fees and some state income tax, plus part of the new marijuana tax collected into the Michigan Transportation Fund (MTF). After some deductions for statewide transportation programs identified in Act 51 of 1951, the MTF funds are split 39.1 percent for MDOT-owned roads under the State Trunkline Fund (STF), 39.1 percent for county roads, and 21.8 for cities and villages. Part of the MTF also funds the Comprehensive Transportation Fund (CTF) for transit needs.

In recognition of the importance of transportation to the economy and quality of life, the State of Michigan passed legislation in 2015 that raised fuel taxes and vehicle registration fees beginning in January 2017 and indexed the fuel tax rate to inflation, with automatic increases to start in January 2022. Furthermore, the Legislature established a recurring income tax redirection to the MTF and specified in its 2018 bill legalizing the sale of

recreational marijuana that 35 percent of the revenue generated by a corresponding tax would flow to the MTF. Gov. Gretchen Whitmer also introduced the Rebuilding Michigan bond program to finance additional investment in Michigan's infrastructure today.

These changes put Michigan in a much better position to weather the storm brought on by the COVID-19 pandemic, which reduced core state transportation tax revenues (such as fuel taxes and weight taxes) by nearly $160 million (6 percent) between FY 2019 and 2020.

Federal funds also helped support Michigan through the pandemic, with the Coronavirus Aid, Relief, and Economic Security (CARES) Act, the American Rescue Plan, and other legislation providing funds for capital projects as well as operational support for transit agencies, departments of transportation, and other local governments. However, these emergency funds are not expected to continue once the pandemic subsides and have been excluded from revenue forecasts.

> **Federal and state transportation investment is shaped by funding requirements as well as many transportation stakeholders**

Project selection varies depending on the type of funding and its requirements, and is typically guided by a planning process and call for projects. Funding for projects on MDOT-owned roads is guided by the 5YTP, which is updated annually. In urbanized areas with more than 50,000 in population, local projects are selected through MPOs' development of their Transportation Improvement Programs (TIPs). Funding targets are given to each MPO for each year of the TIP. Every three years, MPOs undertake a planning and competitive project selection process for their areas. For rural communities, a Rural Task Force (RTF) selects projects for areas outside of MPO boundaries. There are also small urban communities that have a project selection process through a Small Urban Program and receive funding every other year.

Statewide programs such as Local Bridge, Local Safety, and TAP have a statewide call for projects annually for projects approximately three years out. In each case, projects are evaluated on a scoring criteria by a policy or selection committee that is responsible for ensuring a fair and open process and selecting projects that make the best use of transportation funds, accounting for all user needs within the transportation system.

Revenue Forecasts

Federal transportation funding remains guided by the Fixing America's Surface Transportation Act, known as the FAST Act, originally passed in 2015 and reauthorized to provide funds through FY 2021. As of October 2021, Congress is developing the next surface transportation reauthorization bill. MM2045 assumes that future programs and funding levels will align closely with past funding, with federal revenues expected to grow approximately 2 percent per year.

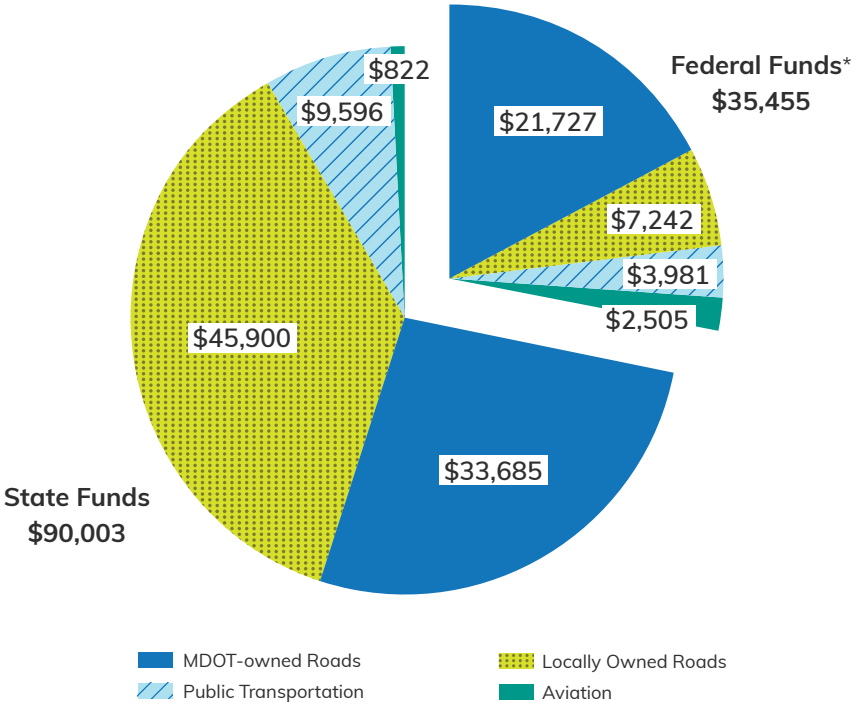
Considering current funding resources, state funding for transportation is projected to equal $90 billion (in 2020 dollars) over the next 25 years, while the federal government is forecasted to send approximately $35 billion in revenues to MDOT and its transportation partners. Across state and federal sources, the bulk of funding will flow to roadways, including those owned by MDOT and local agencies, with smaller shares supporting the state's public transportation providers and airports (see ***Figure 13*** for more detail).

Not all of this revenue will be available to spend directly on transportation programs; some of it must be set aside to pay for administration, debt-service on prior borrowing, and other uses. Of the total projected federal and state revenue, $85 billion is directed to transportation system needs that could be quantified as part of MM2045.

Revenue Needs and Gap

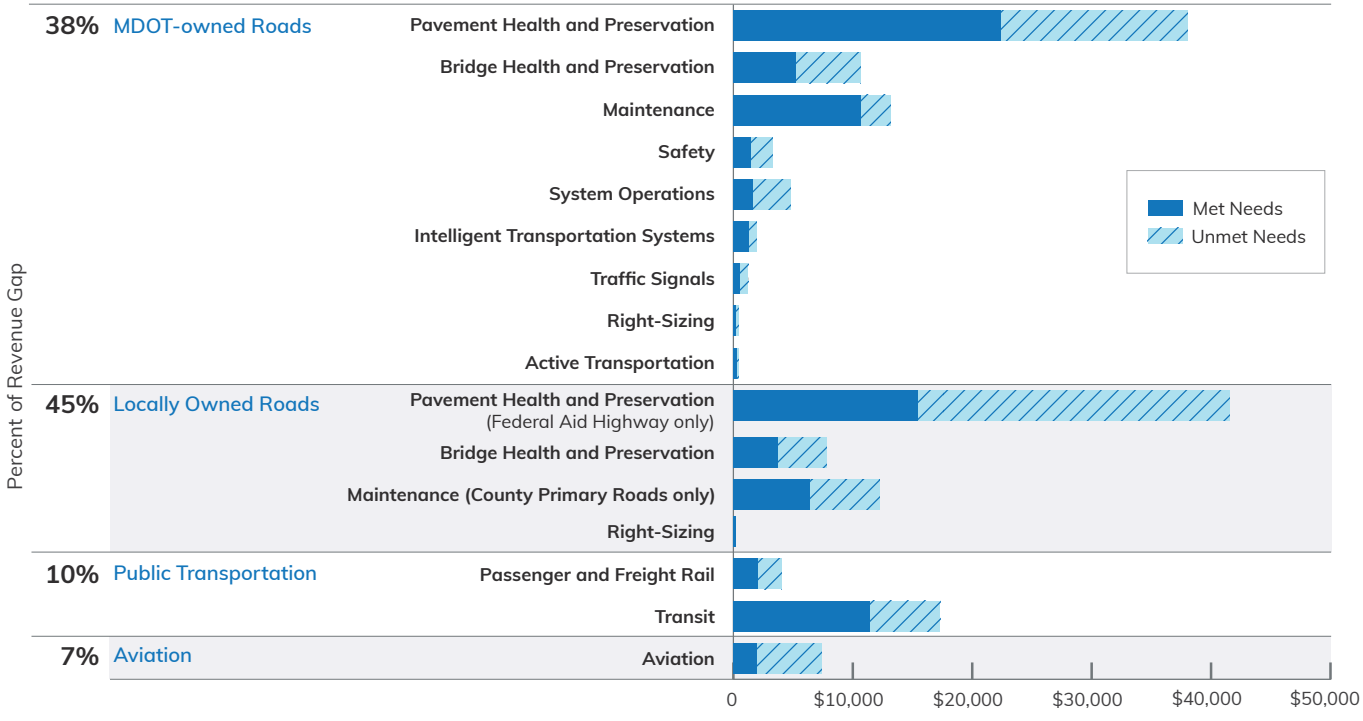
This analysis provides a big picture outlook on the magnitude of long-term needs to sustainably fund and maintain Michigan's multimodal network through 2045. For Michigan's roads and bridges, it covers all assets owned by MDOT. On the locally owned system, however, the quantified needs only include pavement condition of federal aid-eligible roads, maintenance of the county primary road system, condition of bridges more than 20 feet in length, and right-sizing needs. Rail needs include passenger operating subsidies, capital maintenance, and the subset of rail expansion and improvement projects with existing cost estimates. Accounting for the full portfolio of local assets, modal needs for which estimates cannot be currently obtained, and inflation will likely drive the estimate up. As a result, this analysis is a starting point toward understanding Michigan's long-term needs and revenue gaps.

Figure 13. **Total State and Federal Funding Forecast, FY 2021 to 2045 (Millions of 2020 dollars)**



* The MM2045 federal revenue forecast does not account for any changes to federal formula funds, discretionary grant programs, or one-time spending associated with the Infrastructure Investment and Jobs Act or the Infrastructure Expansion Act of 2021.

Figure 14. **Revenue Gap, FY 2021 to 2045 (Millions of 2020 Dollars)**



Michigan's transportation needs (see ***Network and System Needs***) are estimated to total $164.6 billion from FY 2021 to 2045 across the transportation system.[1] ***Figure 14*** summarizes these needs, shows the portion of the needs anticipated to be met by available revenues, and the additional needs that will be unmet unless additional revenue sources are identified.

> **In total, nearly 52 percent of Michigan's total transportation needs are anticipated to be met over the next 25 years, leaving a gap of approximately $79.6 billion.**

Even though the full gap in needs for the locally owned federal-aid road network could not be quantified through MM2045, it is anticipated that those total needs are as significant or higher than those of the MDOT-owned roads over the next 25 years.

Though it has the smallest gap in absolute terms at $5.4 billion, public aviation revenues cover the smallest portion of anticipated needs. However, these revenues do not include spending by airports or airlines that may help to shrink the gap.

Similarly, Michigan's rail needs are largely funded by private freight railroads and Amtrak, while locally owned roads and transit may also be bolstered by local funds that are not quantified in MM2045.

Impacts of Underfunding

Failing to close the revenue gap and fully fund Michigan's transportation needs will have negative consequences for the state's infrastructure and economy. Insufficient investment can lead to infrastructure failures that cause major disruption to everyday life or, in the worst case scenario, may result in death or injuries. Climate change will produce more severe and more frequent weather events over the next 25 years, increasing the risk that already deteriorating infrastructure may fail and deepen the hardships Michigan's most impacted and underserved communities are already facing.

Underfunding and deferring investment simply cost more in the long run. The cost to rebuild damaged infrastructure can be much higher than adequately preserving assets in the first place. Even before reaching the point of failure, aging infrastructure can lead to higher crash rates, increase congestion, and create bottlenecks that lead to longer travel times.

Michigan is already experiencing the consequences of decades of underinvestment. Bridge closures and pump station outages have contributed to temporary and long-lasting disruptions to travel. Absent additional funding, these disruptions will increase in frequency.

By underinvesting in infrastructure, workers have access to fewer jobs and fewer options to get to school or medical appointments, and businesses cannot reach all potential customers. Transportation is a key consideration in business location decisions and increasingly the decisions of the 21st century workforce. Lack of investment in Michigan's transportation assets and services may cause people and companies to look to other states, making Michigan less economically competitive.

Economic Benefit Analysis

The economic benefit analysis (EBA) developed as part of MM2045 evaluates the expected impact of closing the revenue gap on transportation investments on Michigan's economy and society by 2045, as compared to Michigan's forecast available revenue.

The analysis found that closing the $2 billion annual road and bridge preservation revenue gap would result in more than $2.8 billion in statewide societal benefits per year and the Michigan economy could grow by nearly 5,000 jobs in 2045, when compared to the economic conditions under forecast available revenue. These gains would persist each year over time as long as the system is maintained.

Similarly, the EBA found that increasing available safety funding by approximately $33 million annually between now and 2031 could help the state avoid 362 fatalities and 2,188 severe injuries annually and add 6,300 jobs to the Michigan economy by 2031. These economic gains, which stem from productivity improvements from avoided days of lost employment and other workplace costs, would also continue over time as long as funding is maintained.

Bridging the Revenue Gap

Although the revenue gap is large, several avenues are available to reduce it beyond periodic increases in tax and fee rates. MM2045 stakeholder and staff input as well as

1 Data limitations constrain the ability to forecast needs for all local roads within Michigan. The local pavement needs shown in ***Figure 14*** reflect only the needs, and revenue allocations, associated with federal-aid highways (i.e., National Functional Classifications 1 through 5, and 6 for urban roads). Similarly, revenues associated with other types of local road needs that could not be quantified for this plan, such as safety, are excluded from the graphic.

best practices from peer states coalesced around three major funding strategies. The State of Michigan could consider legislation to allow for the following innovative funding solutions:

Innovative Funding Sources

- Road User Charging (also known as mileage-based user fees): systems in which drivers pay a fee for each mile driven, which could help Michigan avoid declines in fuel tax revenues caused by the increase in electric vehicles and vehicle fuel efficiency as a result of consumer demand and regulatory trends.
- Toll Lanes/Roads: signed into law in July 2020, Michigan Public Act 140 of 2020 (PA 140) required that MDOT evaluate the feasibility of tolls as an additional revenue source to finance transportation improvements on Michigan's interstate and highway system. As mandated in PA 140, MDOT has contracted with a national consulting firm to complete the Michigan Statewide Tolling and Managed Lanes Feasibility Study and Implementation Plan. More information can be found at: Statewide tolling and managed lanes programs study for the state of Michigan - Home Page.
- Value Capture: fundamentally aims to link the beneficiaries of a public infrastructure investment to the project by implementing a mechanism for those beneficiaries to pay for portions of the capital, operations, and/or maintenance costs.

Public-Private Partnerships

Michigan should continue to work with private partners, such as railroads, ports, and airlines, to fund infrastructure that supports the public and private interest.

Federal Discretionary Grants

Federal discretionary grants are becoming more common mechanism to fund infrastructure. MDOT and other transportation agencies will continue to aggressively pursue federal discretionary grants to supplement federal formula funds and state and local revenues.

Pursuing strategies that close the funding gap is an important step in implementing the MM2045 plan and providing safe, efficient mobility to Michiganders.

Shaping the Future

Chapter 4 — Vision, Guiding Principles, Goals, and Objectives

Chapter 5 — Partnerships

Chapter 6 — Mobility and Accessibility

Chapter 7 — Community, Environment, and Health

CHAPTER 4

Vision, Guiding Principles, Goals, and Objectives

Over the course of MM2045, a diverse array of stakeholders came together to develop a shared, statewide vision and roadmap for Michigan's transportation system over the next 25 years. The MM2045 Vision, rooted in public and stakeholder values, enables Michigan's constellation of transportation agencies, service providers, private operators, and local, tribal, and regional governments to better collaborate on present and future challenges and opportunities. Achieving the MM2045 Vision hinges on consistent cooperation across sectors and levels of government. Four MM2045 Guiding Principles align stakeholder missions, values, and capabilities with the overall vision. The MM2045 Goals and Objectives help MDOT and individual partners prioritize limited resources for consistent, collective impact over the long term.

Vision

“In 2045, Michigan’s mobility network is safe, efficient, future-driven, and adaptable. This interconnected multimodal system is people-focused, equitable, reliable, convenient for all users, and enriches Michigan’s economic and societal vitality.

Through collaboration and innovation, Michigan will deliver a well-maintained and sustainably funded network where strategic investments are made in mobility options that improve quality of life, support public health, and promote resiliency.”

Guiding Principles

Preservation

Preserve, operate, enhance, and right-size the existing multimodal network as efficiently and effectively as possible, build and manage it to withstand and recover rapidly from disruptions, and maintain a network that provides for predictable access, movement, and interconnectivity.

Modal Choice

Build, maintain, and operate a multimodal mobility network for all users that is safe, adapts to new demographic, economic, and technological conditions, equitably distributes costs and benefits, responds to the public's demand for more modal choices and strengthens economic opportunity with high-quality access to jobs, to commerce, and between economic centers in and out of Michigan.

Future Oriented

Protect mobility investments by pursuing and planning for emerging trends, embracing technology, seeking flexible and diversified funding and financing tools to strengthen cross-jurisdiction and multidisciplinary partnerships, and pursue innovation in every aspect of transportation.

Sustainable Communities

Foster livable, healthy, and connected communities with convenient, multimodal access to jobs, services, social support, and activities by facilitating the safe and convenient movement of all people regardless of age, income, race, or ability, providing strong intermodal connections, and engaging in health-promoting projects and policies that support clean air.

Goals and Objectives

The six MM2045 Goals articulate broad priorities for Michigan's multimodal transportation system over the next 25 years based on input from MDOT, stakeholders, public comments, national goals, and federal planning factors.

Each Goal is accompanied by measurable, outcome-based Objectives that describe what must be done to achieve the Goal and advance the MM2045 Vision.

Quality of Life: Enhance quality of life for all communities and users of the transportation network.

- Create opportunities for safe physical activity, equitable transportation choice, and community engagement.
- Plan, develop, and maintain transportation facilities in a manner that protects the natural, historic, and cultural environment and avoids or minimizes adverse impacts.
- Pursue community-supportive transportation outcomes.
- Strive for cleaner, more efficient and sustainable energy sources for transportation operations and facilities.

Mobility: Enhance mobility choices for all users of the transportation network through efficient and effective operations and reliable multimodal opportunities.

- Improve access and connectivity between modes.
- Provide accessible and equitable modal options for the movement of people.
- Mitigate travel delays and alleviate congestion to provide predictable, reliable travel times.
- Leverage technology, communications, and management strategies to maximize safety and operational efficiency of existing systems.
- Identify redundancy gaps in the network to ensure continued mobility in the event of disaster or other interruption.

Safety and Security: Enhance the safety and ensure the security of the transportation network for all users and workers.

- Reduce the number of lives lost and injuries sustained on Michigan's transportation network, striving for zero.
- Foster a community and workplace culture of safety first.
- Reduce vulnerability from various threats; protect physical assets, cyber assets, and transportation systems.
- Prepare for and implement efficient coordinated response and recovery to emergency and disaster events.

Network Condition: Through investment strategies and innovation, preserve and improve the condition of Michigan's transportation network so that all modes are reliable, resilient, and adaptable.

- Achieve and maintain a state of good repair of transportation assets within the limitations of available resources.
- Cost-effectively maintain, operate and upgrade assets to maximize the useful life.
- Incorporate resiliency, adaptability, and redundancy in the transportation network, systems management, and operations.

Economy and Stewardship: Improve the movement of people and goods to attract and sustain diverse economic opportunities while investing resources responsibly.

- Pursue transportation asset and operational improvements that will expand access to economic opportunities, jobs, and core services.
- Improve transportation connectivity to established and emerging activity centers and tourist destinations.
- Create and enlarge competitive advantage for Michigan supply chains through higher productivity and dependability in the state freight system, supporting economic growth and strengthening economic resilience.
- Coordinate transportation systems with land use for efficient and sustainable use of resources.

Partnership: Strengthen, expand and promote collaboration with all users through effective public and private partnerships.

- Ensure key transportation data is collected, maintained, usable, and accessible to transportation partners and the public.
- Use performance measurement to inform decision-making and show progress toward local, regional, state, and national goals.
- Strengthen collaborative partnerships between public and private sectors and leverage diverse investment opportunities.
- Strengthen coordination of transportation facilities and services between agencies and municipalities.
- Strengthen community engagement and open decision-making processes offered through a combination of inclusive traditional and innovative methods.

Compliance with Federal Requirements

MM2045 is the first plan in the U.S. to integrate all federal statewide transportation planning requirements into a single document. The MM2045 Goals, Objectives, Strategies, and supporting content weave the requirements into a cohesive, forward-looking plan to guide Michigan over the next 25 years. Federal Compliance Supplement illustrates how MM2045 fulfills the SLRTP requirements enumerated in 23 CFR §450.216, Federal Planning Factors in 23 CFR §450.206, Freight Plan requirements in 49 USC §70202, and Rail Plan requirements in 49 CFR §266.15.

National Freight Goals

MM2045 improves the ability of the state to meet the national multimodal freight policy goals described in section 70101(b) of title 49, Unites States Code, and the national highway freight program goals described in section 167 of title 23. ***Table 1*** shows the correspondence between the MM2045 and national freight goals. More detail on how the strategies for implementing the MM2045 goals and objectives will help the state meet the national freight policy and program goals can be found in Chapter 15, ***Recommended Strategies***.

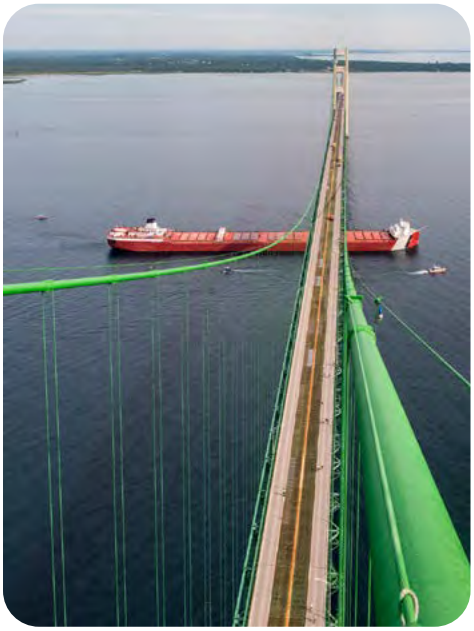


***Table 1.* Linkage of MM2045 Goals and National Freight Goals**

National Freight Goals	MM2045 Goals					
	Quality of Life	Mobility	Safety and Security	Economy and Steward-ship	Network Condition	Partnership
Enhance economic efficiency, productivity, and competitiveness	✓	✓	✓	✓	✓	✓
Reduce congestion and bottlenecks and improve the reliability of freight transportation	✓	✓	✓	✓	✓	
Improve safety, security, and resiliency	✓	✓	✓	✓	✓	✓
Achieve and maintain state of good repair			✓	✓		✓
Use advanced technology to improve the safety, efficiency, productivity, and reliability of the network	✓	✓	✓	✓		✓
Reduce environmental and community impacts	✓		✓	✓	✓	✓
Improve the short- and long-distance movement of goods across and between rural areas and population centers, gateways, and borders		✓	✓	✓	✓	✓

CHAPTER 5

Partnerships

Michigan's transportation future rests on intentional, collaborative partnerships among public and private stakeholders and the people of Michigan. MM2045 represents the first effort toward an SLRTP for **all** of Michigan. The transportation system in Michigan involves numerous public and private entities with no single organization or group overseeing the entire system. Each mode and owner has their own processes, priorities, missions, and areas of influence. As a result, MDOT does not directly control all aspects of the transportation system that Michiganders use every day. Transit, active transportation, trucking, marine, freight and passenger rail, and aviation are strongly influenced by the decisions made by regional and local public agencies, as well as the private sector. It may surprise some that the State of Michigan owns only about one-third of Michigan's 36,675 miles of roads eligible for federal funding. Counties, villages, and cities own the other two-thirds. Ultimately, regardless of jurisdiction, all stakeholders must work together to meet the vision and needs of Michigan's residents and businesses.

Building Partnerships

Because funding is limited, transportation agencies need to join forces and pool funds where possible to maximize the benefits of constrained funding. Partnerships are also important to preserving and improving community quality of life, and achieving equity. Stakeholder input is needed to understand the nature of transportation needs and to select the best solution for the situation. As mentioned in Chapter 2, ***Socioeconomic and Technology Trends, Forecasts, and Scenarios***, the way people and goods move around Michigan is diversifying, which will require precise orchestration between the various modes and owners to harness the best returns over the long run. This means MDOT, MPOs, county road commissions, municipalities, railroads, port authorities, economic development agencies, and transit agencies will need to work more closely together to build complete, connected transportation and communications networks that underpin the quickly evolving 21st century mobility.

Besides existing partnerships, new ones are also needed to secure Michigan's role as a leader in mobility innovation. These partnerships will represent a difference in kind than those of the past. Securely facilitating the flow of data is a prerequisite to modern mobility. Every advantage companies can derive from real-time optimization will improve the efficiency of their supply chain and their use of the transportation system. Moreover, the outcomes will be better if the private and public operations are interactive; for example, through signaling and work zone management systems. Michigan's vehicle fleet at large may also change dramatically. Zero-occupancy CAVs, which could represent a substantial share of the travel market, may require dedicated planning to supply facilities such as depots. If companies move away from selling cars to individual consumers and instead provide fleets of automated cars for on-demand service, necessary updates to regulations — from licensing to insurance — will require input from stakeholders across the state and nation. Ensuring that everyone can benefit from the new jobs that result from increasing automation, especially those potentially displaced from traditional transportation roles in logistics and manufacturing, relies on cementing innovative collaborations between transportation providers, the education sector, and private companies.

Understanding Decision-making

One MM2045 goal is to provide more transparency on the infrastructure operations, funding, planning,

and decision-making processes for the public. The complex interactions involved in transportation planning demonstrate the need for improved partnerships, which will result in a multimodal transportation system with less friction and greater efficiency in management and operations.

The following modal exhibits illustrate the complexity of influences and areas of decision-making within each mode.

Roadways

KEY ORGANIZATIONS -
Cities and villages; county road commissions; MPOs; rural task forces; MDOT; State Transportation Commission; FHWA

OWNERSHIP - State, counties, cities, and villages,

SAFETY - Transportation agencies at the state, county, city, and village levels determine safety improvements to implement on their own roads.

PLANNING - SLRTP, State Freight Plan, Transportation Asset Management Plan (TAMP), State Transportation Improvement Program (STIP), and Transportation Improvement Program (TIP).

FUNDING - Michigan motor fuel tax and vehicle registration fees; county and local government revenues; and federal funding,

INVESTMENT PRIORITIZATION - Local governments select the projects that best reflect their priorities and funding abilities. State and federal funds are prioritized for local roads through the MPO process for urban areas and the Rural Task Force Program for rural Michigan. State-owned roads are prioritized by MDOT through a multi-step process.

Transit

KEY ORGANIZATIONS -
Local transit agencies; intercity bus carriers; ferry operators; local government; MPOs; MDOT; Federal Transit Administration (FTA)

OWNERSHIP - Local transit agencies, intercity bus carriers, human service agencies, MDOT for intercity/intermodal terminals, and private ferry operators.

SAFETY - FTA through Public Transportation Safety Plans and the National Public Transportation Safety Plan, and MDOT for fixed-guideway public transit systems through the State Safety Oversight program.

PLANNING - Involves local governments, MPOs, MDOT, and federal agencies. Transit agencies also conduct their own planning.

FUNDING - Transit agencies through farebox revenue, property taxes, MDOT, and FTA.

INVESTMENT PRIORITIZATION - MDOT's 5YTP proposes investment strategies/distribution for state and federal funds.

Rail

KEY ORGANIZATIONS - Surface Transportation Board; National Transportation Safety Board (NTSB); Federal Railroad Administration (FRA); FHWA; private companies; MDOT

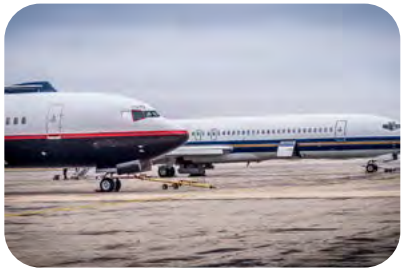
OWNERSHIP - Most of Michigan's 3,600 miles of rail corridors are privately owned, operated, and maintained by freight railroads. The system also supports passenger rail service.

SAFETY - Railroads are responsible for the safety of their operations and rail lines. FRA oversees track, bridges, and any incidents. MDOT has regulatory authority for all grade crossings and manages safety programs, as well as oversees rail worker safety. FRA and FHWA oversee safety programs. FTA and MDOT oversee state safety oversight for fixed-guideway systems.

PLANNING - Railroads conduct their own planning efforts for their property and operations. MDOT is responsible for the State Rail Plan. Other rail studies may be conducted by other parties for specific projects and/or new services. The U.S. Passenger Rail Investment and Improvement Act provides a framework.

FUNDING - Freight railroads fund most freight-related capital and maintenance investments. State appropriations fund intercity passenger rail operations, state-owned lines, and rail-related economic development projects. Grade crossing improvements are funded with dedicated state and federal dollars. FHWA and FRA oversee programs that can fund rail projects. MDOT provides funds to support safety, economic development, state-owned track, and passenger service. FRA oversees grant and funding programs.

INVESTMENT PRIORITIZATION - Railroads determine priorities for their network. MDOT's 5YTP defines its investment strategy for state-owned rail corridors. MDOT also has an FHWA-approved prioritization process for investments at grade crossings and initial prioritization for enhancements to road crossings.



Aviation

KEY ORGANIZATIONS - Michigan Aeronautics Commission (MAC); MDOT's Office of Aeronautics; Federal Aviation Administration (FAA)

OWNERSHIP - Township, village, or county, authority consisting of multiple local governments, or privately owned.

SAFETY - FAA oversees airports and airlines safety programs. MDOT influences aviation safety through airport licensing, inspection, zoning, and planning functions. Guided through the MAC.

PLANNING - Airport System Planning Process and MDOT's Aviation System Plan (MASP).

FUNDING - Airport funds, state funds through tax on aviation fuel, and federal funds.

INVESTMENT PRIORITIZATION - FAA prioritizes projects through grants and awards. The MAC supports polices and strategies. MDOT considers airport's role in the state transportation system.

Active Transportation

KEY ORGANIZATIONS - Counties, cities, villages; nonprofit organizations; MPOs; MDOT; Michigan Department of Natural Resources (MDNR); Michigan State Police (MSP); the U.S. Department of Transportation (USDOT)

OWNERSHIP - All levels of government.

SAFETY - MDOT through the Strategic Highway Safety Plan (SHSP), MSP Office of Highway Safety Planning, and local governments.

PLANNING - MPOs, nonprofits such as the Michigan Trails and Greenways Alliance, MDOT regions, and local governments.

FUNDING - Private (foundations, donations, and philanthropy), local (bonds, taxes, and assessments), state (Michigan Natural Resources Trust Fund, Recreation Passport Grants, gas tax, and MTF), and federal (USDOT).

INVESTMENT PRIORITIZATION - Local governments select projects that best reflect their priorities, the state uses the Approved Recreation Plan and Capital Improvement Program, and MPOs consistent with active transportation plan and regional transportation plan.

Ports

KEY ORGANIZATIONS - Cargo and recreational ports, public port authorities, and marine terminal operators; vessel owners/steamship companies; MDOT; Michigan Department of Environment, Great Lakes, and Energy (EGLE); MDNR; Michigan Department of Agriculture and Rural Development (MDARD); Michigan Economic Development Corp. (MEDC); U.S. Army Corps of Engineers; U.S. Coast Guard; U.S. Customs and Border Protection; U.S. Maritime Administration; U.S. Fish and Wildlife Service; U.S. Environmental Protection Agency (EPA)

OWNERSHIP - The federal government generally maintains the congressionally authorized navigation channels, aids-to-navigation, and other marine services. The private sector typically provides the marine terminals, cargo vessels, and necessary access channels.

SAFETY - Safety of marine vessels and their operation is the responsibility of vessel owners and the U.S. Coast Guard. Safety of marine terminals and their operation is the responsibility of the terminal owner.

PLANNING - MDOT, EGLE, MDNR, MDARD, and MEDC work in partnership with the U.S. Army Corps of Engineers on navigation projects and other marine-related issues. Other organizations involved in dredging of federal commercial navigation channels and port infrastructure improvements include the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, ports, local communities, terminal operators, steamship lines, and dredging contractors.

FUNDING - Private port owners or public port authorities fund landside investments. Local port improvement projects (new or expanded marine terminals, improvements to private navigation channels, or new marine services) are undertaken by the private sector, local governments or development organizations. The federal Harbor Maintenance Trust Fund, funded by the Harbor Maintenance Tax, provides funding for maintenance dredging of congressionally authorized navigation channels. MDOT provides annual operating assistance through the Michigan Comprehensive Transportation Fund to the Detroit/Wayne County Port Authority, with the other funding coming from Wayne County and the City of Detroit. MDOT also provides capital and operating funding for selected marine ferry services.

INVESTMENT PRIORITIZATION - Port owners prioritize according to business needs. The U.S. Army Corps of Engineers prioritizes navigation projects such as dredging according to needs and available funding.

Partnering Examples

Key existing partnerships benefit Michiganders at the project and programmatic levels.

Project-level partnerships are in place on large transportation projects (such as the I-75 Modernization Project and the Gordie Howe International Bridge), between state agencies on trail projects, and between MDOT and transit agencies on automated transit technologies. Current examples include:

- **Public/private:** In 2018, MDOT awarded the design, build, finance, and maintain (DBFM) contract to upgrade the final segment of the I-75 Modernization Project (Segment 3) in southeast Michigan. MDOT determined the DBFM model would provide the best project for Michigan in terms of innovation and delivery while meeting project goals and objectives.
- **Interagency:** The North Eastern State Trail is a beautiful rural trail like no other as it traverses farmlands and former lumber towns near Alpena, Posen, Millersburg, Onaway, and Cheboygan. The improvements to the former railroad corridor involved an exemplary collaboration between two state departments, local governments, and a nonprofit organization. The MDNR owns and manages the trail and has been working with MDOT, which completed the engineering for the project. The Top of Michigan Trails Council helped create the funding package for the trail project, including 60 percent through a federal transportation grant, 20 percent from MDOT, 15 percent from MDNR via the Michigan Natural Resources Trust Fund Grant, and 5 percent from local units of government. The MDNR Parks and Recreation Division maintains the trail surface.
- **Transit collaboration:** MDOT partnered with the MEDC, Michigan Department of Technology, Management and Budget (DTMB), Huron Transit Corp., the Capital Area Transportation Authority (CATA), Michigan State University (MSU), the Suburban Mobility Authority for Regional Transportation (SMART), transit agencies around the country, and other state departments of transportation to form the Automated Bus Consortium. This effort, which also has worked closely with bus manufacturers and providers of automated technology, will demonstrate the feasibility of full-size, electric, accessible, automated buses.

Program-level partnerships deliver even larger statewide benefits and exemplify the collaborative, solution-oriented efforts needed to reach the MM2045 vision. Examples of programmatic partnerships include:

- Michigan Transportation Asset Management Council and Michigan Infrastructure Council
- Michigan Transportation Planning Association - MPOs
- Michigan Public Transit Association - transit providers
- Michigan Association of Regions - regional planning agencies
- Commission for Logistics and Supply Chain Collaboration - freight advisory body
- MAC - aviation
- Rural Task Force
- Michigan Council for Future Mobility

MM2045 Partnering Outreach Activities

Recognizing the importance of transportation partnerships, MDOT employed several strategies and activities to engage partners, stakeholders, and the public in the development of MM2045. This strategy is evident in the comprehensive MM2045 Public and Stakeholder Participation Plan created in October 2018.

The participation plan was the result of analysis of previous Michigan SLRTPs and a peer review of ten other state departments of transportation as well as all of Michigan's MPOs and multimodal transportation plan engagement activities and programs. Additionally, a day-long workshop was conducted with stakeholders to garner ideas and input on public engagement methods.

A review of Michigan SLRTP engagement programs starting in 1999 was also conducted. A comprehensive analysis was done of the two most recent major redevelopments of the plan: the 2030 and 2040 plans. It identified challenges to getting people to attend in-person public meetings regarding SLRTPs. Attendance numbers showed a need to engage more Michiganders online and through diverse methods. Results of the review were reported out to stakeholders during a webinar presentation and discussion.

Methods were identified and implemented to achieve the greatest possible engagement of a diverse cross-section of Michiganders. Tactics included two interactive online MetroQuest surveys, four telephone townhalls, a statewide attitudes and perceptions survey conducted by a professional polling firm, Facebook and Instagram advertisements, and an MM2045 website. MDOT presented at existing meetings to promote the plan rather than scheduling general public meetings. A transportation survey developed in cooperation with the Michigan Department of Civil Rights – Division on Deaf, Deafblind, and Hard of Hearing was conducted using Survey Monkey and featured American Sign Language video translations. Michigan residents in every county of the state were engaged in development of MM2045 (as shown in ***Figure 15***).

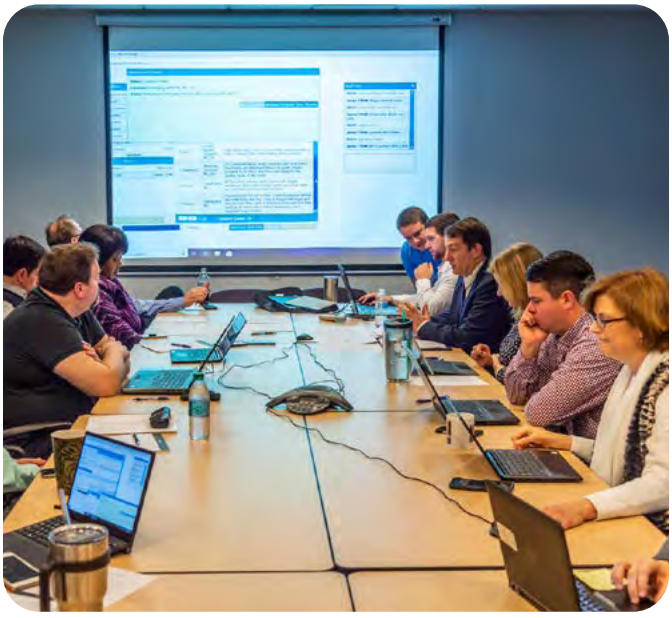
Workshops with stakeholders were included, but reimagined due to the COVID-19 pandemic. MDOT conducted online workshops through videoconferencing for establishing transportation objectives, conducting scenario planning, and examining active transportation and transit needs and freight/rail issues.

Participation in the workshops exceeded 300 people. Virtual breakout sessions were used for some workshops. Interactive online polling was used to get real-time feedback from participants through online survey questions. Social media posts, statewide e-mails, news releases, website posts, and announcements during webinars were used to promote engagement opportunities.

Stakeholder and public participation specific to freight, rail, transit, and active transportation issues were also conducted. In addition to virtual workshops, small group meetings and interviews were conducted, including coordination with the Commission for Logistics and Supply Chain Collaboration (which served as the Freight Advisory Committee for this plan). Additional information is available in the Public and Stakeholder Participation Report.

The results of the outreach, summarized below, met the engagement objectives for MM2045:

- MetroQuest Surveys – **7,537 completed surveys**
- MM2045 Website – **10,848 visitors**
- Social Media Advertisements – **1.2 million impressions**
- Telephone Townhalls – **6,352 participants**
- Virtual Workshops – **More than 300 participants**
- Active Transportation Townhall **- 88 participants**
- Transit Forums - **48 participants**
- Freight Workshop and Industry Forums – **122 participants**
- Statistically Valid Attitudes and Perceptions Survey of Michigan Residents – **1,500 respondents**
- Survey on Transportation for Disabled Users – **200 participants**
- MM2045 Draft Plan – **63 public comments**



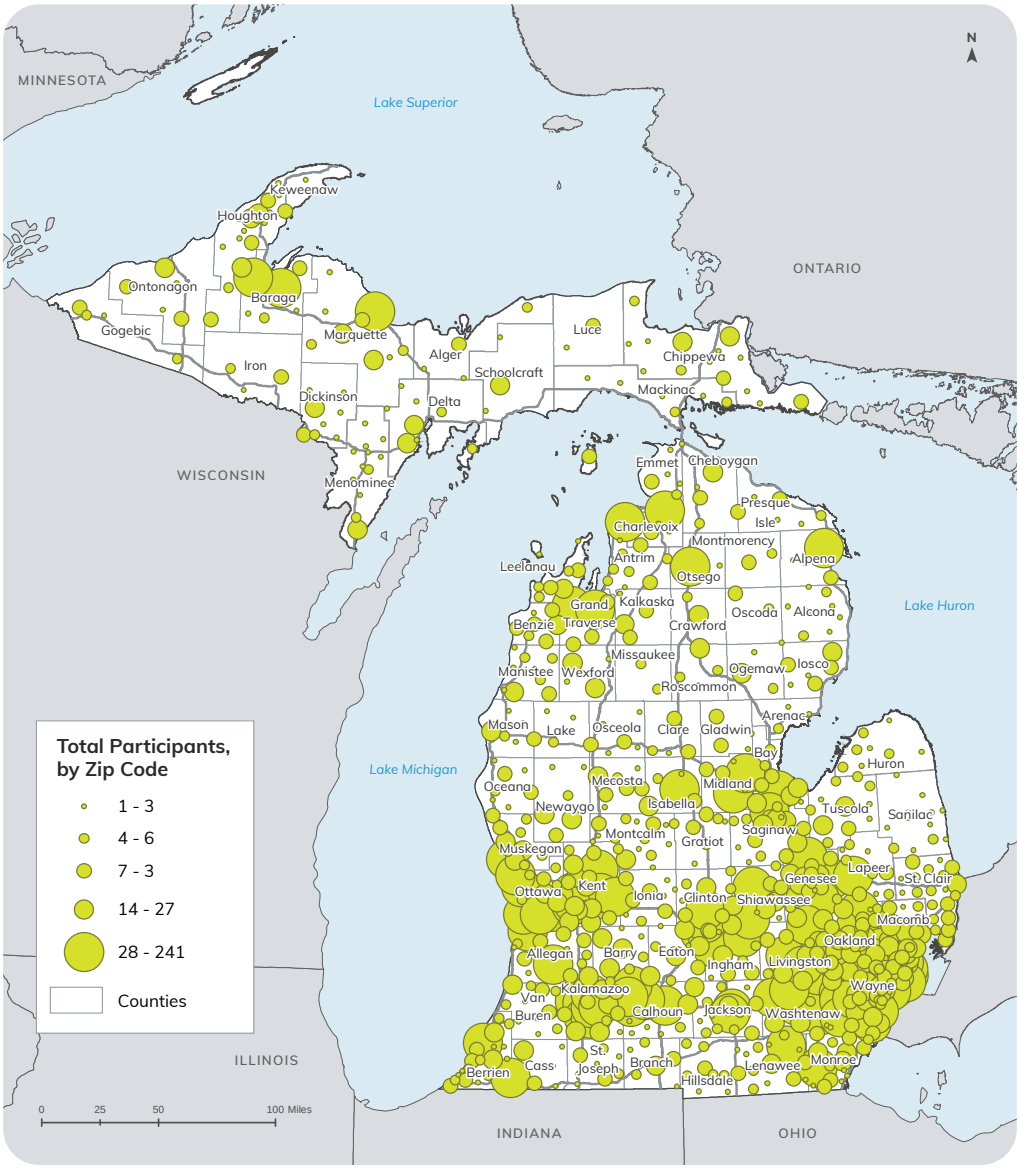
Workshop March 2019

Telephone Town Hall February 2019

Outreach Takeaways

- Michiganders want transportation options that are well taken care of, safe, dependable, and cost-effective.
- Public and stakeholder participation efforts during plan development revealed a desire for a safe transportation system that is accessible to all and includes reliable options for all modes, not just cars.
- The condition of the system is front-of-mind for users. Repairing and maintaining roads emerged as a top priority, followed by maintenance of other transportation assets like bridges, transit fleets, and sidewalks.
- Beyond maintenance, participants identified the need for more safe mobility options, from expanded transit networks to more bicycle and pedestrian infrastructure with a strong emphasis on adopting strategies that ensure the safety of all users, but particularly the most vulnerable. By and large, the public and stakeholders did not place a priority on adding new lanes to highways (consistent with findings in Chapter 10 – ***Network Capacity/Right-Sizing***) or preparing for CAVs.

Figure 15. **MetroQuest Survey and Telephone Town Hall Participants**



CHAPTER 6

Mobility and Accessibility

The future of Michigan's transportation system must be built on the fundamental role of transportation itself: providing mobility and accessibility. Transportation is the necessary link between people and the schools, jobs, and services that shape opportunity and support quality of life. Transportation planning is about figuring out how to get people safely, affordably, and conveniently to those opportunities and providing choices that fit their lifestyles and abilities. Connecting businesses to the production facilities and raw materials they need to make their products and the customers they hope to serve is the flip side of the accessibility coin. All of Michigan's modes have a role to play in advancing equity, getting goods to market, linking small businesses to opportunity, welcoming tourists to experience Pure Michigan, and bringing customers to Main Street.

Accessibility and Mobility for People

Access to Jobs and Education

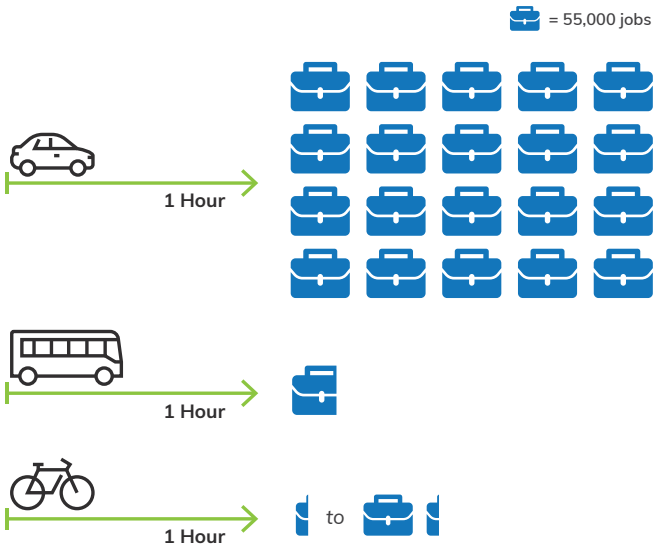
The health of Michigan's economy, including the ability of Michiganders to lead satisfying lives, depends on whether people can reliably get to jobs and education. Job training is not often the barrier to employment; the ability to get to job training often is.

Today, the average Michigan worker with a car can access at least 1.1 million jobs within an hour's drive (when accounting for congestion), according to analysis from a multi-state study led by the Accessibility Observatory at the University of Minnesota. For people using transit, the jobs that can be reached within an hour drops to only 42,000. Those riding a bicycle can reach an estimated 15,000 to 68,000 jobs within an hour's ride, depending on whether they are comfortable riding on streets that do not have low-stress bicycle facilities (see ***Figure 16***).[1]

For each mode of transportation, targeted investments in the transportation system can increase job access:

- In the case of auto travel, addressing highway congestion could expand Michigan drivers' access to an additional 200,000 jobs within an hour's reach.

Figure 16. **Job Access by Transportation Mode**



- To expand job access for people who use transit, the most important investments are to increase the frequency and span of services. Many buses arrive only once an hour, and many public transit systems in Michigan do not even operate in the evening or on weekends, which are times when many retail and service employees are expected to work. Analyzing gaps in fixed-route and demand-response

1 Owen, Andrew; Murphy, Brendan. 2021. 2018 Auto Accessibility Report -Michigan; 2018 Transit Accessibility Report - Michigan; 2019 Bike Accessibility Report - Michigan. University of Minnesota Center for Transportation Studies, Accessibility Observatory.

paratransit service to job centers could reveal strategic transit network improvements.

- Introducing commuter rail service to connect suburbs with central business districts would improve reliability for travelers in areas with higher levels of congestion - helping people get to work on time.
- Increasing the number of jobs that are easily accessible by bicycle involves making streets safer and more comfortable to ride for people of all ages and abilities. This depends on the speed and volume of vehicular traffic on the road and whether cyclists have their own designated facility. Low-stress networks must be convenient and connected.
- Many people in Michigan cannot easily reach jobs, education, services, and health care without a car. The lack of alternate transportation options for people who cannot drive because of the high costs of car ownership or due to health or age can exclude these groups from employment and economic mobility. On the whole, this pattern suppresses Michigan's economic potential.

People do not move around in just one way: accessibility includes not only how many destinations are within reach of home but also how many ways there are to get there and how easy and affordable they are to use. Providing access to information about travel times collected by connected infrastructure, real-time bus availability, and connections between modes for people with and without smartphones has become an essential part of the transportation system.

Transportation options are necessary to keep the economy running, especially during times of crisis. Transit provides an essential service for people who cannot drive or afford the high costs of driving. During the peak of the COVID-19 pandemic, providers connected transit-dependent essential workers to Michigan's hospitals, grocery stores, and factories, keeping supply chains operational, putting food on shelves, and saving lives.

Attracting and retaining younger generations of workers to Michigan, particularly those who can choose where they want to work based on local amenities and quality of life, increasingly depends on available transportation choices. Those who do not want to be locked into traveling by car alone may look for employment in markets where active transportation and high-quality transit are more available. Workers with preferences for active lifestyles also desire proximity to recreational trails and greenways. To realize the growth in professional services and advanced manufacturing jobs projected over the next 25 years, Michigan will need to expand infrastructure and mobility services to entice college-educated workers to stay or migrate from other states.

Access for Healthy Living

In addition to jobs, people need access to healthy food, essential services such as health care, and safe opportunities for physical activity, as further discussed in Chapter 7, ***Community, Environment, and Health***. This is especially significant for seniors, young people, persons with disabilities, and low-income households who may be unable to drive or have access to a vehicle.

Ensuring adequate access in the form of transit or active transportation to these basic needs enables people to stay healthy, which is a foundation for overall prosperity. Reducing the number of doctor's appointments missed due to a lack of reliable transportation benefits individual health outcomes and curtails costs to the health care system, which can be invested elsewhere. For many rural residents, transit is a lifeline to access medical care and other essential services.

In 2017, Michigan ranked 8th nationally in the rate of deaths due to heart disease, 19th in the rate of deaths due to stroke, and 20th in the rate of deaths due to diabetes. By tackling the upstream factors like low physical activity and delayed care by building complete networks and mobility services, Michigan can turn these trends around.

More isolated areas such as Michigan's outlying islands depend on local and regional airports to move critical medical supplies and to transport patients from small hospitals to facilities that provide specialized care. To provide these services, remote airports must have adequate instrumentation and visual guidance systems to guarantee year-round and all-weather access.

Accessibility and Mobility for Businesses

Access for an Efficient, Resilient Supply Chain

Statewide, roughly one in every five jobs depends on moving freight via the state's transportation network. Nearly $800 billion in goods traveled on Michigan's transportation system in 2019. Like people traveling, businesses depend on reliable networks with a diversity of options to send and receive goods, whether that be by truck, rail, ship, air, or pipeline.

Businesses in Michigan and across the country employ a portfolio of freight modes to optimize supply chains. This happens because transportation modes differ in the character of their services and are priced accordingly. A manufacturer may use rail for raw materials destined to their plant, ocean transport for components from overseas delivered to the factory by truck or rail, trucks to deliver their finished products to customers, and air delivery when customers are in a hurry. Using different modes for different purposes allows businesses to buy only as much service as they need, and having that choice keeps the business cost competitive.

Michigan gives businesses a complete portfolio of modes to choose from, and that advantage helps the state compete for attracting and retaining industries. There are two further benefits: 1) multiple modes ensure alternative routes when the transportation system is disrupted, and thus provide an important measure of resiliency, and 2) modes are interdependent. Long-distance transportation can be more cost effective with a combination of rail and truck than by either mode alone. Aircraft land at airfields and require trucks to bring goods to customer sites. Any mode by itself is often not enough to do the job or to do it as well as it could be done. A strong portfolio solves the problem.

Highway congestion causes bottlenecks for goods shipped by trucks, causing delays and imposing costs that are passed on to consumers. In 2019, urban bottlenecks led to an estimated $1.3 billion in costs, with rural bottlenecks contributing an additional $187 million.

Today and into the future, trucking access depends on connected infrastructure and real-time, uninterrupted data flows. Congestion mitigation may not come purely in the form of highway expansion but by pervasive vehicle-infrastructure communications systems and incident management that can be communicated back to freight planners, carriers, and supply chain operators.

Due to changes in the supply chain and the rise of e-commerce discussed in Chapter 2, ***Socioeconomic and Technology Trends, Forecasts, and Scenarios***, the efficient movement of freight has become increasingly dependent on the last-mile journeys between highway and distribution center and distribution center and doorstep. MDOT, MPOs, and local agencies will need to develop network-level plans to balance freight needs with goals to make streets safer and more accommodating for people walking and biking and to reduce the disproportionate burden of truck traffic on low-income and minority communities.

Railroads play an important role in the mobility of goods. In 2019, railroads in Michigan moved 85.6 million tons of freight, which translates to roughly 3.4 million truckloads (more than 9,000 trucks per day) not using Michigan's roadways. According to the Association of American Railroads, a typical intercity freight train carries an equivalent of 170 truckloads. Freight moved by rail also generates fewer greenhouse gas emissions and consumes less fuel than equivalent movements by truck.

Certain Michigan industries rely heavily on the state's water and rail networks to move commodities. Although railroads accounted for 16 percent of the total freight tonnage in 2019, it is the predominant mode for two commodities: miscellaneous freight in containers and coal. Several other commodities (chemicals, metallic ores, pulp, and paper) move significantly by rail. Michigan businesses will rely on continued investment in multiple freight modes.

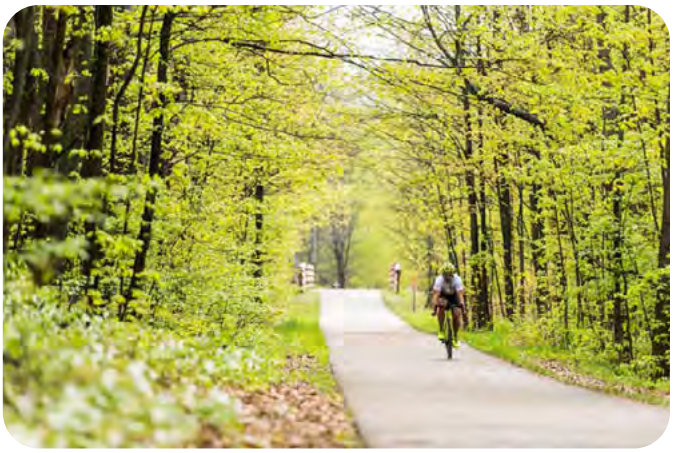
Access for Mainstreet

Small businesses benefit from Complete Streets that accommodate all users, regardless of how they travel. Many customers shop on foot, by bike, or via transit. Comfortable sidewalks, bikeways, and bus stops attract foot traffic and economic activity. Research shows that when new facilities are installed or upgraded in walkable areas, retail spending rises.[2,3] With the explosion of e-commerce, sense of place is a fundamental differentiator for brick-and-mortar retail.

Access for Tourism

Travel and tourism is an essential part of Michigan's economy, particularly for communities in the Upper Peninsula and northern Lower Peninsula. In 2019, visitors to the state spent $26.3 billion and directly supported more than 230,000 jobs, making tourism the 11th largest industry in Michigan.[4] The Great Lakes State (Pure Michigan), with its rich natural resources and scenic beauty, is a haven for outdoor recreation and adventure tourism.

To foster this growing element of the economy, MDOT can coordinate transportation investments in ways that support the state's plans for tourism. This includes continued promotion of scenic highways and assistance with building amenities and facilities identified in each route's scenic corridor management plan. Michigan's trails attract many tourists. Completing gaps in statewide and



regional active transportation networks can also boost visitor numbers, particularly with the growing interest in bicycle tours and gravel races that create a market for local lodging, food, and entertainment. Stakeholders in northern parts of Michigan also point out that tourism is year-round, and that active transportation investments should include attractions like trails that can be used for mountain biking in the summer and cross-country skiing in the winter. Reaping the statewide benefits requires close collaboration with the local road and parks departments responsible for expanding and maintaining these facilities.

Michigan's aviation system also plays a central role in bringing visitors to the state. The 2017 MASP estimates that Michigan's 114 Tier 1 and Tier 2 public airports generate nearly $22 billion in direct and indirect economic activity annually, much in the form of visitor spending.

Further discussion of the types of investments that are needed in Michigan's transportation network to sustain and grow Michigan's human and economic potential can be found in Chapter 13, ***Network Accessibility and Connectivity***.

2 Smith Lea, N., Verlinden, Y., Savan, B., Arancibia, D., Farber, S., Vernich, L. & Allen, J., Economic Impact Study of Bike Lanes in Toronto's Bloor Annex an Korea Town Neighbourhoods, Toronto Center for Active Transportation and Clean Air Partnership, 2017.

3 Smart Growth America. 2016. Benefits of Complete Streets: Complete Streets Stimulate the Local Economy. Accessed June 30, 2021. https://smartgrowthamerica.org/wp-content/uploads/2016/08/cs-economic.pdf

4 Michigan Department of Community and Economic Development. n.d. Economic Impact of Tourism in Michigan 2019. Accessed June 30, 2021. https://medc.app.box.com/s/g0vot2gdissrzzz1em4l7jsu8ec7r5p4

CHAPTER 7

Community, Environment, and Health

Achieving the MM2045 vision requires a thoughtful assessment of the potential impacts of transportation investments, both positive and negative, on Michigan's communities, natural landscapes, and health. Previous transportation planning and design efforts placed a premium on building high-speed roads through greenfields and urban environments to accelerate the movement of cars and trucks. This approach created a national interstate highway system that has transformed Michigan's economy and greatly broadened the public's access to employment and goods. Unfortunately, the convenience and ubiquity of driving have also negatively affected community quality of life, the natural environment, and public health.

Climate Change

MM2045 creates a framework that supports other initiatives underway from the Governor's Office and the Michigan Department of Environment, Great Lakes, and Energy (EGLE). In September 2020, Gov. Gretchen Whitmer issued an executive order to announce the Michigan Carbon Neutral by 2050 Plan to protect public health and create clean energy jobs. This executive order created the Council on Climate Solutions, which is tasked with developing recommendations to move Michigan toward a carbon neutral future. The draft recommendations from the council are expected by the end of 2021. Through the MM2045 implementation plan actions, it is expected that the transportation partners in the state of Michigan will incorporate recommendations of the council into the transportation planning process and work together toward the governor's goal of carbon neutrality by 2050.

MDOT is also working to address the impacts of climate change by incorporating climate resiliency into its departmental infrastructure and asset management processes, as discussed in greater detail in Chapter 14, ***Network Resiliency***. This is an ever-important pursuit. Michigan has experienced an increasing number of severe flooding events, all of which have greatly impacted local communities and MDOT operations. These events have made the department especially conscious of the important role that the transportation sector plays in developing a sustainable and resilient network that is able to mitigate and adapt to future climate disasters.

As such, MDOT is taking proactive steps to plan for the future, including developing a state vulnerability assessment, risk-based transportation asset management plan, partnering with the Southeast Michigan Council of Governments on developing a flooding vulnerability tool for Metro Detroit, and continuing to study the impacts of changing Great Lakes water levels on near-shore infrastructure. In addition, the department actively supports the transition to electric vehicles by partnering with other state agencies to prepare for a future that includes electric vehicles as well as increased alternative transportation options for non-vehicular travel.

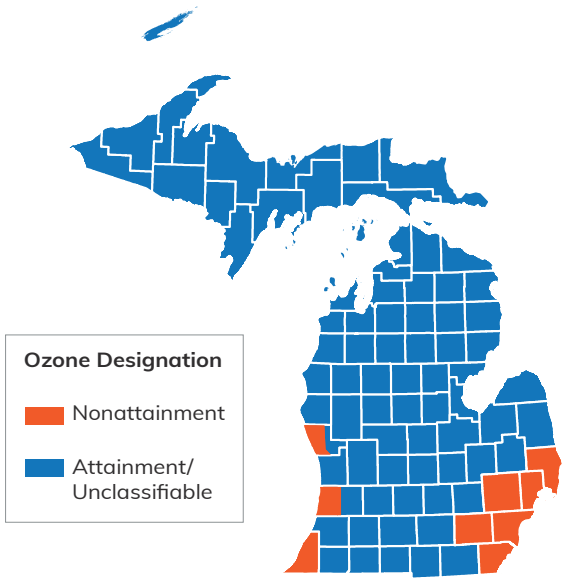
Addressing Impacts

High-speed roads often negatively impact the communities they purport to serve. Examples of these negative impacts include: noise and air pollution, decreased safety (particularly for people traveling on foot or bike), and the creation of barriers between neighborhoods, especially in the case of high-speed roads that provide access only at interchanges. Community quality of life is also affected when the overall road network lacks connectivity.

Michigan's natural environment often faces the negative impacts of transportation twice. Primary impacts of transportation occur when roads are built through important natural landscape. Introducing impermeable pavement modifies hydrology and wildlife habitat contributes to habitat loss and excess stormwater runoff that the ground cannot not absorb. This water flows

quickly into nearby waterways, carrying pollutants of the roadway vehicle traffic. Secondary impacts of transportation include air pollution contributed by the vehicles traveling on the state's transportation system, specifically cars, heavy trucks, train locomotives, and marine vehicles. In Michigan, Metro Detroit, Berrien County, and portions of Allegan and Muskegon counties exceed federally established limits for ozone (designated by the EPA as "nonattainment areas" - see ***Figure 17***). These nonattainment areas are likely, in part, unacceptably polluted because of transportation traffic.

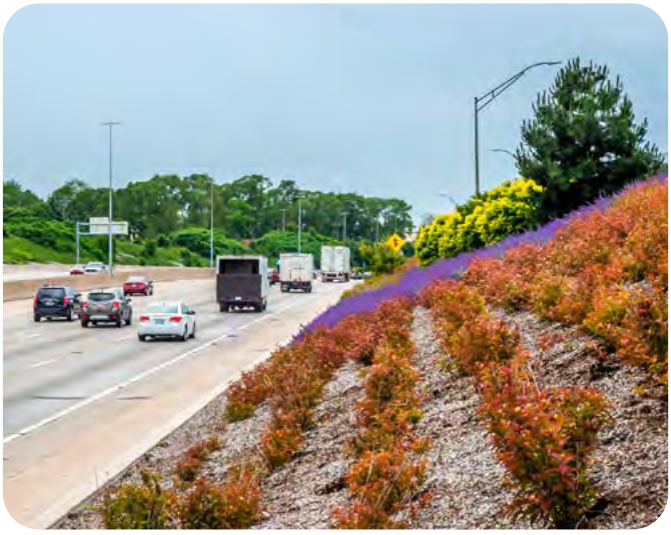
Figure 17. **Nonattainment Areas for the 2015 Ozone Standard**



At a policy level, MM2045 promotes reducing the proportion of single occupancy passenger vehicle trips by enabling alternative modes of travel that are convenient, comfortable, and affordable. Where alternative modes are not available, MM2045 recommends upgrading passenger, transit, and freight fleets to electric and low-emission models, supported by the appropriate charging and fueling infrastructure.

In response to growing concerns about such impacts on public health and community quality of life, MDOT is revisiting the way that the state's road are planned and designed. MDOT formally adopted a Context Sensitive Solutions (CSS) Policy in 2005 to promote an interdisciplinary approach to developing transportation projects that respect a community's scenic, aesthetic, historic, economic, and environmental character. In using CSS, MDOT solicits open dialogue with local governments, road commissions, industry groups, land use advocates, and state agencies early in project planning to discuss how transportation solutions may best fit community character and needs. Several successful initiatives have grown out of the CSS policy, including a Complete Streets Plan, Guidance for Trunkline Main Streets, and Multimodal Development and Delivery (M2D2).

To address the varied natural resources impacts associated with transportation projects, MDOT continues to implement innovative and sustainable transportation development practices. An important focus area for the department is implementing national stormwater collection techniques that spread stormwater runoff across a broader area rather than concentrating it through pipes. In addition, MDOT has started to use vegetation to filter out road pollutants, allowing runoff to be absorbed in the immediate area instead of into the nearest waterway. MDOT is also designing rain gardens, small depressions landscaped with native plants that retain stormwater, in urban areas as a method of ensuring safe road drainage that can also beautify the public way. Local agencies have also built raingardens and other green infrastructure. These are often accomplished thought grant programs and other partnerships.



MDOT is implementing the following methods to mitigate the impacts of transportation projects on the natural environment:

- **Wetland banking** requires developers to offset wetland impacts by creating new wetlands elsewhere within the same watershed. To save time and money, MDOT designs and builds larger wetland areas in advance, then uses portions of these "banks" as needed as a "credit" for acreage affected by specific projects.

- MDOT is working with partners on initiatives that encourage electric vehicle use through the **expansion of charging infrastructure,** including a partnership with MDNR to install electric vehicle charging stations at state parks.
- MDOT identifies **wildlife conservation** "hot spots" where crashes involving wildlife are reported more frequently. When the agency is about to make improvements near one of these locations, it evaluates whether there are ways to improve the situation, such as providing a safe crossing for wildlife.
- To combat habitat loss, MDOT is creating **pollinator gardens** by dedicating road rights of way to provide food sources and shelter for pollinators. MDOT resource specialists implement reduced-mowing policies, plant native flowers, and use herbicide only at strategic times.

Environmental Justice and Equity

Michigan's transportation agencies have a duty to serve all Michiganders, including minority groups, low-income populations, the elderly, people with disabilities, and all those who traverse the state. MDOT recognizes its responsibility to provide fairness and equity in all of its programs, services, and activities, and to abide by and enforce federal and state civil rights legislation related to transportation.

Title VI of the Civil Rights Act of 1964 and Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations) set the current legal standards for equity. Title VI is a federal statute that prohibits discrimination based on race, color, national origin (as well as gender, age, and persons with disability through other federal and state nondiscrimination authorities), whereas Executive Order 12898 is a directive to federal agencies to achieve environmental justice (EJ) by addressing the disproportionately high and adverse effects of activities on minority and low-income populations. Title VI prohibits discrimination by law, while EJ mandates a process for inclusive decision-making.

MDOT is committed to achieving transportation equity through the fair distribution of the impacts of transportation resources, projects, and policies. Equity is not the same concept as equality. Equality is giving everyone the same thing; equity is striving to provide everyone the resources and opportunities that they need to live a full life. MDOT recognizes that not all Michiganders have the same access to opportunity, safe mobility options, and healthy environments. Advancing transportation equity requires listening to communities presently affected by inequity, changing the way we evaluate investments, and working with external stakeholders to develop interdisciplinary solutions to larger challenges. Some of the ways to increase transportation equity include the following:

- Prioritize projects focused on greater access for EJ communities.
- Enhance neighborhood identity and safety through traffic calming, wayfinding, and public art.
- Improve condition and increase coverage of active transportation infrastructure (e.g., crosswalks, sidewalks, sidepaths, trails, signs, and signals).
- Expand modal choice within neighborhoods through improved assets (e.g., street paving, new sidewalks, crosswalk enhancements, and bike lanes).
- Continue to fund transit vehicle replacement and diesel retrofits to reduce emissions in developed areas.
- Facilitate better access to, and maintenance of, parks and playgrounds and recreational centers.

To help improve equity, the State of Michigan recently created the Michigan Advisory Council on Environmental Justice, which is the state's first EJ advisory council. Members represent an intentional combination of frontline activists, advocacy organizations, academia, tribal representation, local governments, business and industry, public health, and labor. The Michigan Advisory Council on Environmental Justice is an advisory body for EJ actions spearheaded by the Interagency Environmental Justice Response Team and the Office of Environmental Justice Public Advocate. In addition, MDOT is also adding a chief cultural, equity and inclusion officer to its staff.

Transportation agencies are adopting novel strategies to address the impacts of transportation on the natural environment, public health, and community quality of life. One strategy that MDOT is pursuing is the right-sizing of Michigan's transportation network. Right-sizing is a fundamental re-sizing (either larger or smaller) of existing roadway assets to better fit current and emerging needs over time. For more on right-sizing, see ***Chapter 10***.

MDOTs right-sizing strategy includes developing a right-sizing policy to manage/reduce life-cycle costs and achieve best and highest use of assets and revenues, integrate right-sizing objectives and opportunities into existing business practices, and develop policy guidance to ensure agency stakeholders, partners, and the public have a shared understanding of engagement and outcome expectations. MDOT is applying these approaches as part of the I-94 Modernization Project in Detroit.

MDOT has been working closely with the community and city stakeholders impacted by the 7-mile-long project to develop a right-sized vision for neighborhood mobility and connectivity. At the forefront of this engagement is the need to correct some of the negative community impacts that resulted from the original construction of I-94. As part of the project scope, 67 bridges in various states of disrepair are being rebuilt with complete streets facilities, like low stress bikeways and wider sidewalks, providing enhanced connections to neighborhoods that were historically divided when the freeway was built (see ***Figure 18*** for an example).

Figure 18. **Redesign of Second Avenue Bridge over I-94 as a Complete Streets Facility**

Second Avenue Over I-94 Existing

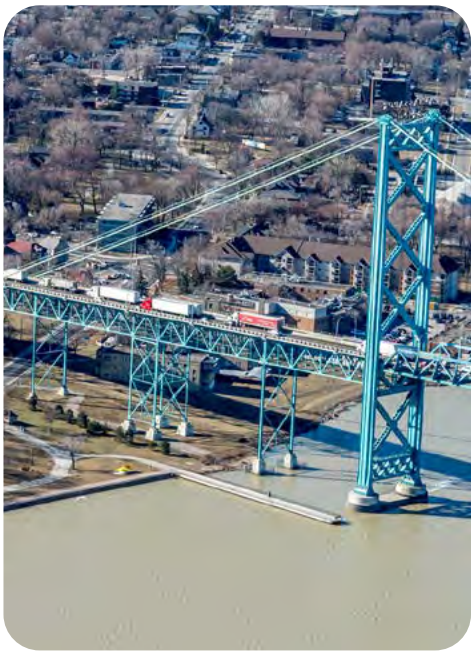
Second Avenue Over I-94 Proposed - Artist's Rendering

Potential impacts of proposed multimodal freight investments

The environmental impacts associated with multimodal freight (trucking, marine, air, and pipeline) are similar to the impacts associated with any transportation project previously discussed in this chapter. Over 96 percent of Michigan's EJ population lives within the Strategic Multimodal Corridors, the key transportation routes that link Michigan's activity centers and constitute the state's major commodity trucking routes (see ***Chapter 8*** for more discussion). However, these investments can also have positive impacts on air quality and energy use. For example, shifting goods and services to rail or marine modes from trucking has a net positive impact on air quality by reducing pollutants and emissions associated with highway traffic.[4] Similarly, energy use will go down. Even for highway-based freight, fixing bottlenecks in areas of recurring congestion will also improve air quality because fewer cars and trucks will idle in one area.

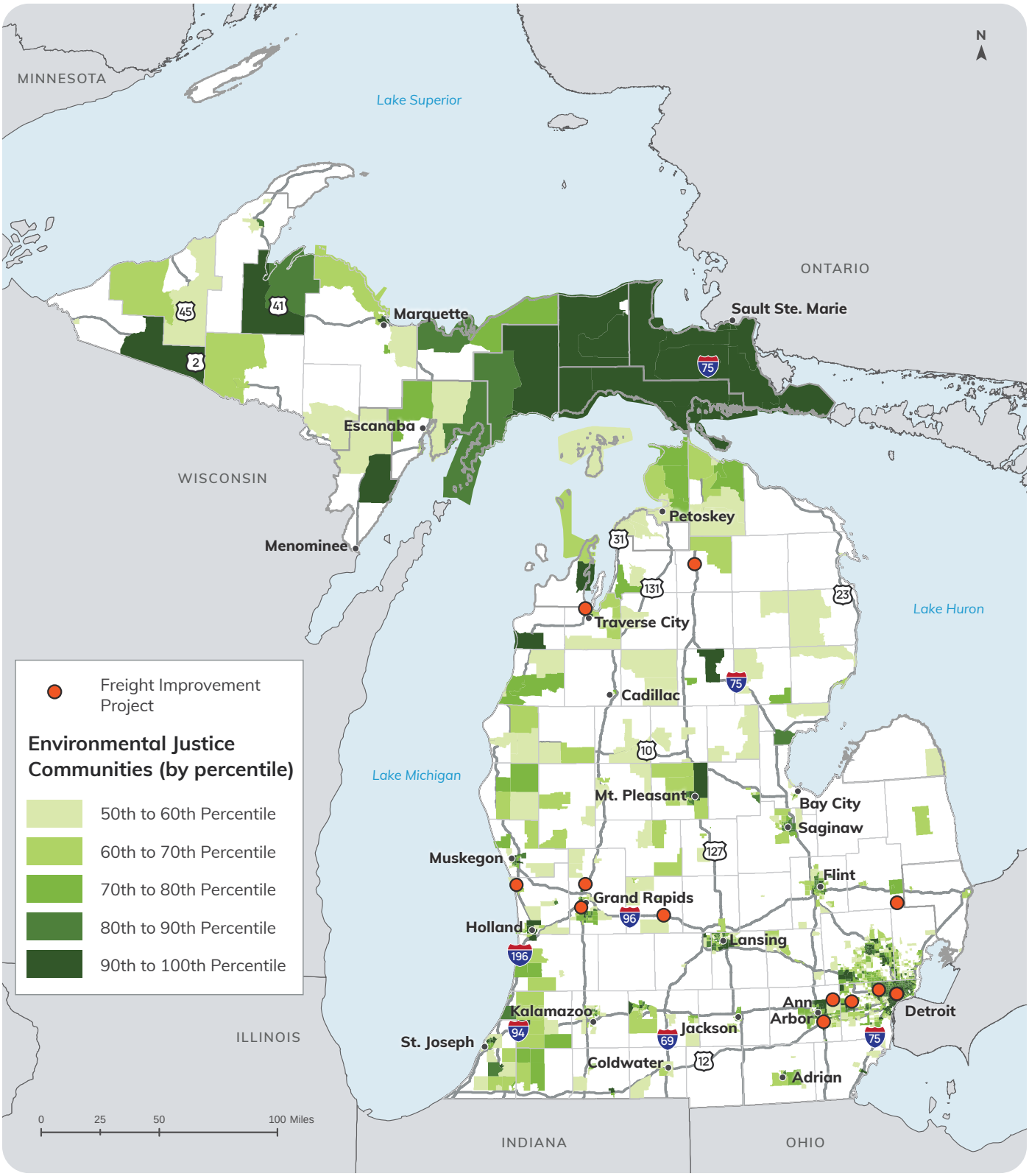
When evaluating the proposed list of multimodal freight investments summarized in ***Recommended Strategies***, it is important to overlay the projects on MDOT'S statewide EJ zones to determine whether these projects affect EJ communities (see ***Figure 19***) and to develop a plan for distributing benefits and mitigating drawbacks. In general, projects that expand the right of way could negatively affect communities by dividing neighborhoods. In addition, any project that removes access or significantly changes local access can have a negative impact. Project sponsors also need to consider the existing and future pedestrian environment for multimodal freight projects to ensure that individuals without vehicles can still access nearby businesses, transit, and other destinations. It is important to note that this high-level discussion does not replace the more detailed EJ analysis required under the National Environmental Policy Act performed during the project development process.

Where existing industrial and manufacturing sites drive freight movements, technological innovation and electrification can mitigate the impacts of truck traffic on neighboring communities. Advanced driver-assistance systems make trucks safer and electrification makes them cleaner. Adopting these technologies in the short-term can mitigate existing impacts on EJ communities while long-term land use policy solutions come to fruition.



4 American Association of Railroads. 2020. Freight Rail and Preserving the Environment. Accessed June 30, 2021. https://www.aar.org/wp-content/uploads/2020/06/AAR-Sustainability-Fact-Sheet.pdf

Figure 19. **Freight Improvement Projects and Environmental Justice Communities**



Note: Environmental Justice communities were identified using a location quotient methodology comparing the share of minority or low-income persons at the Census Tract-level to the share of minority or low-income persons in the entire state. Areas above the 50th percentile have been identified as EJ communities of concern.

Source: U.S. Census American Community Survey (ACS) five-year data; U.S. Department of Health and Human Services

Network and System Performance

Chapter 8 — Multimodal Network Performance

CHAPTER 8

Multimodal Network Performance

Performance management enables Michigan's transportation agencies and stakeholders to assess where progress has been made toward the MM2045 Vision and where additional investment is necessary. Perhaps most importantly, performance measures provide the public the opportunity to see whether transportation spending is effectively accomplishing stated goals. In 2012, Congress passed laws requiring states to monitor and report transportation performance on roads and highways as a condition of receiving federal funds. Michigan monitors a variety of performance measures that encompass all modes of travel at the statewide level as well as the performance of key transportation networks that are especially critical to the state's security and economy. Overall, network performance tells the story of where Michigan is today and how far it needs to go over the next 25 years.

Performance-Based Planning and Programming

MDOT monitors many key performance measures, exceeding federal requirements to encompass all modes to advance the MM2045 Vision. MM2045 considered and integrated national transportation goals and performance measures in developing Michigan's Goals, Objectives, Strategies, and Performance Measures. The MM2045 Performance Measures map directly onto four of the seven national performance goals, as illustrated in ***Table 2***. How Michigan's extensive list of performance measures dovetail with the MM2045 Goals is summarized in ***Table 3***. Going beyond the federal performance measures benefits Michigan and the nation in the following ways:

- Tracking performance beyond the NHS provides decision-makers information necessary to evaluate the effectiveness of transportation planning and programmed investments across the entire transportation network.
- Monitoring performance over time enriches policy decisions and provides transparent accountability of public investment.
- Ability to compare performance over time using a variety of methods and metrics beyond those prescribed by the USDOT that are narrow in focus
- More detailed insight, as in the cases where MDOT tracks not just total highway fatalities but specifically the number of fatal crashes involving work zones, commercial trucks, etc. This can help evaluate the effectiveness of policies and project types.
- Promoting a more resilient “portfolio of modes” for Michigan by tracking performance for rail, freight, and aviation.

MDOT’s System Performance Report, a companion document to MM2045, provides regularly updated information on the state’s progress toward meeting the targets set for the performance measures. ***Figure 20*** shows a sample of recent high-level system performance.

Each of the policies and investments included in ***Recommended Strategies*** contribute to Michigan’s ability to meet the national transportation performance management goals. For example, focusing on increasing investment over the next 25 years to improve the overall rating of highways, bridges, and transit will help move the state toward meeting the national goals for infrastructure condition. For active transportation users, many of MM2045’s policies are centered on improving facilities for pedestrians and cyclists, which will reduce fatalities and serious injuries. With regard to multimodal freight and freight rail movements, travel time reliability may be improved by implementing MM2045 strategies for operations and technology, in addition to the specific multimodal freight and rail projects listed in ***Recommended Strategies***.

***Table 2.* Performance Measures by National Transportation Performance Management Goal Area**

National Goal Area	Performance Measures
Safety	**Highways** ▸ Number of fatalities. ▸ Fatality rate per 100 million VMT. ▸ Number of serious injuries. ▸ Serious injury rate per 100 million VMT. ▸ Number of nonmotorized fatalities and serious injuries. **Public Transit** ▸ Number of reportable fatalities. ▸ Fatality rate per total vehicle-revenue miles by mode. ▸ Number of reportable injuries. ▸ Injury rate per total vehicle-revenue miles by mode. ▸ Reportable safety events. ▸ Rate of safety events per total vehicle-revenue miles by mode. ▸ Average revenue-miles between major mechanical failures by mode.
Infrastructure Condition	**Highway Pavement Condition** ▸ Percentage of pavement on the interstate National Highway System (NHS) in good condition. ▸ Percentage of pavement on the interstate NHS in poor condition. ▸ Percentage of pavement on the non-interstate NHS in good condition. ▸ Percentage of pavement on the non-interstate NHS in poor condition. **Highway Bridge Condition** ▸ Percentage of NHS bridges classified in good condition. ▸ Percentage of NHS bridges classified in poor condition. **Public Transit** ▸ Percentage of non-revenue service vehicles within a particular asset class that have met or exceeded their useful life benchmark. ▸ Percentage of revenue vehicles within a particular asset class that have met or exceeded their useful life benchmark. ▸ Percentage of facilities within an asset class rated below 3.0 on the FTA's Transit Economic Requirements Model scale.
System Reliability	**Highways** ▸ Percentage of person-miles traveled on the interstate NHS that are reliable. ▸ Percentage of person-miles traveled on the non-interstate NHS that are reliable.
Freight Movement and Economic Vitality	▸ Truck Travel Time Reliability Index

Table 3. **MM2045 Performance Measures**

Performance Measure	Related MM2045 Goal(s)
Percentage of Michigan bridges in Good or Fair condition	Network Condition
Percentage of MDOT (trunkline) bridges in Good or Fair condition	Network Condition
Percentage of Local Agency bridges in Good or Fair condition	Network Condition; Partnership
Number of Michigan bridges classified Serious or Critical (National Bridge Inventory rating of 3 or less)	Network Condition
Percentage of MDOT (trunkline) pavements with a Remaining Service Life (RSL) value of three years or higher	Network Condition
Percentage of federal-aid road pavement condition in Good or Fair condition based on Pavement Surface Evaluation Rating (PASER) rating	Network Condition; Partnership
Percentage of Tier 1 airport primary pavement condition in Good or Fair condition based on FAA's Pavement Condition Index (PCI)	Network Condition
Number of Tier 1 airports with all-weather access	Safety and Security; Mobility; Economy and Stewardship
Annual number of crashes involving motor vehicles on Michigan public roadways	Safety and Security
Annual number of fatalities involving a motor vehicle on Michigan public roadways	Safety and Security
Annual number of serious injuries involving a motor vehicle Michigan public roadways	Safety and Security
Annual number of nonmotorized fatalities and serious injuries involving a motor vehicle on Michigan public roadways	Safety and Security
Annual number of crashes on Michigan public roadways involving a commercial truck	Safety and Security
Annual number of work zone traffic fatalities and serious injuries on Michigan public roadways	Safety and Security
Percentage of Michigan's rural population within 25 miles of an intercity passenger transportation bus route	Mobility; Quality of Life
Number of signalized intersections integrated into the MDOT Central Signal Control Software and connected vehicle-ready	Mobility
Percentage of year-over-year growth or decline in rail carloads by commodity on MDOT-owned freight lines relative to the statewide rail system	Economy and Stewardship
Percentage of freeway incidents cleared within 120 minutes	Safety and Security; Mobility; Economy and Stewardship

Performance Measure	Related MM2045 Goal(s)
Percentage of MDOT pump stations in Good or Fair condition	Network Condition
Percentage of alternative-fuel, hybrid, and electric vehicles in the transit revenue service fleet	Quality of Life
Number of public electric-vehicle charging stations	Partnership; Quality of Life
Amount of funds awarded by the Transportation Economic Development Program	Partnership
Percentage of federal-aid roadway system that has reliable travel times	Mobility; Economy and Stewardship; Quality of Life
Percentage of trunkline railroad crossings in Good or Fair condition based on Crossing Condition Index	Network Condition
Percentage of MDOT carpool parking pavements in Good or Fair condition based on PASER	Network Condition
Number of passengers using state-supported passenger rail services	Mobility; Economy and Stewardship; Quality of Life
Truck-delay cost of urban freight bottlenecks	Mobility; Economy and Stewardship
Truck-delay cost of rural freight bottlenecks	Mobility; Economy and Stewardship
Number of freight bottlenecks delaying truck access to major airports, water ports, and intermodal container facilities	Mobility; Economy and Stewardship

***Figure 20.* Sample Performance Measures, 2020**

Mobility

- 88.6 percent of person miles traveled on Michigan's interstates has reliable travel times (2020, based on Level of Travel Time Reliability)
- 88.5 percent of person miles traveled on Michigan's non-interstate National Highway System has reliable travel times (2020, based on Level of Travel Time Reliability)

Network Condition

- 6.2 percent of National Highway System bridges in poor condition (2020, weighted by deck area)
- 4.6 percent of interstate pavements in poor condition (2020)
- 19.1 percent of non-interstate National Highway System pavements in poor condition (2020)

Safety and Security

- 1,083 traffic fatalities, 5,433 serious injuries (Statewide, 2020)
- 727 nonmotorized traffic fatalities and serious injuries (Statewide, 2020)

Quality of Life

- 16.1 percent of travel in Metro Detroit is not in a single-occupant vehicle (2020)

The Strategic Multimodal Transportation Network

With the adoption of MM2045, MDOT has defined a network of Strategic Multimodal Corridors (SMC) (see ***Figure 21***). These corridors represent an integrated, multimodal system serving the movement of people, services, and goods that are vital to the economy. They link the state's key activity centers (concentrations of people, jobs, educational and medical services, freight and intermodal facilities, tourist attractions, and other similar destinations) to each other. Focusing MDOT's major transportation investments on these strategic multimodal corridors allows the state to achieve the strongest return on investment, given limited funds.

The basic framework of the SMCs is generally built on Michigan's NHS, but is defined broadly enough to include parallel major highways that serve as alternate routes, along with Class I (large) rail lines, passenger rail and intercity bus routes, airports, and U.S. bike routes. MDOT's decision to include all modes is based on the recognition that a resilient, equitable transportation system provides multiple ways to connect population and employment centers.

Michigan's SMCs carry the vast majority of miles traveled in the state, regardless of mode. MDOT produces regular reports on the performance of this network based on the key measures related to infrastructure condition, safety, traffic congestion and travel time reliability, further described in the Strategic Multimodal Corridors Report. By reviewing the corridor performance summaries, MDOT can identify and prioritize areas of the network that need more detailed planning, engineering, and construction work, as well as evaluate the impact of transportation policies and projects.

The SMCs represent Michigan's core highway freight network, the critical truck routes and include less-traveled highways that are important to reaching key destinations in rural areas of the state. These minor routes also play an important role in alternate routing during road work or an emergency, providing the redundancy that is critical to a resilient freight network.

State Rail Network

Most of Michigan's railroad network, 81 percent, is privately owned and operated by 28 railroad companies (excludes WATCO's recent purchase of CN UP line). Most of these corridors are owned for the purposes of moving freight. The state's 28 freight railroads fall under two classifications:

- Class I Railroads are the large, national-scale railroads, such as Canadian National, Canadian Pacific, CSX, and Norfolk Southern.
- Short-Line Railroads (Class III railroads) frequently provide service to locations that the larger Class I railroads cannot serve cost-effectively. Short-line railroads can also provide switching services (that is, freight-car pickup and delivery service at a particular industry location or port, or within a limited geographic area). Compared to other states, short-line railroads operate a relatively high percentage of Michigan's freight rail mileage, with 24 companies in the state. Four of these companies operate publicly owned freight lines managed by MDOT. ***Figure 23*** shows the MDOT-owned segments of the rail network.

Michigan's rail system also supports three intercity passenger rail services provided by Amtrak. Amtrak has some ownership in the state and otherwise operates on MDOT, CN, and CSX corridors to serve 22 station communities (***Figure 24***). The key routes provide Michiganders with a connection to Amtrak's national network centered in Chicago and east-west connections between cities across southern Michigan. Amtrak's "Thruway" intercity bus system (also shown in ***Figure 24***) helps extend long-distance transit service to the northern Lower Peninsula and Upper Peninsula areas not directly served by passenger rail.

Figure 21. **Michigan Strategic Multimodal Corridors**

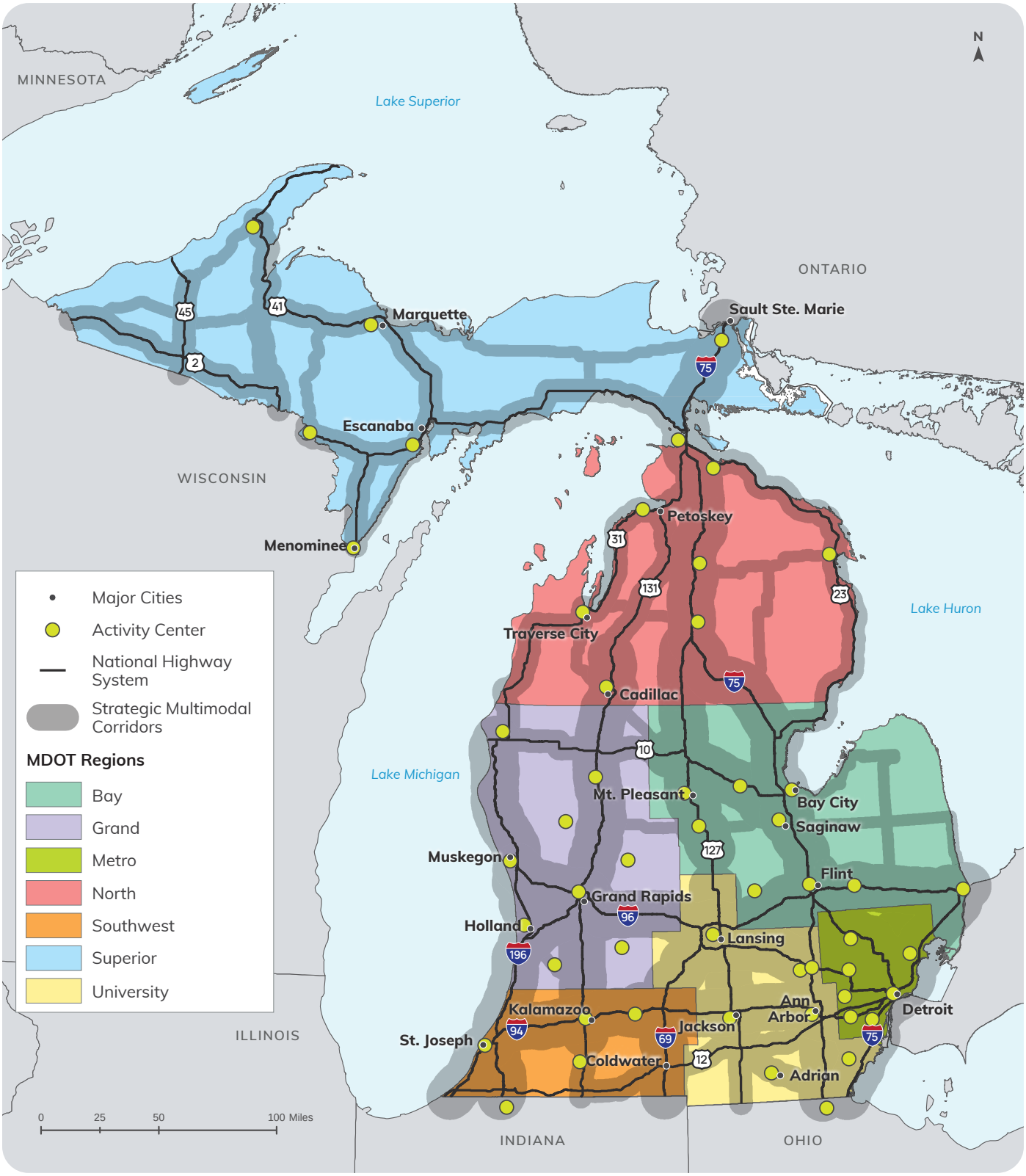


Figure 22. Michigan Railroad Network

Figure 23. State-Owned Rail Lines

Figure 24. **Extended Michigan Amtrak Network with Thruway Motorcoach Connections**

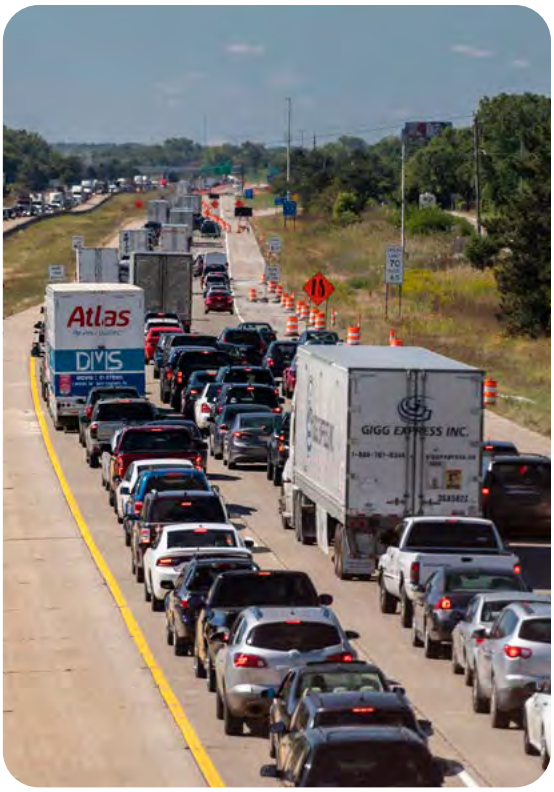
Highway Travel Time Reliability

Research has found that public and freight industry satisfaction with traffic flow is based not so much on the level of congestion but rather the level of reliability.[2] Travel time reliability measures how consistent the travel time is from one point to another, from one day to the next. When travel times are unreliable, drivers are more likely to experience unexpected delays and must build extra time into their plans to ensure on-time arrival.

MDOT uses two methods for measuring reliability:

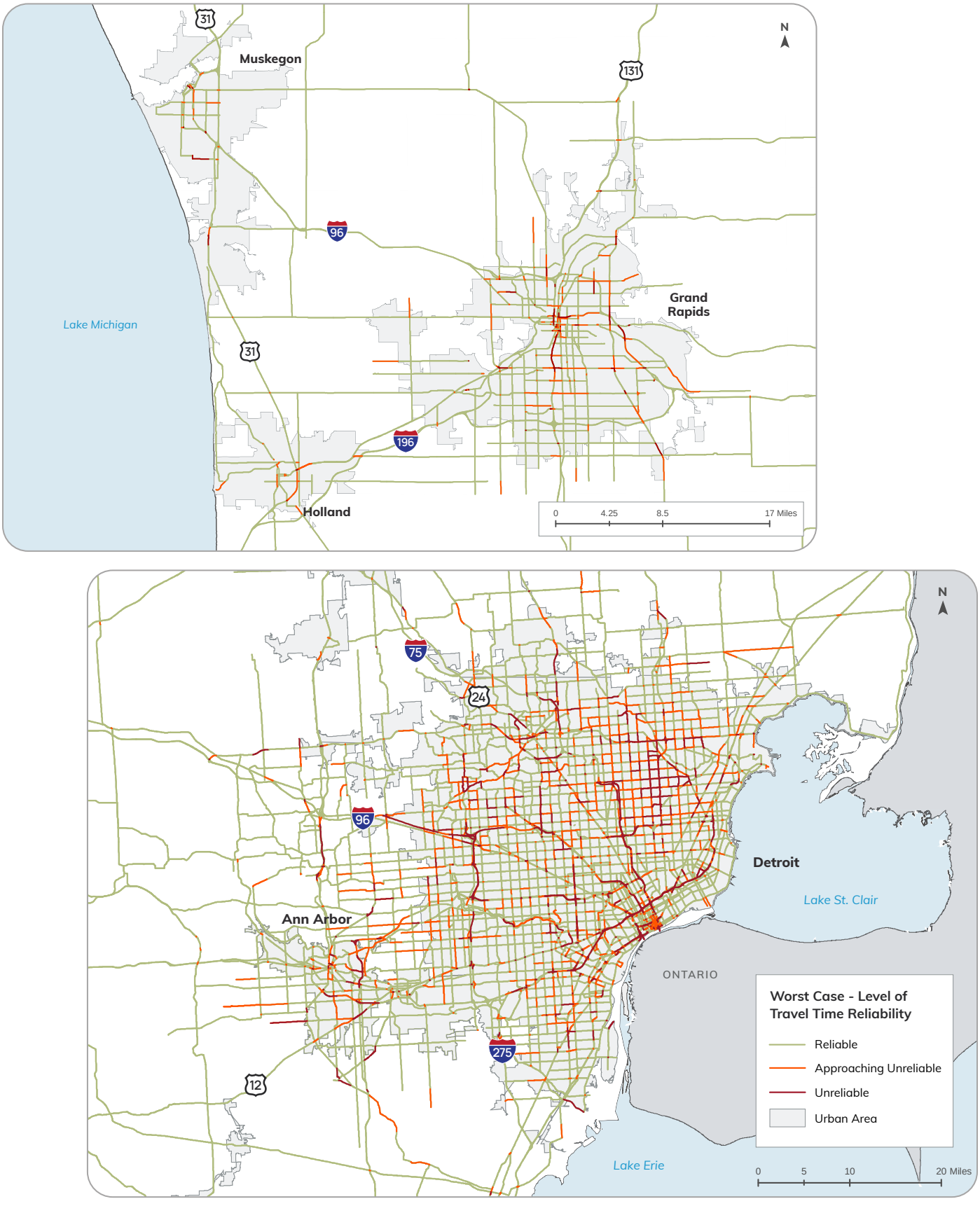
- **Level of Travel Time Reliability.** Travel times are considered reliable when the 80th percentile travel time remains close to the average travel time.
- **Planning Time Index.** This index represents the total time that a traveler should allow to ensure on-time arrival. It includes the time that the trip would take during uncongested conditions, plus the buffer time needed to arrive on time at least 95 percent of the time.

Travel times across much of Michigan are generally reliable, with 94 percent of the state's major highway (NHS) mileage classified as reliable during the worst-case time period, based on level of travel time reliability. Most of the roads with unreliable travel times are in the Metro Region (Detroit), where 5 percent of directional miles are unreliable during the worst-case time period. In the University Region (Ann Arbor), 1.5 percent of directional miles are unreliable, while less than 1 percent of directional miles in the Grand Region (Grand Rapids) are unreliable (see ***Figure 25***). It is important to recognize that freight travel is more sensitive to unreliable travel times, as discussed in the following section. Because a large portion of the freight moving on Michigan highways travels through Metro Detroit, unreliable travel times in this region must be addressed, even if overall reliability is good across the state.



2 https://ops.fhwa.dot.gov/perf_measurement/reliability_measures/index.htm

Figure 25. Travel Time Reliability (Grand and Metro Regions)



Credit: INRIX, University of Maryland CATT Lab, Wayne State University

Truck Travel Reliability

The roadway network is the backbone of the freight transportation system. Most supply chains require multiple truck movements to get products to market, and freight shipments made by other modes frequently require a truck to connect to the customer. Therefore, the performance of the roadway network can determine the speed, reliability, and competitiveness of most supply chains in the economy. Distinguishing between recurring and non-recurring congestion is important because freight users are much more concerned about non-recurring congestion than recurring congestion. Motor carriers can schedule deliveries that account for slower speeds when traveling during congested times of the day; however, non-recurring congestion is difficult to anticipate.

MDOT uses the following method to estimate truck travel reliability:

- **Truck Travel Time Reliability Index.** Similar to the highway planning time index, the truck travel time reliability index represents the total time a truck should allow to ensure on-time arrival. It includes the time that the trip would take during uncongested conditions, plus the buffer time needed to arrive on time at least 95 percent of the time.

Another aspect of truck travel reliability is user cost for the delay. This is calculated by quantifying the costs caused by recurring congestion and adding in the cost caused by non-recurring congestion, which leads to a single combined metric. This allows the truck bottlenecks to be prioritized based on economic values. While congestion is concentrated in the Detroit region, roughly half of the congestion occurs on routes outside of Metro Detroit.

Michigan's top truck bottlenecks (95th percentile of user costs) affect nearly 150 locations, shown in ***Figure 26*** and represent approximately $4 million a day in costs to users. The 114 urban truck bottlenecks identified combine to generate $3.5 million in congestion costs to freight each day, while the 39 rural truck bottlenecks combine to generate $511,000 in congestion costs to freight each day.

High freight volumes can cause or exacerbate congestion. Congested segments in the Michigan TDM were analyzed for their proximity to freight-intensive uses. Congested road segments within 0.5 miles of freight-intensive industries (more than 300 employees) and with volumes exceeding 500 trucks per day are considered to be impacted by the truck traffic. The 20 congested segments impacted by truck traffic in Michigan are listed in ***Table 4***. Three-quarters of locations are in the Metro Region (Detroit).

Figure 26. Top Truck Bottlenecks

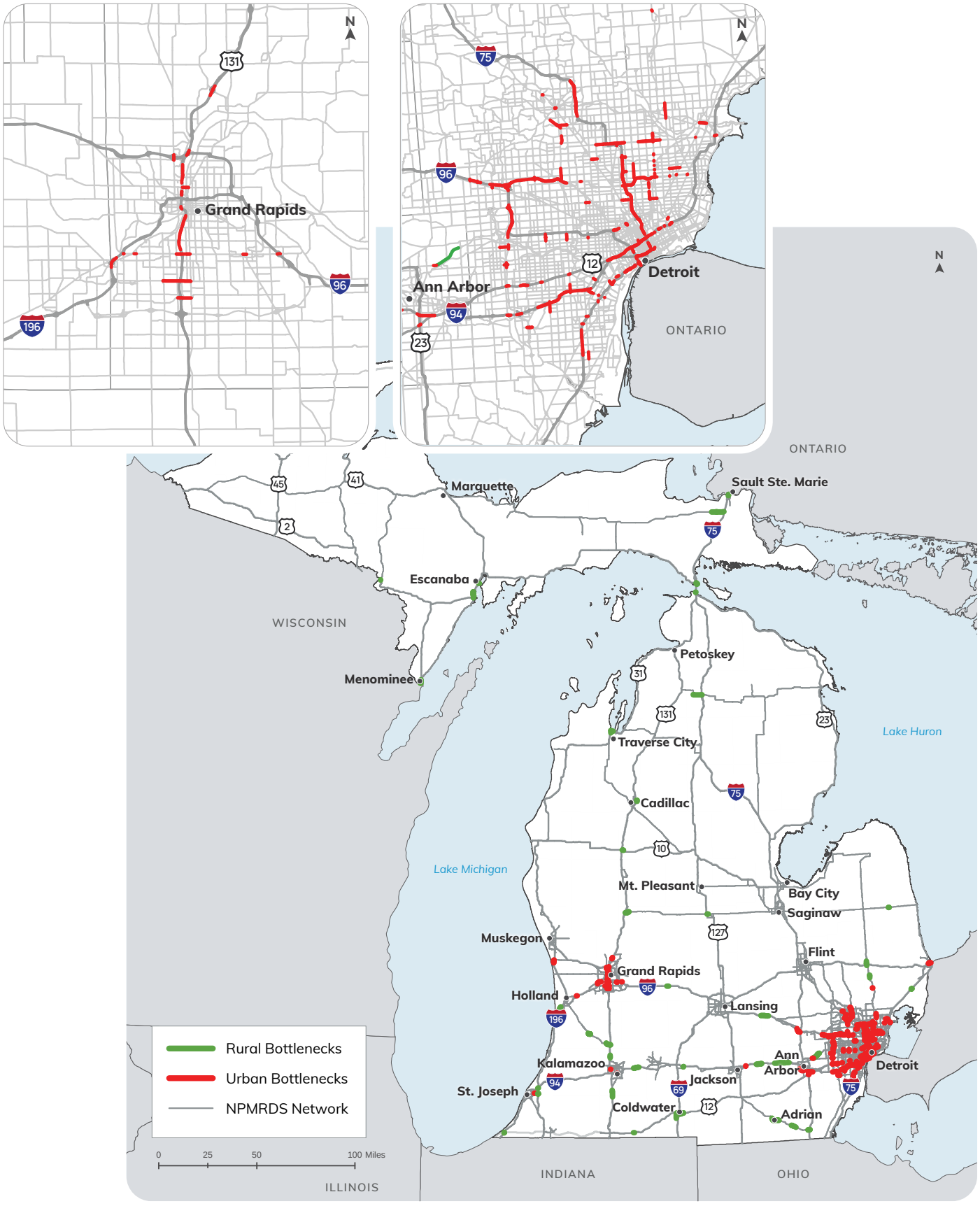


***Table 4.* Congested Segments Impacted by Freight**

Route	Corridor Directions	County	From	To	Length (miles)
Leonard Street NW	East-west	Kent	Hamilton Avenue	Turner Avenue	0.1
Fuller Avenue NE	North-south	Kent	Fountain Street	I-196	0.2
Riley Street	East-west	Ottawa	132nd Avenue	US-31	0.7
I-196	East-west	Kent	Lane Avenue	US-131	0.8
N I-75/I-69 ramp	North	Genesee	Bristol Road	E I-69	0.2
S I-375 Service Drive	South	Wayne	E Lafayette Street	E Congress Street	0.0
W 8 Mile Road	East-west	Oakland	Cambridge Drive	Haggerty Road	0.5
Randolph Street	North-south	Wayne	E Jefferson Avenue	Detroit-Windsor Tunnel	0.0
Rochester Road	South	Oakland	Stephenson Highway intersection		0.1
I-275	North-south	Wayne	Ann Arbor Road	I-96/M-14 interchange	2.3
John R Road	North-south	Oakland	Lovington Drive	E Maple Road	0.2
I-96	East-west	Oakland	Beck Road	Novi Road	3.1
12 Mile Road	East-west	Macomb	Lorna Avenue	Mound Road	0.2
Mound Road	North	Macomb	13 Mile Road intersection		0.0
I-696/I-96 interchange	East-west	Oakland	I-696/I-96/I-275 interchange		1.5
I-75	North-south	Oakland	12 Mile Road	Rochester Road	6.7
I-696	East-west	Macomb	Mound Road	Van Dyke Avenue	0.6
I-94	East-west	Wayne	I-75	E Grand Boulevard	1.1
E I-94/Pelham Road and M-39 ramp	East	Wayne	I-94	Pelham Road	0.2
I-94	East	Wayne	S Wayne Road	Vining Road	0.4


We're Going Your Way – Daily!
Indian Trails

Network and System Needs

CHAPTER 9

Network and System Preservation

Maintaining the roads, bridges, railroad corridors, locks, runways, buses and fleet vehicles, intelligent transportation system (ITS), and other infrastructure and assets that make up Michigan's transportation system is critical to moving people and goods affordably, safely, and efficiently. The same rule applies across all modes of transportation: without investing in regular maintenance and replacement, costs rise, the potential for failure grows, and reliability drops. For these reasons, the current federal surface transportation bill, 2015's FAST Act, emphasizes that achieving and maintaining a state of good repair is a national imperative. Over the next 25 years, Michigan will require substantial investment in preservation to ensure a well-connected, multimodal system that supports the state's quality of life and economic vitality for generations to come.

Scale of Need

Over the next 25 years, the cost of preserving Michigan's transportation system amounts to $123.5 billion, the most significant of all investment needs identified in MM2045 (see ***Figure 27***). This sum reflects the level of investment required to achieve pavement and bridge preservation (for all bridges longer than 20 feet) performance targets identified by roadway and bridge experts on MDOT and locally owned federal-aid road networks as well as maintenance operations on MDOT's and county primary road networks. The estimated cost of preserving MDOT roadways and locally owned federal-aid road network over the next 25 years total $61.9 billion and $61.6 billion, respectively.

The costs of preserving Michigan's transportation infrastructure and assets are likely higher. Due to lack of data availability at the time of MM2045 development, modal preservation and maintenance costs are not reflected. Determining the full scale of need requires continued concerted partnership between MDOT and other system owners. MM2045 presents preservation needs at a high level; more detailed local needs can be found in resources such as the County Road Investment Plan.

***Figure 27.* 25-year Network and System Preservation Needs (in Millions of U.S. Dollars)**

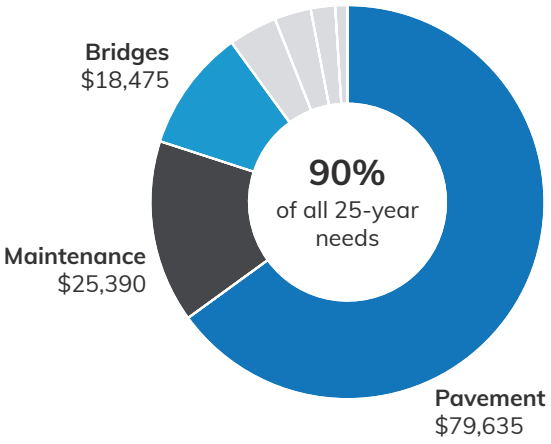


***Table 5.* Investment Needs - Network and System Preservation**

Mode	Investment Type
Roads and Bridges	Pavement rebuilding, improvements, and preventive maintenance; overlays; pothole patching; joint repair; pavement markings; sweeping and snow clearance; bridge replacement, improvements, and preservation; ITS and signals maintenance; carpool lot pavement preservation; pump stations.
Freight	Pavement rebuilding to include heavier truck weights, airport runway extensions, marine port dredging; local port improvement projects; locks.
Freight Rail	Bridge replacement, improvements, and preservation; track and signals maintenance, building maintenance (engine houses, train sheds).
Passenger Rail	Bridge replacement, improvements, and preservation; track and signals maintenance; train car preservation; building maintenance (engine houses, train sheds).
Aviation	Runway and taxiway pavement improvements and preventive maintenance; runway extensions; approach protection (tree trimming); and lighting/visual aid maintenance.
Transit	Vehicle replacement; facility maintenance (stations, administration buildings, repair shops).
Active Transportation	Sidewalk, bikeways, and trails asset inventory; trail surface and pavement rebuilding; overlays, signs; drainage maintenance.

Mode-Specific Needs

Pavement and Bridges

Pavement Condition and Health

Pavement condition receives a great deal of public attention, consumes a substantial portion of Michigan's annual transportation budget, and has a significant impact on travel quality. The overall pavement condition of the state and locally owned federal-aid road network has been in decline since 2008. Almost 50 percent of the locally owned federal-aid road network and about 25 percent of state-owned roads have poor pavement conditions. If spending does not increase, overall roadway conditions will continue to decline at a faster pace. Poor pavement and roads lead to more frequent auto repairs, longer travel times, and potentially unsafe conditions.

Bringing Michigan's roads up to a state of good repair requires more than doubling current annual investment, as shown in ***Figure 28***. Current annual pavement spending averages $800 million for MDOT-owned roadways and $700 million for locally owned federal-aid roads. Additional investment is especially needed on the locally owned federal-aid road network. A billion dollars of additional annual investment will be needed to bring the locally owned federal-aid road network up to Michigan's performance standards. MDOT-owned roads, which include the interstate highway system, will need an additional $626 million per year for a total of $1.7 billion in additional annual pavement preservation costs.

Bridge Condition

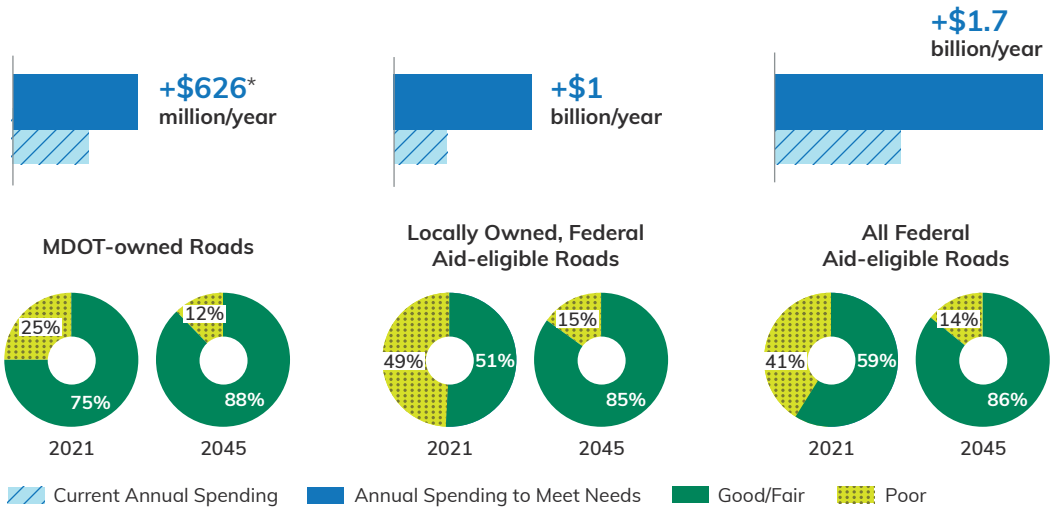
There are more than 11,000 bridges statewide, split between MDOT, bridge authorities, and local agencies' jurisdiction. Similar to pavement, the number of bridges in poor condition is also trending upward, with more than 6

percent of MDOT-owned bridges and 14 percent of locally owned bridges in poor condition in 2021. Poor conditions are concerning because a bridge must be closed to traffic once it reaches a certain level of deterioration. In fact, MDOT has closed bridges in recent years and may be forced to consider other closures unless additional funds become available for bridge improvements and/or replacement.

Bridge condition is estimated using the National Bridge Inspection (NBI) rating system, which rates bridges as either good, fair, or poor condition. MDOT's performance target for MDOT-owned bridges is 98 percent good or fair on freeways, and 95 percent good or fair on non-freeways. Current annual bridge spending averages $157 million for MDOT-owned bridges and $75 million for locally owned bridges. Under current funding levels, freeway and non-freeway bridges are under performance targets and will decline over time. Bringing bridges up to Michigan's performance standards will require an additional annual investment of $216.2 million for MDOT bridges and $164.4 million for locally owned bridges, as shown in ***Figure 29***.

Figure 28. Pavement Preservation, Annual Needs

Getting Michigan's federal aid-eligible roads to a state of good repair requires about $1.7 billion in additional investment every year, more than doubling current expenditures.



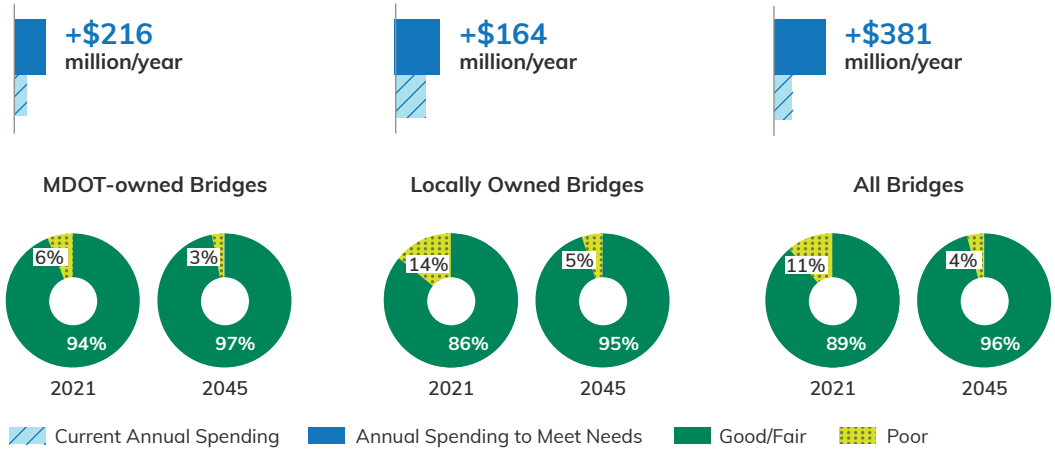
MDOT and local agencies use different primary performance measures for assessing pavement condition. MDOT uses Remaining Service Life (RSL), while local agencies use Pavement Surface Evaluation Rating (PASER). Good, Fair, and Poor ratings are generally consistent across RSL and PASER performance measures. 2045 needs correspond to meeting the pavement performance criteria in the 2019 Transportation Asset Management Plan (TAMP).

*Estimate represents an average annual investment over all 25 plan years, reflecting additional expenditures of $1.9 billion between 2021 and 2031 necessary to catch up to performance goals, tapering to lower levels through 2045 to maintain pavement at goal levels.

Source: MDOT

Figure 29. Bridge Preservation, Annual Needs

Getting Michigan's bridges to a state of good repair requires $381 million in additional investment every year, more than doubling current expenditures.



Source: MDOT

Maintenance

Regular maintenance of roads and bridges can reduce the amount of annual preservation work and is necessary for safe, reliable operations throughout the year. MDOT categorizes maintenance activities into two categories, winter and non-winter. Winter maintenance includes snow and ice removal, but non-winter maintenance includes all of the routine work to maintain the roadway, such as joint and crack filling, pothole repair, and patching. Other summer activities include mowing, culvert cleaning, pump station maintenance, and tree removal, among others. An insufficient budget for pavement and bridge maintenance results in deferring necessary work, kicking the can down the road only to incur more costly capital or emergency work. Adequate maintenance funding would enable Michigan's transportation agencies to conduct maintenance on a recurring basis, decreasing the number of critical and high-priority maintenance events created by the current cycle of deferred maintenance.

Visible lane markings are needed for automobile and truck drivers to take advantage of new safety technology, which relies on striping to alert the driver when the vehicle is drifting out of its lane. Road maintenance also benefits multiple modes of travel. For example, gravel and other debris must be swept regularly from roadway shoulders to improve safety for bicyclists. The estimated maintenance cost for MDOT roadways and locally owned federal-aid road network under the jurisdiction of a county, city, or village over the next 25 years total $13 billion ($3.2 billion for winter and $9.8 billion for non-winter) and $12.2 billion ($2.2 billion for winter and $10.0 billion for non-winter), respectively.

***Figure 30.* 25-year Maintenance Needs**

ITS/TSMO Equipment

While MDOT has not significantly increased the number of road lane-miles and bridges for which it is responsible, it has been investing substantially in ITS that collect, store, process, and distribute information relating to the movement of people and goods. The goal is to do more with existing infrastructure and get maximum performance from new investments.

The number of cameras, radar detectors, and other equipment has grown as MDOT has expanded its programs for freeway management, roadway weather management, and incident response. These operational investments are a cost-efficient way to manage roadway capacity and improve traveler safety. However, the equipment must be replaced regularly and an adequate number of personnel are required to monitor and act on the information that the devices provide. With funding already insufficient to maintain traditional infrastructure, further investment in Transportation Systems Management and Operations (TSMO), strategies that focus on operational improvements that can maintain and even restore the performance of the existing transportation system before extra capacity is needed, may require other spending tradeoffs. Seeking financial partnerships may be critical if Michigan is to remain a leader in implementing transportation technology. More discussion of the state's ITS and TSMO needs, as well as estimated costs for preservation, can be found in Chapter 12, ***Network Management and Operations***.

Carpool Lots

Maintaining Michigan's 243 carpool lots (also known as Park and Ride) is another consideration regarding preservation of Michigan's transportation system. These carpool lots provide around 9,000 parking spaces across the state and provide an essential resource for the commuting public. An additional 17 carpool lots are located at various Meijer stores around the state as part of a public-private partnership.

Transit

Michigan has 78 transit agencies operating fixed route bus service, light rail, paratransit, and dial-a-ride services. Twenty-one are urban systems, such as the Capital Area Transportation Agency (CATA) serving the greater Lansing area, while the other 57 are rural public transit agencies. There are also 4 public ferry boat systems in rural areas. Every transit agency must develop a transit asset management plan (TAMP) if it owns, operates, or manages capital assets used to provide public transportation and receives federal financial assistance.

Urban agencies prepare their own TAMPs, while MDOT takes on this responsibility for the rural providers. Vehicle replacement and facility maintenance are big challenges for transit agencies. A TAMP assists transit agencies by prioritizing funding based on condition and performance to achieve and maintain a state of good repair. Maintaining a fleet of aging vehicles can be very expensive and time-consuming. Inconsistency is an issue for transit agencies when it comes to completing their TAMPs. MDOT will need to work with transit agency providers to report transit asset management on a statewide standardized basis.

17.4 percent of Michigan's transit vehicles are beyond their useful life as defined by FTA.

Active Transportation

Michigan's active transportation network comprises various facilities for pedestrians, bicyclists, and other human-powered forms of transportation, depending on location and environment. Walking and biking are a growing mode of travel, and people are more likely to choose to walk and bike if the infrastructure is convenient, safe, and maintained; therefore, sidewalk and shoulder maintenance are essential. In addition, sidepaths and trails throughout Michigan require routine maintenance. As more than 600 road agencies and thousands of townships and parks departments are responsible for active transportation facilities, a statewide inventory does not exist. A comprehensive inventory should be developed to estimate needs across the system.

Rail

Freight Rail

Michigan's freight rail network, which is primarily owned and funded by 28 private rail companies, has approximately 3,600 miles of rail corridors.

The State of Michigan owns approximately 665 miles of these rail corridors, which are part of the greater rail network. These state-owned corridors are primarily operated by freight short lines (that is, rail carriers having annual operating revenues of approximately $39.2 million or less), but also includes a 135-mile portion of Michigan's accelerated passenger rail corridor, which runs between Kalamazoo and Dearborn. The accelerated rail corridor is operated by Amtrak for passenger service, but used by Norfolk Southern for freight service.

Michigan's passenger rail service is operated by Amtrak through the state-supported route network and served 780,000 riders in FY 2019. The Amtrak routes serve 22 stations, which are key access points to connect communities and people to the national rail network. All of these communities are served by active stations, many of which are historic and can be a challenge to preserve and maintain for the owners. Modern, well-maintained passenger rail stations and equipment (locomotives and coaches) are important to ensure continued safe operations, as well as attract new users.

Maintaining the overall track and rail bridge condition is a significant challenge for Michigan due to the high cost of maintaining rail infrastructure. In many instances, passenger and freight rail utilize the same corridors, which require a higher level of maintenance due to the higher condition requirements for passenger rail service that runs at higher speeds. Maintenance for railroads typically includes the replacement of ties at regular intervals to maintain safe operations. Other capital needs are more long-term, such as bridges and bridge components that eventually require repair or replacement. In Michigan, there are 137 bridges located on MDOT-owned freight rail corridors, most of which are at least 100 years old and in need of replacement.

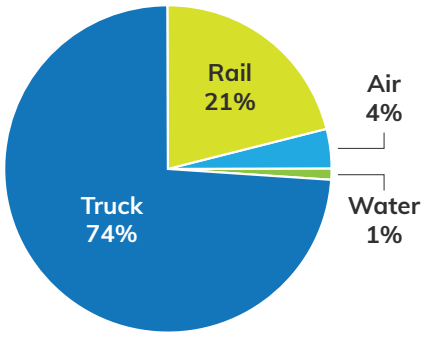
As with other states, there are rail corridors in Michigan that do not have enough rail volume to operate efficiently. In Michigan, about 17 percent, or 614 miles, of active rail lines carry fewer than an annual average of 50 carloads

per mile. Of these lines, Class III railroad carriers, which are smaller carriers and often have limited resources to invest in their rail infrastructure, operate all but 90 miles. Another 52 miles carry 50 to 100 carloads per year, which at these traffic levels is difficult for railroads to cover all their long-term capital needs. Low-density rail lines tend to be located in the northern portion of the Lower Peninsula and in the Upper Peninsula, where there is low population density and little, if any, through-freight traffic. In these areas of relatively sparse population, rail access is vital to local industries even though the volumes shipped are low. Within rural and northern Michigan, agriculture, mining, and forestry industries particularly rely on rail but volume activity can fluctuate due to market conditions and seasonality of movements. While the maintenance of these lines can be challenging, their preservation is one measure of success to ensure that rail continues to be a modal option for those areas of the state.

Freight

Michigan is a peninsula state, bounded on three sides of each peninsula by the Great Lakes, has virtually no domestic through-freight traffic. However, Michigan also borders Canada. When seen from a North American perspective, Michigan is the nation's largest gateway with our most important trading partner. This is apparent from the international trade routes that link these regions. For example, the state's busiest rail line links populous regions of Canada with the U.S., Midwest, and points beyond. In 2018, $792 billion of goods traveled by all modes of freight transportation throughout Michigan. The automotive, metals and machinery, food and agriculture, and chemicals and plastics industries produce approximately two-thirds of the volume of freight (by dollar value), is moved by truck. Most of the rest travels by rail. Other parts of the freight network include cargo moved via water for heavy, lower-value goods, and cargo moved by air for lighter, higher-value goods, or for urgent shipments (see ***Figure 31*** for a modal comparison).

Figure 31. Freight Moved by Value (2019)



Heavy Trucks

A significant portion of Michigan's economic health is related to the movement of freight. Maintaining the overall network, especially the highway and bridge networks, translates to improved safety and more reliable travel times (think just-in-time delivery) for the freight industry. This can translate to lower cost products for Michigan residents and reduced truck-car crashes.

Some industries (mining, agriculture, energy, cargo and equipment, and timber) have a higher percentage of heavily-loaded vehicles than others. The condition of roads with a high number of heavy vehicles may deteriorate substantially faster than those without heavy vehicles. Since 1982, federal law has required all states to allow an 80,000-pound gross vehicle weight (GVW) on the Interstate system and other designated highways. This weight is typically spread over five axles (including a three-axle tractor with a tandem-axle semi-trailer, making up the familiar "eighteen-wheeler"). Michigan and several other states allow greater than 80,000-pound GVW when spread over more than five axles.

Michigan law controls loads on individual axles, not total vehicle weight. The FHWA Comprehensive Truck Size and Weight Study (released in 2000) found that pavement damage caused by a vehicle is not directly related to GVW, but rather to axle loadings, along with other factors such as weather.

Even if weight is well distributed on an individual truck, however, roadways that typically carry high volumes of heavy trucks may be subject to greater wear and tear. Industries that frequently transport heavy loads include construction (which uses mined goods such as gravel from quarries), energy (such as petroleum fuels), lumber, and agriculture. ***Figure 32*** maps the tonnage flows of these industries on Michigan roads compared to the location of Michigan preservation projects in the 5YTP. The heaviest

Figure 32. Commodity Flows of Industries that Typically Carry Heavy Commodities (2018)

Source: IHS Transearch Database

flows are on major freeways that are already the subject of preservation efforts, such as I-94, I-75, US-23, and I-196. All regions in Michigan have multiple pavement and bridge projects that are addressing nearly every major freight corridor. In addition, some facilities with relatively lower but significant volumes of heavy commodities, such as US-2 in the Upper Peninsula, are also the focus of preservation efforts. The broad picture is that Michigan is addressing roadway preservation needs on heavy vehicle routes. MDOT should continue this type of analysis as future preservation projects are developed.

Marine

The Great Lakes Marine Transportation System includes 33 active cargo ports and 112 cargo terminals in Michigan that handle 51.7 million tons of cargo valued at $4.1 billion annually. It is a critical part of the overall freight transportation system, which contributes to the modal diversity that is one of the state's competitive advantages. In Sault Ste. Marie, the Poe Lock is nearly 50 years old with no alternative lock for vessels passing through the St. Mary's Falls Canal. Congress has authorized building a new lock, which will provide necessary redundancy and replace two World War I-era locks that are now closed.

Maintenance of commercial navigation channels by periodic dredging is also an important issue for the Great Lakes. In 2020, lake levels were at historic highs, which has led to significant shoreline erosion. However, in 2013 they were at historic lows, which required some cargo ships to carry lighter loads. During winter months, the maintenance concern is channels blocked by ice. Most of the U.S. Coast Guard's fleet of icebreakers in the Great Lakes area are more than 40 years old and need to be replaced.

Recent action has been taken at the federal level to address the new lock, and the resources needed for dredging and icebreaking, but follow-through is critical to avoid further economic impacts to the state's manufacturing, power generation, and construction sectors.

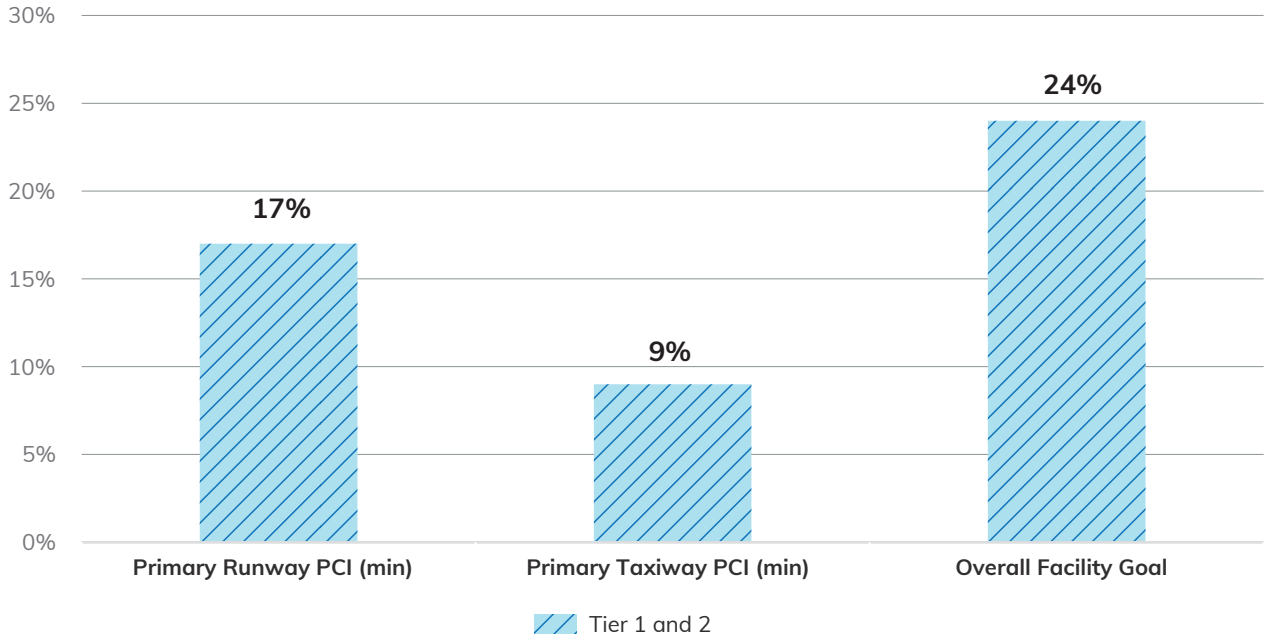
Aviation

The 2017 MASP established airport development and preservation goals for Tier 1 and 2 airports that meet essential/critical needs of Michigan's airport system and community needs.

Runway pavement preservation is needed to keep Michigan's communities and economy connected. In 2017, 24 percent of Michigan Tier 1 and 2 airports did not meet pavement condition index (PCI) goals for primary runways (see ***Figure 33***). E-commerce is driving growth at Michigan's airports - including some smaller ones. As more people shop online and are promised fast delivery, packages are shipped by FedEx, UPS, and others from their national hubs into their Michigan-based air hubs (such as Grand Rapids and Lansing), then distributed throughout the state. Maintaining access to more remote areas is becoming more important because many people depend on e-commerce services year-round for essential goods. Other time-sensitive cargo traveling by air includes parts and supplies needed by the automotive industry, much of it passing through airports in Metro Detroit.

Michigan's aviation system has the largest gap, proportionally, of all needs identified through MM2045 (including preservation and other system development investments). Projected met needs (revenues) account for 26.4 percent of 25-year, $7.4 billion aviation needs. The shortfall in meeting Michigan's aviation system needs negatively impacts statewide aviation reliability, all-season access to Michigan's geographically isolated communities, and suppresses latent economic development potential.

Figure 33. Percentage of Airports Not Meeting Minimum PCI Goals



Notes: Excludes runways and taxiways that have a turf surface or are not part of the MDOT Airport Pavement Management System (AMPS), unless a PCI was specifically provided by the airport.

Source: 2017 MASP

CHAPTER 10

Network Capacity/Right-Sizing

Right-sizing Michigan's transportation system is imperative to providing the mobility options that residents, businesses, and visitors need and ensuring fiscal sustainability. Aging infrastructure, inadequate funding, and changing needs are challenging transportation agencies in Michigan and across the United States. Where and how Michiganders travel has and will continue to change. Transportation agencies struggle to maintain aging assets built when transportation priorities were different, straining available resources. Managing a cost-effective, efficient transportation system that meets the MM2045 Vision means strategically deciding where to contract existing infrastructure and where to expand the system, particularly in light of the negative impact of past policy decisions on certain communities and modes. Across all modes, Michigan's transportation system must be right-sized to reflect Michigan's current and future needs and budgets. MDOT adopted the following definition of right-sizing as part of MM2045:

> *"The modernization and changing of infrastructure to meet the current and future transportation needs of communities, people, and freight movement. It is a process by which a transportation agency makes intentional decisions to adjust the size, extent, function, and composition of its existing or planned infrastructure and service portfolio in response to changing needs over time. Right-sizing transportation infrastructure is repurposing or physically re-sizing (either expansion or reduction) an existing asset or future asset for a newly understood economic function, purpose or need."*

Scale of Need

MM2045 represents the first attempt at systematically identifying opportunities to right-size Michigan's multimodal transportation network and services.

Due to constraints in available data, MDOT can calculate only the investment needed to add a travel lane to the streets and highways anticipated to be congested in 2045, amounting to $686 million over 25 years (see ***Figure 34***). Reducing lanes on certain segments of the system will result in long-term savings in maintenance and replacement, reducing a portion of costs. The magnitude of savings, however, won't be known until MDOT and partners analyze alternatives and coordinate with the public. Because MM2045 represents MDOT's first steps toward developing statewide plans for active transportation and transit, calculating the full needs and corresponding costs of right-sizing those pieces of the transportation system are not yet in reach. The scale of needs over the next 25 years is likely higher.

Arriving at the full costs and benefits of right-sizing requires a longer-term effort involving the public, MDOT, MPOs, local agencies, private businesses, and transit and rail operators.

***Figure 34.* 25-year Network Capacity/Right-Sizing Needs (in Millions of U.S. Dollars)**

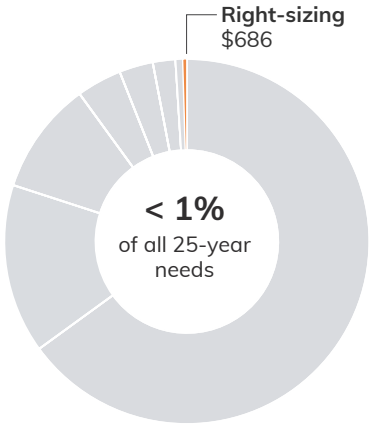


***Table 6.* Investment Needs - Network Capacity/Right-Sizing**

Mode	Investment Type
Roads and Bridges	Road diets; conversion of traditional highways to multimodal complete streets; flex routes; removal of underutilized bridges; conversion of signalized intersections to roundabouts; operational improvements; targeted lane additions to support economic growth; turning state management and jurisdiction of roadways over to local agencies.
Freight	New lanes; interchange reconfiguration; lane and shoulder widths (fixing substandard geometry); port planning and investment.
Freight Rail	Signal and track upgrades; track relocation; yard improvements; and equipment maintenance.
Passenger Rail	Expansion of passenger route services; separation of passenger and freight train operations; station improvements.
Aviation	Runway extensions; new hangars; retain smaller adjacent airports to relieve capacity constraints at larger airports.
Transit	Increased service frequency and service span; expanded service areas; increased flexibility.
Active Transportation	Leverage right-sizing to expand/add sidewalks and add low-stress bike facilities; expand active transportation network through complete streets and rural shoulder widening.

Needs Across Multiple Modes

Right-sizing requires using a multimodal lens across the full array of funding sources, as well as examining how each mode affects the others and how they are interconnected or integrated. In essence, getting right-sizing "right" depends on examining how modes interact with each other and making decisions that are good for the entire system to the extent that public engagement, data, and analysis allow.

Mode-Specific Needs

Roads and Bridges

Right-sizing Michigan's roads means adding lanes if/where needed and downsizing or closing facilities where utilization is low and there are alternative routes or opportunities to repurpose space for other modes.

To determine candidate roads where lanes could be removed or added, MDOT calculated the directional morning and evening peak-hour traffic for interstate , freeway, arterial (major streets that enable long distance travel at higher traffic volumes), and collector (moderate volume streets that link residential streets to arterials) street segments in the state. Based on projections from MDOT's Statewide Travel Demand Model, less than 10 percent of Michigan's lane-miles will be congested in 2045,[1] and many miles of uncongested locally and state-owned highways and roads will have excess capacity.

This analysis summarizes the magnitude of right-sizing candidates over the next 25 years from a high-level perspective. Right-sizing projects on the MDOT-owned network will be developed collaboratively with the public and stakeholders through the Context Sensitive Solutions (CSS) approach to project development.

Adding Lanes

MDOT's travel demand model projects that there will be 195 lane miles of congested roads and highways under the jurisdiction of MDOT and 142.6 lane miles owned by local agencies in 2045, most of which are found in urban centers like Detroit, Lansing, and Grand Rapids.

MDOT and partners will review congested segments during corridor-level planning efforts to determine the appropriate way(s) to address delays, which may include

adding capacity in the form of additional lanes or flex routes where congestion occurs only at peak periods.

In 2017, MDOT completed the first Michigan Flex Route on US-23 in Washtenaw and Livingston counties to address congestion in the growing Ann Arbor metropolitan area. Instead of adding a full lane, MDOT built an active traffic management system consisting of overhead signs, cameras, and electronic message boards, which MDOT employees monitor and adjust as needed to allow traffic to use a median shoulder during peak travel periods. Such projects add capacity at key times while significantly cutting capital costs. The state's second Flex Route on I-96 from Kent Lake Road to the I-275/I-696/M-5 interchange connecting Lansing and Detroit is currently under design.

Reducing Lanes

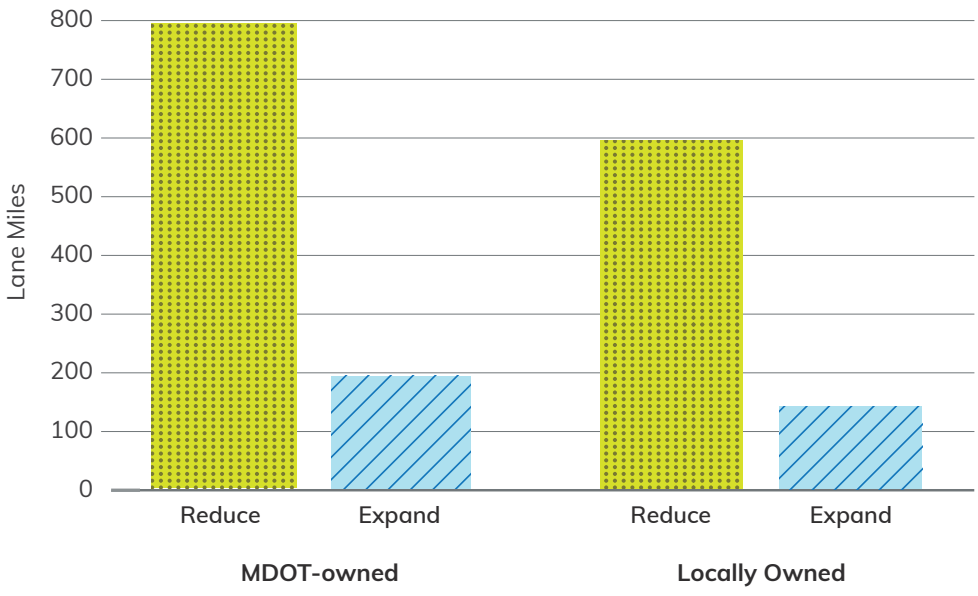
More than 90 percent of Michigan's roadways are uncongested and not projected to experience significant future traffic congestion. In fact, some facilities may be overbuilt for the existing and projected number of vehicles. MDOT used projections from the statewide travel demand model to determine where lane reductions might be warranted, using the following criteria to identify candidates for lane reductions:

[1] MDOT defines a roadway segment as congested when the volume-to-capacity ratio is equal to and greater than 0.9. Volume-to-capacity is the relationship between the average traffic on a road segment and the number of cars a road can fit given the number of available lanes, existing traffic controls, and environmental conditions over a given period of time. A volume-to-capacity ratio less than or equal to 0.2 indicates very low traffic for the operational characteristics of the existing road.

- Type of Street:
  - Interstates, freeways, arterials, collectors, and local roads, excluding highway ramps.
  - Two-way roads with three or more lanes total (excluding all minor collector roads, which have only two lanes).
  - One-way roads with two or more lanes total.
- Performance:
  - Volume-to-capacity ratio is less than or equal to 0.2, calculated using the maximum a.m. or p.m. peak period (excluding segments with no traffic in the 2045 model year).

Based on the selection criteria, 795 lane miles of roads under MDOT's jurisdiction were identified as candidates for right-sizing. Nearly all of these miles were arterial roads; no interstate or freeway segments met the lane reduction criteria. On the local network (limited to those roads in MDOT's travel demand model), MDOT identified 596 lane-miles as candidates for lane reduction, almost all on arterials. Arterials tend to be wider and can handle faster traffic speeds, making them especially inhospitable environments to biking or crossing the road. Reducing lanes saves in long-term costs and better balances the safety and needs of all users (see ***Figure 35***).

***Figure 35.* Candidates for Lane Reduction and Expansion by 2045: MDOT- and Locally Owned Roads**



Retiring Bridges

Bridges carrying low volumes of traffic that could be diverted to nearby alternate routes could be removed to reduce ongoing maintenance and replacement costs. Using the following criteria, MDOT identified bridges that could be candidates for permanent removal when their service life has expired and when they become a candidate for major work:

- Removing the bridge would create a detour of 10 miles or less.
- No other bridges would be removed on the bypass route.
- Average daily traffic is 100 vehicles per day or less.

Based on the criteria, 161 bridge structures (eight under MDOT's ownership, 153 under local ownership) could be candidates for removal.

Freeway Decommissioning

Many transportation agencies, in partnership with the communities they serve, are using the bold method of freeway decommissioning to disinvest from aging and/or failing assets and make up for negative community impacts that came from freeway building decades ago.

Absent the level of federal funding that the interstate system received in the 1950s and 1960s, states and local governments are now deciding to decommission and remove out-of-date, crumbling, or overbuilt freeways not only to save costs but to address the inequitable consequences of their initial construction. Many of the original urban freeways were built in low-income and minority neighborhoods and business districts, in tandem with urban renewal efforts. The displacement of Black residents and businesses in Detroit's Paradise Valley and Black Bottom neighborhoods to build the I-375 spur is part of this legacy. Decommissioning freeways creates opportunities not only to build at-grade boulevards that safely serve all modes, but also to initiate a process of atonement and healing by reconnecting neighborhoods, to create open spaces, and to reclaim walkable real estate.

Freight

Trucks

Michigan's top truck bottlenecks affect nearly 150 locations and represent approximately $4 million a day in costs to users. The majority of truck bottlenecks lack scheduled capacity or operational improvements in MDOT's most current 5YTP. With so many unmet needs, priority should be given to the costliest bottlenecks: rural bottlenecks that incur user costs more than $30,000 a day and urban bottlenecks with user costs more than $50,000 a day. Of these bottlenecks, all five rural and four of 18 urban locations lack projects in MDOT's 5YTP. All nine high-priority bottlenecks, shown in ***Figure 36***, are in the southern Lower Peninsula. Overall, Michigan is attempting to address many of the worst urban truck bottlenecks. Additional targeted investment is needed, however, to keep Michigan's supply chains moving smoothly.

Marine

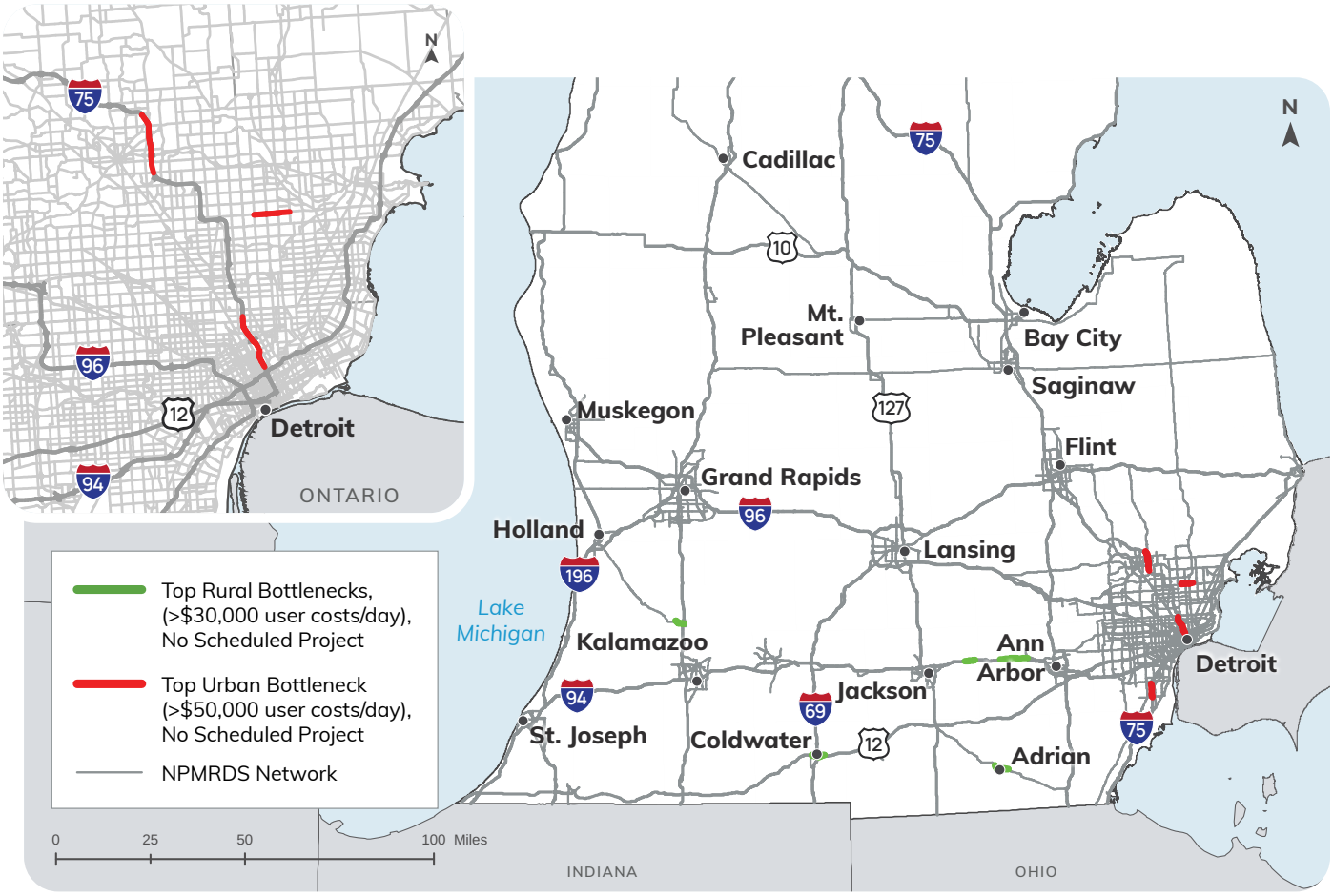
Regulatory impacts and lack of channel maintenance have dampened demand at the ports. Individual ports indicated that those issues coupled with lack of local funding sources have resulted in the loss of customer opportunities. Stakeholders interviewed for MM2045 noted that other states, such as Wisconsin and Florida, have ongoing marine grant programs that support needed port infrastructure improvements. Stakeholders noted that a reliable funding source, even if not large, would allow Michigan ports to plan for growth and could supply the local matching funds required for federal grants when the federal government will foot most of the bill. An extensive comparison of state-level assistance programs for Great Lakes commercial ports concludes that Michigan's programs are not as competitive as several neighboring states.

Passenger Rail

Like roads and bridges, the routes that carry passenger trains can be right-sized to improve passenger travel times. Possible investments include eliminating low-speed curves to allow for faster travel speeds, double-tracking heavily traveled sections, or investing in bypasses of tracks that are currently shared with freight trains.

MDOT is currently making upgrades to the MDOT-owned portion of the accelerated rail corridor between Kalamazoo and Dearborn to support train operations at

Figure 36. **Top Bottlenecks without Scheduled Projects**



speeds up to 110 mph. Additional improvements have been proposed to further enhance passenger train service on that line as well others. These projects fall into two categories, with key investments being:

- Upgrading Existing Infrastructure to Improve Service, such as:
  - The Niles-Glenwood Road Double Track Project will involve building a second track in Niles to increase line capacity and train speeds.
  - The Jackson Station Reconfiguration and Track Improvement Project will expand the center station platform to allow safe boarding of trains, decrease boarding times, and permit passing trains.
- Separating Passenger and Freight Train Operations, such as:
  - The Battle Creek Connector Project will involve building a bypass track to separate passenger trains from freight trains operated by Canadian National Railway.
  - The New CSX/Michigan Line Connection Project will include installing a new track connection to CSX to reduce passenger train and freight train conflicts into Chicago.

Freight Rail

The significant majority of freight rail corridors in Michigan are privately owned, thus, infrastructure and equipment right-sizing is determined by operating railroads. For the Michigan-owned short-line railroads, MDOT and the lessee railroad collaborate on rightsizing decisions.

Michigan has hundreds of miles of low-density freight lines that may require infrastructure improvements to remain in service. Most of these low-density lines are operated by short-line railroads. Potential projects include the following:

- Making capital improvements to rail corridors

(including upgrading bridges and tracks) to accommodate freight railcars that carry 286,000 pounds.

- Providing financing and assistance to improve privately owned short-line railroads with signal upgrades, yard improvements, and equipment to promote more freight rail traffic.

The initial capital costs to access the rail system can be a deterrent to shipping by rail. By helping Michigan companies overcome this barrier, transportation agencies can help ensure commodities travel via the most cost-efficient mode, which reduces unnecessary demand on the roadway system. Industry trends point to the potential for more intermodal freight transportation. Chapter 13, ***Network Accessibility and Connectivity*** discusses the following improvements in-depth, and they have important ramifications for the right-sizing of Michigan's transportation network:

- Building new truck-rail transload facilities, or improving existing facilities.
- Providing new or improved railroad sidings and spurs to industrial sites.
- Upgrading Michigan's truck/rail intermodal container network, which includes enhancements within the Detroit terminal, improved railroad access to terminals, and upgrades to rail line connections that help freight fluidity in Detroit.

Recommended Strategies provides a full list of passenger and freight rail projects.

Transit

Right-sizing fixed-route transit like bus and light-rail primarily involves expanding frequency, span of service hours, or geographic service area. In many markets, there is unmet demand for transit service for people who can't afford cars, for travelers looking to reduce the amount of driving in their daily travel, for households looking to save money, or riders who must take complex journeys to reach their destinations, but service is not available for where and when they need to travel. As Michigan recovers from the COVID-19 pandemic, transit providers are taking a hard look at the service they will provide in the future. If travel times spread throughout the day, morning and evening peak weekday service hours can be redistributed to 24/7 routes that essential workers rely on. In the long term, Michigan's transit service needs will exceed current service levels.

Many in Michigan (including seniors, people with disabilities, and rural residents) rely on flexible

demand-response services like paratransit to shop and get to medical appointments. As Michiganders age out of driving, demand for these services is likely to increase.

Sustainably right-sizing transit service hinges on accessing new, stable sources of operating funds. Directing more operational and capital funding toward transit will especially benefit Michigan's lower-income and disadvantaged communities.

Aviation

Right-sizing Michigan's aviation system relies on two principal strategies: upgrading airport infrastructure and maintaining a system with sufficient redundancy to accommodate surges in air traffic.

The 2017 MASP Plan identified that 54 percent of Michigan's Tier 1 and Tier 2 public airports could benefit from primary runway extensions to enable use by larger aircraft, which would likely require additional upgrades to aircraft services like hangars and maintenance facilities.

Although stakeholders interviewed for MM2045 did not identify current airport bottlenecks, future expansion of e-commerce could put pressure on the larger metro airports that serve most of Michigan's air cargo needs. Preserving smaller regional airports can better distribute freight traffic across the road network.

Active Transportation

Public input received during the development of MM2045 strongly emphasized the need to take a complete streets approach to safely accommodate all users, especially

vulnerable pedestrians and bicyclists. Repurposing lanes on arterial and collector roads with excess capacity (also known as road diets) opens up opportunities to increase safety and expand, improve, and address gaps in sidewalk and bikeway networks. Underutilized travel lanes might be upcycled as medians with pedestrian refuge islands or as low-stress, parking-protected bike lanes through resurfacing and pavement marking projects. In some commercial areas, sidewalks are not wide enough for the expected volumes of pedestrians and other users, or simply not compliant with the Americans with Disabilities Act. More capital-intensive street rebuilding projects might extend sidewalks to accommodate sidewalk dining, better transit shelters, and raised bike lanes.

MDOT's M2D2 work plan aims to educate MDOT staff across all regions to effectively implement designs like road diets and to address the policy barriers that inhibit broader adoption of these tools as MDOT improves roads and bridges under its jurisdiction. Needs extend well past MDOT-owned roads. Training and funding partnerships are needed between MDOT and local agencies to tackle the 596 lane-miles that are candidates for lane reductions off of the MDOT system.

CHAPTER 11

Transportation Safety and Security

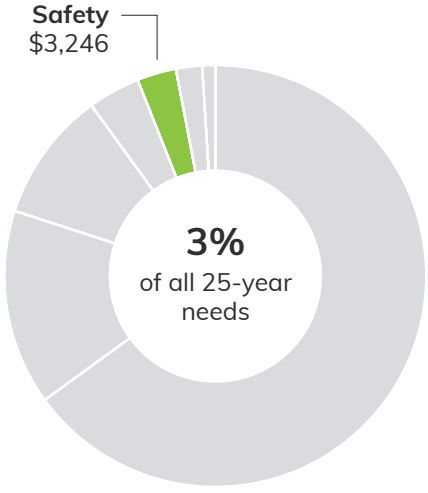
Safety for all users of Michigan's transportation system is a priority for all transportation agencies, railroads, airports, and service providers. Prior to the COVID-19 pandemic, efforts by MDOT and its partners had resulted in an overall decline in fatal and injury crashes, although nearly 1,000 people still lose their lives every year on Michigan's roads.[1] Alarmingly, the COVID-19 pandemic has turned the trend in the wrong direction. Injuries and fatalities from traffic crashes continue to be a critical public health concern in Michigan. Crashes, even those that aren't severe, disrupt travel and create shipping delays that impact consumers and businesses alike, impacting the food supply and flow of essential medicines. From keeping roads, rail corridors, and airports open to protecting Michigan's digital infrastructure from cyberattacks, securing Michigan's transportation system is crucial to the safety of the state and the nation.

Scale of Need

Over the next 25 years, Michigan's safety needs amount to $3.2 billion (see ***Figure 37***). The safety needs include the cost of installing safety countermeasures to address systemic improvements (such as rumble strips, traffic signals, cable median barriers), freeway pavement markings, and non-freeway pavement markings on roads owned by MDOT, as projected based on recent MDOT highway safety improvement and strategic highway safety plans.

The calculated safety needs do not account for cyber security, mode-specific needs (like improvements for people walking and biking), and safety improvements on local roadways under the jurisdiction of a county, city, or village. Local safety needs most likely total in the billions of dollars since the local federal-aid roadway network alone exceeds 27,000 route miles. Data were not available during the development of MM2045 to quantify these costs across the state. Coming to terms with the costs associated with these needs requires increased coordination and planning across modes and levels of government.

***Figure 37.* 25-year Transportation Safety and Security Needs (in Millions of U.S. Dollars)**



1 Michigan Office of Highway Safety Planning, Michigan Traffic Crash Facts, 2015-2019

***Table 7.* Investment Needs - Transportation Safety and Security**

Mode	Investment Type
Roads and Bridges	Pavements markings; roadway delineation; roundabouts; reducing the number/frequency of bottlenecks; targeted safety campaigns.
Freight	Queue warning/management system; roundabout upgrades; incentives for retrofitting older fleet vehicles with new safety technologies; cable median barriers.
Freight Rail	At-grade crossing improvements and separation; reducing rail trespassers; rail safety education campaigns; positive train control systems.
Passenger Rail	At-grade crossing improvements and separation; reducing rail trespassers; rail safety education campaigns; positive train control systems.
Aviation	Meet all-weather and year-round access airport development goals to serve isolated communities; lighting and visual upgrades.
Transit	Safer bike and pedestrian access to transit stops; vehicle collision avoidance systems; bus stop lighting and security.
Active Transportation	Expand low-stress bike and pedestrian facilities and safety countermeasures; lighting; speed reduction.

Needs Across Multiple Modes

In-Vehicle Technology

In-vehicle technological advancements have decreased fatalities and serious injuries. The advent of seat belts and airbags has saved countless lives and made injuries less serious when crashes occur. In more recent years, the advancement of advanced driver-assistance systems (ADAS) in automobiles and commercial trucks has reduced the number of crashes on roadways. According to the National Highway Transportation Safety Administration, 94 percent of serious crashes are due to human error. Technology can assist the driver in quick decision-making, ultimately allowing drivers to make more informed, and safer, decisions when behind the wheel.

While in-vehicle technological advancements can reduce serious injury, the technology can be quite expensive when first brought to the public. Airbags used to be an optional feature, yet today they are standard in every vehicle. This is the same case with ADAS technology such as lane-keeping assistance, collision warning, and blind spot detection — all currently options, but one day could be standard features. Most people associate these features with automobiles, but this technology is also used in commercial trucks by large carriers who renew their fleets every three to four years and thus acquire the newest safety technologies. Unfortunately, much of the trucking industry consists of small fleets and owner/operators who typically rely on used equipment and do not rotate their fleets nearly as often. As a result, these new safety technologies take years to trickle down into the commercial fleet. Although ADAS can be retrofitted for older trucks, small operators may be unable to afford them. Considering crashes involving trucks are likely to be more serious, the State of Michigan should consider a financing or tax incentive program for purchasing or retrofitting trucks with ADAS similar to what some transportation agencies offer carriers to encourage acquisition of later model trucks with cleaner diesel engines. The continued proliferation of in-vehicle technology such as ADAS in automobiles and commercial trucks will help reduce the number of crashes and the severity of crash injuries by assisting the driving task.

Security

The state's transportation system is critical to all aspects of individual's lives. The system moves the food that feeds Michiganders and the materials that build Michigan's cities and towns, and allows residents to enjoy a high quality of life. Yet, any disruption to this system can have dramatic consequences for all residents. In an age where technology is embedded more and more within all aspects of Michigan's transportation infrastructure, securing data and systems is more important than ever. Due to this concern, MDOT has prioritized the following strategies to protect the state's transportation infrastructure:

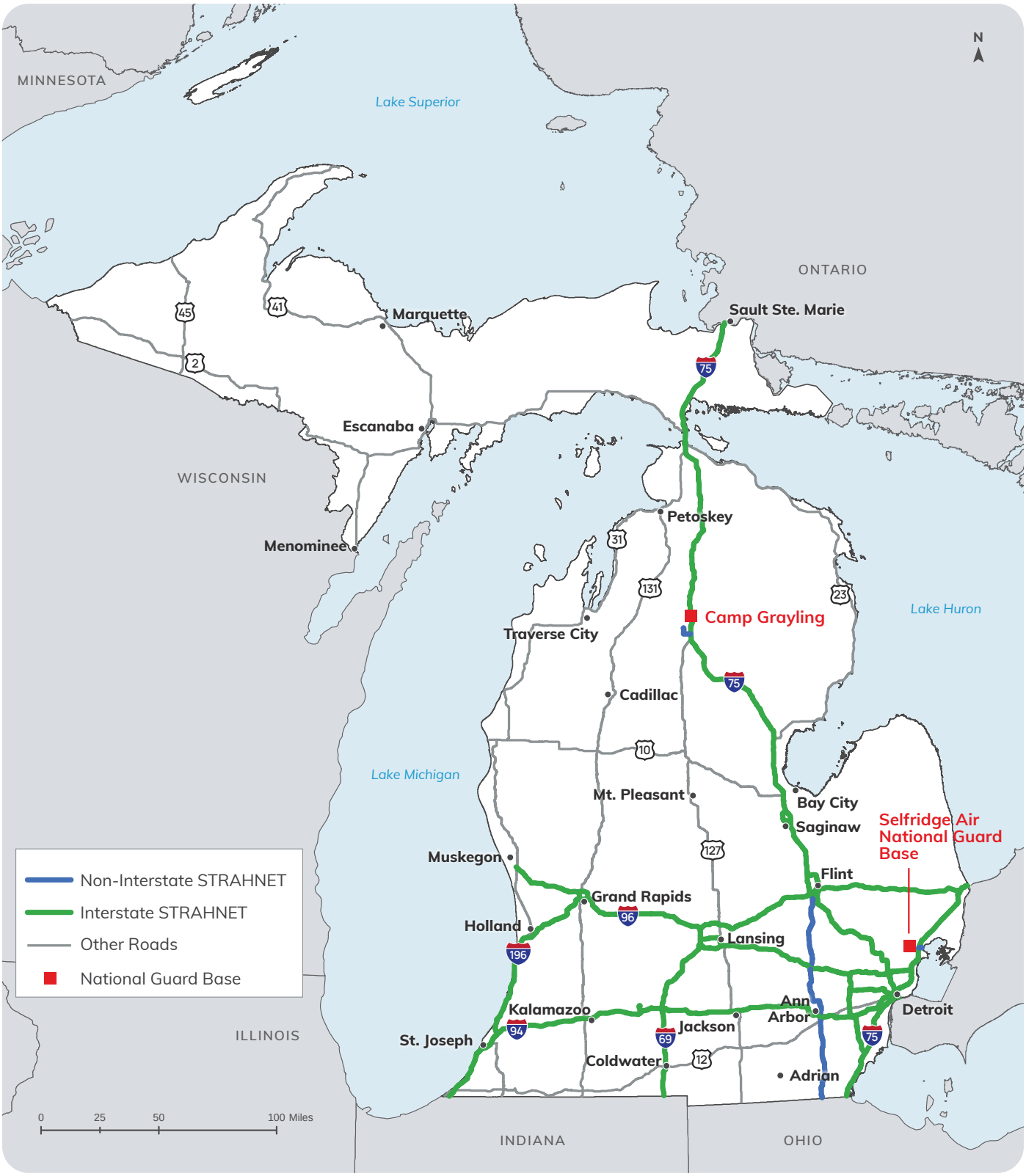
- Protect Michigan transportation data and cybersecurity-dependent infrastructure through best-practice credentialing and cybersecurity measures, including tracking new security standards and collaborating with stakeholders.
- Identify and prioritize cybersecurity-dependent critical infrastructure and systems.
- Conduct a statewide vulnerability assessment, incorporate its data and findings into asset management plans and practices, and integrate risk-related data into the Michigan Geographic Framework (digital base map for state government) to strategically improve transportation infrastructure to advance the transportation network's resilience and security.

By taking these steps, MDOT will ensure that the state's transportation system is protected from cyberattacks.

Additionally, the physical rail and roadway systems play a vital role in the defense of the nation. The U.S. Department of Defense has a national a Strategic Highway Network (STRAHNET) and Military Strategic Rail Corridor Network (STRACNET). These networks are given this designation to provide "defense access, continuity, and emergency capabilities for movements of personnel and equipment in both peace and war." These networks move critical personal and equipment to ports and provide connection between military facilities.

The STRAHNET consists of 61,044 miles, including the 45,376-mile Interstate System and 15,668 miles of other important public highways. Michigan has 1,240 interstate miles designated as part of STRAHNET and an additional 91 miles of non-interstate roadway as part of STRAHNET. ***Figure 38*** shows the STRAHNET in Michigan.

Figure 38. **STRAHNET in Michigan**



Strategic Rail Corridor Network

The STRACNET consists of 32,500 miles of rail lines, as well as another 5,000 miles of track essential to connect military facilities to each other. ***Figure 39*** shows the STRACNET in Michigan.

Michigan has 73 miles designated as part of STRACNET and 271 miles designated as STRACNET connectors. Designation can affect passenger rail operations since high-level platforms must not interfere with STRACNET horizontal clearance requirements. Connectors extend to National Guard installations in Grayling and Lansing.

Figure 39. **STRACNET in Michigan**

Mode-Specific Needs

Roads and Bridges

Roadways are the backbone of Michigan's transportation system, assisting in moving people and goods daily and enabling products to be delivered to stores, people to get to their jobs and other activities. Tragically, across the U.S. and in Michigan, travelers (particularly vulnerable users) face unacceptably high rates of death and life-altering injury. In 2019, 985 people, an average of nearly 3 people per day, died in crashes on Michigan roadways and 5,629 were suspected to have been seriously injured.

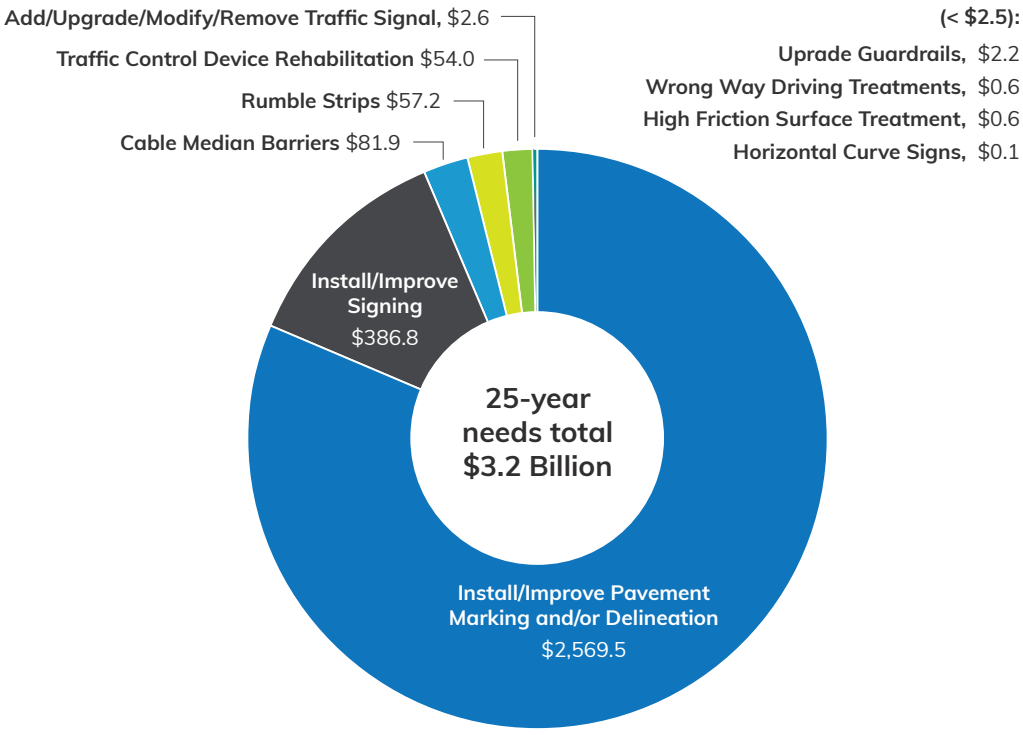
Achieving Michigan's safety goals hinges on partnerships, especially in the state's pursuit of Toward Zero Deaths (TZD). Michigan acknowledges that since severe traffic crashes are preventable, even one death on the transportation system is unacceptable. Under the leadership of the inter-governmental Governor's Traffic Safety Advisory Council, MDOT publishes the multi-year SHSP in cooperation with local, state, federal, and private sector stakeholders. The four-year plan provides a comprehensive, data-driven framework including goals and safety emphasis areas. Guided by the SHSP, MDOT develops the annual Highway Safety Improvement Program (HSIP) to fund improvements to reduce fatalities and serious injuries on state and local roads.

While poor pavement and infrastructure condition can affect safety, there are many different types of investments that can save lives and prevent severe crashes. MDOT invests in proven safety treatments on roads under its jurisdiction and by administering funding for education and targeted enforcement. Local agencies, law enforcement, MPOs, and other state agencies all play key roles in designing safer roads, targeting dangerous behaviors, running education campaigns, and conducting emergency response across all of Michigan's roads.

MDOT has direct control over improving roadway conditions on its own network, but does not have unlimited funds. The systematic safety improvement needs for the next 25 years amount to $3.2 billion.

A vast majority of these improvements will be used for pavement markings and roadway delineation (see ***Figure 40***). These two improvements, while simple, can make a dramatic difference for roadway safety. Between 2009 and 2018, the top facility-related safety issue was lane departures. Improving pavement markings and roadway delineation will help reduce crashes on Michigan roadways, especially on rural roadways where a large number of lane-departure crashes have occurred. Additionally, it is important that roadways be properly striped to allow for new in-vehicle technology, such as lane-keeping assistance (which relies on pavement edge

***Figure 40.* 25-Year Safety Systematic Improvement Needs (Millions)**



striping), to work. Having proper pavement markings and roadway delineation helps both newer technologies recognize the roadway and also the human driver who may not have that technology in their vehicle yet.

Additionally, other strategies that MDOT will implement to decrease the number of crashes on Michigan roadways, including roundabouts, reducing the number and frequency of bottlenecks, and queue warning devices. The public has a mixed opinion on roundabouts. They have been proven, however, to dramatically increase safety when compared to traditional intersections. Siting and design decisions are key to their successful operation. Roundabouts also must be designed with proper consideration of commercial trucks, which enter more slowly and require more space. While MDOT can make roadway improvements to increase safety, funding is limited. Increasing funding will be critical to reducing crashes on Michigan roadways.

Toward Zero Deaths

To supplement MDOT safety engineering solutions, TZD is an initiative that MDOT, FHWA, MSP, and other partners are working together to achieve zero deaths on Michigan's roadways. The TZD initiative aims to reduce all roadway fatalities for all users, including motorized and active transportation. Efforts by MDOT and its partners are making a difference. In fact, rail crossing crashes have declined by 70 percent over the past two decades. Highway traffic fatalities were declining before the COVID-19 pandemic but increased in 2020, not only in Michigan but across the entire country. Early indications are this may have been related to the pandemic. With less traffic on the roads, people may have driven at faster speeds, with many people having reported consuming larger quantities of alcohol. Prior to the pandemic, two of the top fatality-related highway safety issues were tied to driver behavior (occupant protection and impaired driving). Driver behavior, shaped significantly but not entirely by road design, factors into nearly 90 percent of all fatal crashes. TZD will be key to bringing together MDOT, MSP and other partners to identify additional non-engineering means to reduce severe crashes in addition to ongoing design efforts by MDOT and transportation agencies throughout the state .

In recent years, FHWA has emphasized reducing crashes that involve active transportation users who are more at risk of injury or death than drivers and passengers. This emphasis aligns with the findings from the public involvement survey conducted for MM2045. The public was asked to rank a series of transportation issues on a scale of one to five stars, with one being the least important and five being the most. The end result showed two highway safety issues being the most important: "At Risk Users – Promote actions to assist and protect pedestrians, bicyclists, seniors, youth, and motorcyclists" (this was the highest five-star rated issue) and "High Risk Behaviors – Promote actions to address distracted and impaired driving." These findings validate MDOT's commitment to the TZD initiative and FHWA's emphasis on active transportation users.

Freight and Passenger Rail

Freight and passenger rail safety is a priority for MDOT and the state's railroads. The focus on safety has led to significant reductions in incidents over the last decade. The average annual frequency of train-motor vehicle crashes at highway-rail grade crossings in Michigan declined by nearly 50 percent in the last 10 years (2010–2019) compared to the previous decade (2000–2009). Trespasser fatalities also declined by 14 percent over the same period.

The reduction in incidents was attributable to maintaining rail lines in a state of good repair, crossing improvement programs, and enhancing the public awareness of the dangers of rail transportation. Current investments include:

- MDOT administers the Railway-Highway (Section 130) Safety Program, the federal program aimed at eliminating hazards at highway-rail grade crossings. According to the program's formula, Michigan received $8.1 million in FY 2019.
- MDOT also dedicates $3 million per year of state road funding toward highway-rail grade crossing safety issues.

In addition to disbursing these funds:

- MDOT continues to advocate for increased funding and applies for federal discretionary funds to make rail crossings safer.
- MDOT collaborates with local road authorities and railroads to close crossings that will not affect emergency response or local mobility.
- For state-owned lines, MDOT partners with its operating railroads and local road authorities to address specific trespassing incidents and to take actions that discourage trespassing.
- MDOT provides funding to support Michigan Operation Lifesaver, a program to increase public awareness of railroad grade crossing safety; this includes participation along with the railroads and the Operation Life Saver program during Rail Safety Week.

MDOT will continue its focus on rail safety. Innovative technologies are evolving that will supplement traditional crossing maintenance programs. WAZE is including grade crossing information in its smartphone application. Michigan Technological University is part of an FRA research program supporting in-vehicle auditory alerts for rail crossings and standardizing the warnings across platforms. The project outcomes will provide design guidelines that consider different road conditions, auditory parameters, driver characteristics, distractions, and actual implementation directions.

Freight

Truck crashes, when they occur, can result in serious injuries and death in addition to disruptions that reverberate through the supply chain. Twenty-seven segments in Michigan experienced 10 or more truck crashes in 2019, all in south Michigan (see ***Figure 41***).

***Figure 41.* Top Truck Crash Locations**

At least one of the following factors are attributed to nearly every segment:

- Snow and icy conditions.
- Roundabouts with heavy mixed-vehicle traffic.
- High-volume work zone corridors.
- Congested corridors with truck bottlenecks and accessibility issues.

Michigan's transportation agencies have employed many strategies to alleviate the number of truck crashes. MDOT has installed hundreds of miles of cable median barriers to reduce cross-median crashes, some of the more severe and fatal highway crashes. Thousands of miles of rumble strips have been installed throughout Michigan as a cost-effective countermeasure to lane-departure crashes brought on by driver drowsiness, distraction, and/or inattention. Furthermore, MDOT has expanded its use of social media and variable-message signs to get real-time information to the public regarding weather and dangerous road conditions.

Aviation

Michigan's airport network is critical to the economic competitiveness of the state; it also plays a key role in improving Michiganders' quality of life by connecting them with the nation and the world. Safety as it relates to the airport network is critical because incidents at airports can be extremely dangerous. Disruptions to operations at airports can adversely affect accessibility for urgent medical care, especially for isolated communities.

In 2017, MDOT evaluated the facilities, infrastructure, and accessibility of each of Michigan's 114 Tier 1 and Tier 2 airports against seven facility development goals. All of Michigan's Tier 1 and 2 airports met MDOT's approach protection goal, which refers to land uses and height regulations that protect airport approaches and airspace. However, 52 percent did not meet MDOT's all-weather access goal and 49 percent did not meet the lighting and visual aid goal. Meeting these highly important goals to ensure that airport operations are not disrupted during adverse weather conditions is critical to aviation safety.

Transit

Public transit plays an important role in Michigan's transportation system because it allows access to essential services such as jobs, groceries, and medical facilities for those who do not have other means of transportation. In 2019, more than 82 million rides were provided across all public transit systems in the state. The safety of riders within this system is of utmost importance. In 2018, only two fatalities occurred for the millions of rides given that year.

Safe transit operations depend on equipment and technology that can mitigate blind spots and alert operators to the presence of nearby pedestrians, cyclists, and drivers. MDOT and transit providers are currently collaborating on safety innovations such as the Bay Area Transportation Authority's vehicle collision avoidance system pilot and the statewide Automated Bus Consortium discussed in Chapter 5, ***Partnerships***.

Transit safety also encompasses personal security for riders and operators alike. Addressing safety starts at the transit stop with proper lighting and other visibility enhancements and continues onto the transit vehicle. Personal safety issues, real and perceived, significantly impact the public's desire to ride transit.

A significant safety issue for transit users is access to and from designated transit stops. While data on incidents involving pedestrians trying to access a transit stop is not readily available, through outreach with transit partners and the public, it is clear that making it safer to walk and bike to transit is a key issue. Having a transit stop does the community no good if the proper infrastructure is not in place to provide access the stop safely. MDOT, in partnership with the public transit agencies and local jurisdictions, should work together to ensure that proper bike and pedestrian infrastructure is provided to allow access to transit stops. By ensuring proper bike and pedestrian access to transit stops, MDOT can increase ridership and improve safety conditions for riders.

Active Transportation

Safety is a vital concern for every travel mode but is perhaps most serious for pedestrians and bicyclists, as they represent the most vulnerable users. Between 2013 and 2019, pedestrians and bicyclists were involved in

less than 1.5 percent of the crashes in the state, while disproportionately accounting for nearly 20 percent of all fatalities. Perceptions of safety and access to safe, low-stress facilities shape individual travel behavior. Without proper use, individuals are less inclined to walk or bike to get to destinations. Public engagement indicated safety is a primary obstacle to increasing active transportation infrastructure.

MDOT and partners throughout the state share the goal to expand the active transportation network and institute safety countermeasures to allow for the safe use of active transportation infrastructure. However, Michigan lacks comprehensive data and the ability to quantify active transportation infrastructure needs. The lack of this data creates challenges to identify urban gaps and barriers and disparities in access, to discuss network preservation, to perform robust safety analysis, and to identify current and latent demand. Due to these constraints, MDOT and local agencies will need to initiate a bicycle and pedestrian counting program and develop robust inventories and data collection procedures that will serve as the building blocks for a statewide database. These steps will allow Michigan to safely expand its active transportation infrastructure and encourage more healthy travel behaviors.

CHAPTER 12

Network Management and Operations

Minimizing the delay people and goods encounter on the way to their destinations isn't always accomplished by widening roads or adding more service. Often, it's achieved by better managing and getting the most performance out of current assets and infrastructure. In many situations, transportation agencies cannot simply build their way out of congestion, nor would it be feasible to do so from a financial or practical perspective. In fact, 60 percent of Michigan's traffic congestion is due to "nonrecurring" issues, such as crashes and other incidents (25 percent), bad weather (15 percent), work zones (10 percent), poor signal timing (5 percent), and special events (5 percent). Behind the scenes, interconnected traffic signals, traffic counters, message boards, and other equipment carry information between travelers and operations managers to plan real-time detours around congestion and crashes. MDOT has developed a TSMO strategy to deploy these cost-effective operational improvements where they are most needed. Essentially, TSMO are strategies that can maintain and even restore the performance of the existing transportation system before extra capacity is needed. Funding and implementing TSMO strategies for Michigan's overall transportation system can improve quality of life and safety, reduce congestion and fuel consumption, provide cleaner air, and improve economic opportunities.

Scale of Need

Maintaining the existing infrastructure necessary to manage traffic and expanding it to meet growth in passenger and freight activity anticipated over the next 25 years requires concerted investment. Capital and maintenance needs for operational improvements and operations management on MDOT-owned highways and roads amounts to $4.8 billion, with ITS and traffic signals accounting for an additional $2 billion and $1.2 billion, respectively, over the same period (see ***Figure 42***).

Operation, traffic signals, and ITS needs on the locally owned federal-aid road network under the jurisdiction of a county, city, or village is not included in these figures due to lack of data. However, network management and operations needs on the locally owned federal-aid road network most likely total in the hundreds of millions of dollars since the federal-aid roadway network under the jurisdiction of a county, city, or village exceeds 27,000 route miles. Coming to terms with the costs associated with these needs requires increased coordination and planning across modes and levels of government.

***Figure 42.* 25-year Network Management and Operations Needs (in Millions of U.S. Dollars)**

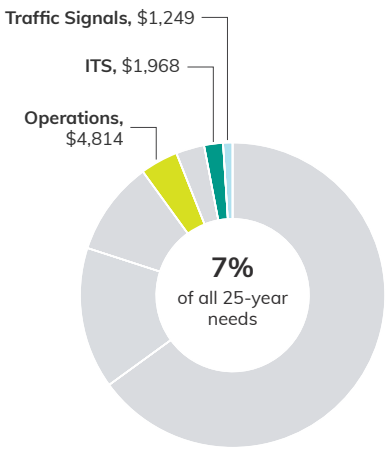


***Table 8.* Investment Needs - Network Management and Operations**

Mode	Investment Type
Roads and Bridges	Traffic incident management; work zone management; implementing connected infrastructure; maintaining and upgrading traffic signals; operational improvements, such as turning lanes and weave/merge lanes; advanced traffic management systems (ATMS).
Freight	Trucker talent attraction and retention; pavement markings to help with lane designation; wayfinding; alternative routing in areas of high congestion; weather advisory services.
Freight Rail	Centralized traffic control (CTC); automatic block signaling (ABS).
Passenger Rail	CTC; ABS.
Aviation	Pilot/mechanic talent attraction and retention; year-round access; pilot and aircraft services; landslide access; lighting and visual aids.
Transit	Operator/mechanic talent attraction and retention; statewide transit data dashboard; transit signal priority; connected and automated transit vehicles; upgrade dispatching software and systems; farebox modernization.
Active Transportation	Active transportation activity counts; statewide active transportation asset inventory; pedestrian signal timing; crosswalk spacing.

Needs Across Multiple Modes

Local/State Coordination

Michigan's transportation system is made up of multiple modes that all work together to move people and goods into, out of, and throughout the state. For this system to work efficiently, close planning and coordination between MDOT and entities that own and operate transportation infrastructure is paramount. For example, gaps in a sidewalk network owned by a local municipality can create delays and when riders on the local transit system can't easily or safely connect to their destinations. Trucks leaving the highway headed for their final destination on local streets may encounter intersections they cannot easily traverse and therefore snarl traffic as they navigate routes not necessarily designed with them in mind. While MDOT does not own or maintain all of the transportation infrastructure throughout the state, it can coordinate with entities to ensure that the investments put in place by each individual entity advances the MM2045 Vision.

Operator and Mechanic Shortages

Even before the COVID-19 pandemic, there were not enough bus drivers, pilots, and long-haul truckers to keep up with demand and not enough mechanics to keep fleets in top condition. The problem persists today. Operator shortages cut services and concentrate risks in fewer flights, hauls, and runs. Fewer mechanics make it more difficult to maintain a state of good repair, reducing reliability and on-time performance. The boom in certain private industries (like parcel delivery) has increased competition for these valuable trades. Automation may theoretically reduce demand for operators, but just as today's commercial pilots mainly oversee the auto pilot system, tomorrow's transit operators and truck drivers will likely still be needed to monitor their vehicles and respond to emergencies. Addressing the shortage will require assessing education and workforce training programs with partner agencies, education systems, and nonprofits to determine how to better attract and retain these critical workers.

Mode-Specific Needs

Roads and Bridges

Michigan's federal aid-eligible roads and highway network are critical to Michigan's economy and carries 73 percent of all freight to, from, or within Michigan. MDOT can increase the efficiency of this network through system operations and innovative technologies.

Operations Management

MDOT uses a range of operations improvements, such as roundabouts, diverging diamond interchanges, auxiliary lanes, and boulevard improvements, to improve traffic flow and reduce the risk of crashes.

Diverging diamond interchange, Kent County

MDOT and local partners manage operations on the state's highways and roads using the following tools:

- **Traffic Incident Management** – Unexpected incidents such as crashes cause significant impacts on the safety and mobility of Michigan's traveling public, environment, and economy. MDOT partners with state and local law enforcement, first responders, local road agencies, and towing companies to mitigate traffic incidents. This coordinated effort includes courtesy patrols and cameras to rapidly detect incidents.
- **Work Zone Management** – Using detailed traffic control, traffic operations, public information, and performance assessment plans, MDOT repairs and improves roadways while maximizing safety and minimizing impacts on mobility. For example, dynamic message signs alert the traveling public to the presence of a work zone, reduced speed limits, and increased penalties for traffic violations.

- **Management of Recurring Congestion** – MDOT closely tracks areas of regular congestion and poor travel-time reliability using microwave vehicle detection systems to gather throughput and vehicle-speed data.
- **Flex Routes** – MDOT uses technology to actively manage traffic by using advisory speed limits and dynamic lane control.

Intelligent Transportation Systems

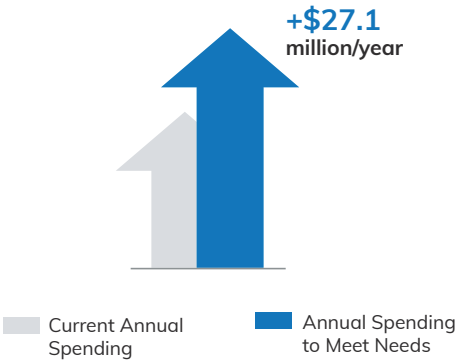
ITS make managing and optimizing the transportation system possible. MDOT has used ITS infrastructure to improve the operation of Michigan's transportation system since the 1960s. What began as a modest system of closed-circuit televisions, ramp metering, and dynamic message signs grew with technological advancement and regulatory requirements into a diversified system of nearly 6,000 devices. MDOT's ITS infrastructure includes traffic signals, travel-time signs, and connected infrastructure, which communicate to three traffic operations centers to efficiently monitor traffic and manage traffic incident responses.

MDOT traffic operations center, Detroit

ITS needs will grow as more vehicles incorporate vehicle-to-infrastructure (V2I) and connected features. V2I technology, which allows vehicles to communicate with signals and other infrastructure, is the first step to advanced CAVs. CAVs have the potential to remove people from the process of driving, partially or completely, ultimately improving safety, traffic flow, and quality of life. Without investment in connected traffic signals, Michigan will delay the broader adoption of connected fleets and fail to capitalize on the associated economic and safety benefits.

Figure 43. **ITS, Annual Needs**

Preserving and expanding ITS equipment requires $27.1 million in additional investment every year, nearly 50 percent more than current expenditures.



Traffic Signals

Maintaining and upgrading traffic signals is a particularly critical task. Modernized and interconnected signals increase the safety and reliability of Michigan's roads. Signal controllers (the computer hardware behind each traffic signal) will need to be upgraded to communicate with CAVs and emergency vehicles. MDOT is implementing a central signal control system to remotely manage and monitor signals to enhance its abilities to optimize the road network, with additional benefits to ongoing signal maintenance.

Freight

The movement of freight is essential to the economic vitality of Michigan. While freight is moved to, from, and within Michigan by all modes of transportation, movement by truck accounts for 73 percent of all tonnage. By 2045, the number of trucks supporting Michigan's industries is projected to grow by 15 percent, resulting in millions of additional truckloads a year. Michigan cannot increase capacity across its entire system to accommodate the demand. System management and operational investments must be implemented strategically to manage growth.

Shippers use data from ITS devices to optimize their routes and drivers respond to incoming information to make adjustments when needed to stay on schedule. MDOT has hundreds of congestion and weather sensors throughout its roadway network that help inform shippers of roadway conditions. Feedback from the industry received during the development of MM2045 showed that more ITS devices are needed to optimize truck routing.

Many movements occur on local roads. MDOT will need to expand its collaboration with the private sector and local governments to optimize the movement of freight, which is relying more on big data and the sensors built into the roadway. As shippers look to add urban and suburban distribution centers to fulfill demand for e-commerce deliveries, local governments might leverage ITS infrastructure to detect and redirect large trucks that are entering local streets, and thus assuage resident concerns about increased truck traffic.

In addition to cutting-edge infrastructure, there still must be a focus on the basics. MDOT will need to consider freight in its work zone or incident detour plans. Detours are problematic for large trucks to traverse, creating unintended disruptions and delays. Deteriorating bridges that can only handle reduced loads can also create issues for freight detours. If bridge funding does not increase, this problem will worsen. Keeping lane markings maintained is another priority. Without clear markings, drivers can't use onboard lane-keeping systems.

Freight and Passenger Rail

Most of the rail network within Michigan (and in the nation) is privately owned. Most rail lines in Michigan consist of only a single track, with trains passing each other at sidings. However, high-density segments of the network consist of two tracks or more. As with other modes of transportation, it isn't economically feasible to only add additional infrastructure to increase capacity. Dispatching technologies, such as centralized traffic control (CTC) and automatic block signaling (ABS), serve to increase capacity.

High-density rail lines are dispatched using CTC, in which electric circuits in the rails monitor the locations of trains. Railroad dispatchers at remote locations can manage train movements, while controlling both signals and switches to passing sidings. For medium-density rail lines, the ABS system, which also uses electronic circuits to monitor train locations, is employed. CTC and ABS allow train crews to enter a section of track without first obtaining permission or warrants by radio, phone, prearranged schedule, or electronic transmission from a dispatcher, making operations more reliable. MDOT will continue to work with railroads to ensure that, where warranted, CTC and ABS systems are upgraded and expanded to handle potential increases in rail freight volumes.

TSMO in the rail industry extends beyond train dispatching technology. Technology to improve safety, such as positive train control (PTC), is fully implemented. Enhancements are being contemplated. TSMO also includes the capability to monitor and manage asset "health" or condition. Trackside detectors are used to provide near real-time data. Norfolk Southern, GATX Corporation, Genesee & Wyoming, Trinity Rail, and Watco have established a venture, Rail Pulse, to facilitate and accelerate the adoption of GPS and other telematics technologies across the freight car fleet. One purpose of the technology is to monitor the health of freight cars, notifying the car owner, the railroad operator, and shippers of safety-related failures. A second purpose is to provide a more visible supply chain, improving the competitive position of freight rail transportation. Rail Pulse will provide real-time reporting of freight car location, load/empty status, and condition. MDOT supports the implementation of this new technology.

Transit

Source: Bree Girard, the Rapid

No mode can move people on a corridor as effectively as transit. However, full transit vehicles are often stuck in traffic behind cars that have only a single occupant. Moving people efficiently, especially in congested urban areas, depends on getting transit out of traffic. Michigan has several options to improve operations: bus rapid transit moving in a dedicated right of way, far-side bus stops at intersections, and pocket lanes at bottlenecks. Where right of way is constrained, road agencies and transit providers can partner to implement transit-signal priority, which enables buses to communicate with nearby traffic signals to extend green time or get a jump at a red light to minimize delay for riders.

Onboard, app-based, and back-end technologies could also provide significant benefits in transit operations. Electronic fares and tap-to-pay farecards reduce passenger boarding time, making the trip faster for

everyone on the bus and allowing each driver to serve more customers in a standard day. MaaS platforms that assist travelers choose from the growing menu of travel options also help riders find the most efficient and cost-effective way to complete their trip. Many of these investments also have complementary benefits to accessibility and connectivity, as discussed in Chapter 13, ***Network Accessibility and Connectivity***.

Making flexible, demand-response paratransit services work better is also a key area for improvement. Many smaller providers rely on outdated systems to schedule and dispatch trips. Some agencies have been unable to upgrade to digital systems and others are locked into software that cannot be integrated with smartphones or the systems of neighboring providers. Bringing all of Michigan's transit providers, small and large, up to a digital, interoperable standard will result in shorter waits and fewer missed rides, which would especially benefit people with disabilities, seniors, and rural residents. MDOT's Office of Passenger Transportation is especially well positioned to facilitate the uptake and adoption of these upgrades.

Active Transportation

While Michigan will need to expand the overall active transportation network to meet current and future demand, accessibility and safety for people walking and biking can also be improved by addressing gaps in the existing network.

Pedestrians face a number of common gaps found throughout the state. Damaged or overgrown sidewalk panels divert people walking into the street or force them to take a longer, more inconvenient route or to use a different mode of transportation entirely. Long distances between marked crossings, especially on roads with multiple lanes in each direction, require pedestrians to either take a long detour or cross at locations where motorists do not expect them, increasing the risk of a serious crash. At traffic signals, adequate crossing time and information (such as accessible pedestrian signals and countdown timers) should be provided so that people can cross safely.

Bicyclists face similar challenges to pedestrians: small gaps can create significant issues. For example, many bike lanes become a shared facility or terminate entirely at intersections. Exposure to merging and turning vehicles increases crash risk and reduces user comfort. In addition, signals are typically timed for expected vehicle operations. Bicyclists struggle to cross larger intersections. Where signals on a corridor are sequentially timed based on

vehicle speeds, bicyclists may get stopped at every light, increasing delay.

As with other users, people biking and walking should be provided safe, convenient facilities through work zones to minimize disruption. Oftentimes, accommodations like temporary walkways and bike lanes can be implemented in place of a detour or closure to preserve access to businesses and mitigate delays.

Identifying and resolving active transportation operational issues requires MDOT and local partners to work together to develop a consistent approach across the full roadway network.

CHAPTER 13

Network Accessibility and Connectivity

Accessibility and connectivity (getting people and freight where they need to go safely and conveniently) is the bedrock of the transportation system and fundamental to unlocking Michigan's economic growth, equitable access to opportunity, and improved health outcomes, as discussed in Chapter 2, ***Socioeconomic and Technology Trends, Forecasts, and Scenarios***. Michigan's access needs include investing in new infrastructure such as rail spurs, expanding transit systems, and filling missing links in the statewide trail network and local sidewalk and bikeways networks. Interconnections between modes are equally as important. Without facilities that transfer freight from rail to truck and sidewalk connections to bus stops that are compliant with the Americans with Disabilities Act (ADA), transportation networks are not useful to everyone. Increasingly, access also means digital connections between people and services as well as vehicles and infrastructure. Investing in access and connectivity over the next 25 years will increase the potential of Michigan's residents and businesses.

Scale of Need

The level of investment necessary to address Michigan's accessibility and connectivity needs is currently unknown. Many of the techniques for quantifying the scale of need for the statewide transportation system have been developed for preserving, optimizing, and generally improving the mature, existing transportation network. Tallying up the sum total of infrastructure that is yet to be built at the statewide level is more challenging. In part, this is the result of historical underfunding. In an environment of constrained funding, transportation agencies focus their energies on what their existing assets and address new infrastructure and programs when budgets allow. On the other hand, there is significant uncertainty in projecting who pays for emerging technologies like electric-vehicle charging stations and connected, 5G-enabled infrastructure and how much. The following chapter outlines high-level needs that MDOT, transit agencies, local governments, the private sector, the public and other stakeholders will need to define and quantify in the years to come.

***Table 9.* Investment Needs - Network Accessibility and Connectivity**

Mode	Investment Type
Roads and Bridges	Electric vehicle charging stations; ITS and connected infrastructure.
Freight	First- and last-mile improvements; ITS and connected infrastructure; access bottleneck improvements at ports, airports, and pipelines.
Freight Rail	New and upgraded sidings for short lines; new transload facilities; improvements to inter-modal facilities.
Passenger Rail	Expand and extend passenger rail service to neighboring states and within Michigan.
Aviation	Year-round/all-weather access, landside access, runway extensions, lighting and visual aids, and airport services.
Transit	First- and last-mile connections; increase coverage and flexibility of on-demand services; expand fixed route service coverage and span; expand intercity/regional transportation.
Active Transportation	First- and last-mile connections; ADA-compliant sidewalks and curb ramps; close gaps in biking and walking networks.

Needs Across Multiple Modes

First- and Last-Mile Connections

First- and last-mile connections are necessary for nearly all modes to function affordably and efficiently. Michigan's passenger rail lines, intercity and local bus routes, and airports get travelers most of the way to their destinations, but their journey isn't complete without a first- and last-mile connection: the walk, bike ride, or shared ride on either end. Likewise, manufacturers that move goods by rail (which can be more cost-effective for long-distance shipments) but don't have direct rail access at their factory must use trucks at the beginning and end of the journey. Investing in first- and last-mile connections looks different depending on the mode:

- **Transit and Active Transportation** – Making it easier for transit riders of all abilities and backgrounds to access transit requires complete sidewalk networks, curb ramps and waiting areas that are ADA-compliant, and enhanced crossings and bike facilities that allow riders safe access to stops and stations.
- **Freight** – Once off the highway, trucks need designated routes to their destinations that are covered by wireless networks and connected signals that send data back to fleet managers.
- **Parcel delivery** – In urban areas, delivery companies rely on local land use policy to provide sufficient siting of distribution centers to enable same-day shipping. Delivery trucks need temporary loading zones at curbs to access homes and businesses.

Across modes, making first- and last-mile connections work requires planning and investment partnerships between multiple entities. Many first- and last-mile trips use local networks that are under the ownership of county road agencies and municipalities. Sufficient funding on local networks for sidewalks, safe crossings, and connected infrastructure is a prerequisite for today's multimodal connections.

Connected Infrastructure and Communications

Many modes take advantage of increasingly ubiquitous wireless communications networks to move people and products. Supply chain managers depend on real-time data to plan freight moves and respond to disruptions. Transit riders use emerging MaaS platforms like smartphone apps to find a bikeshare bike or book a ridehailing service for the last mile of their journey. Data needs are projected to increase with the advent of automated and connected cars, buses, and trucks. Providing access increasingly means installing fiberoptic cable, 5G transmitters, and connected infrastructure.

Providing a Diverse Portfolio of Modes for Freight Movement

Adapting to and taking full advantage of trends toward supply chain diversification and redundancy as discussed in Chapter 2, ***Socioeconomic and Technology Trends, Forecasts, and Scenarios*** will require additional intermodal terminals (where unitized containers or trailers are transferred from truck to rail and back) and transload

facilities (where non-unitized goods move between truck and rail) to give shippers that do not have direct access to a rail siding or spur the opportunity to use cost-effective railroad transportation for long-distance shipments (see ***Figure 44*** for Michigan's existing facilities).

Mode-Specific Needs

Roads and Bridges

Electrification

The future of vehicle propulsion is electric. Both Ford and General Motors are investing billions of dollars in electric vehicles and have committed to switching all their new production vehicles to electric propulsion in the near future. Today, electric vehicles account for only 2 percent of the nation's vehicle fleet, and there are large gaps in electric charging infrastructure, making electric vehicles impractical for many journeys, especially in rural areas. In effect, many parts of the state are off-limits to electric fleets. If the electric fleet is going to expand, then supporting infrastructure will be needed as well. In fact, Michigan's Office of Future Mobility and Electrification (OFME) is working actively to accelerate electric vehicle adoption in the state.

Source: Michigan Economic Development Corp.

MDOT, OFME and other public and industry partners will need to coordinate and determine the power needs, charging connection types and speeds, and size of parking areas for charging. For example, electric trucks have greater power demands than passenger vehicles and are sensitive to charging time because it affects productivity. Rising to meet the trend and realizing the benefits of reduced greenhouse gas emissions that come with electrification will require significant cross-sector investments in electric charging infrastructure across Michigan. Special emphasis on underserved and remote communities will be necessary to ensure that everyone can access and share in the benefits of electrification.

Freight

Truck bottlenecks reduce access to certain key freight facilities in Michigan, creating delay and suppressing growth.

The Port of Detroit is the only port where some of the top truck bottlenecks in the state affect marine access. Bottlenecks impinge on highway (exits to/from I-75 between Springwells Street and Clark Street) and local routes (M-85/W. Fort Street) to port terminals. While the primary cause could be through-truck and commuting traffic, these bottlenecks impede access to the Port of Detroit at peak periods and affect loading and unloading of vessels. Of course, every port depends on road, highway and rail connections to function. The quality of access to marine facilities around the state - as well as preservation of ports' ability to expand - is essential to freight service in Michigan.

Detroit Metro Airport is the only air cargo airport where some of the top truck bottlenecks in the state bring access issues. It is affected by four truck bottlenecks during peak periods on nearby highways (I-94 between Vining Road and M-39 (Southfield Freeway), and I-94 at the I-275 interchange) and the local network (Middle Belt Road, Eureka Road). Other Michigan airports of course are vulnerable to access constraints because they all require road connection; the single interchange access to the cargo areas of Gerald R. Ford International Airport in Grand Rapids is one example. Air is favored for its reliable service. It is projected as the fastest growing freight mode in Michigan and attracting logistics facilities for this reason; for air to fulfill this role, protecting its quality of access is critical.

Top truck bottlenecks in four locations in southeast Michigan affect access to pipeline terminal locations in Detroit, Woodhaven, Farmington Hills, and Romulus. The bottlenecks in Detroit also affect the terminals near the Port of Detroit, Detroit Metro Airport, and the Marathon oil refinery on Fort Street.

Freight Rail

Many of the needs and opportunities identified during the development of MM2045 involve providing rail as an option in more areas of the state to strengthen freight resiliency and help Michigan's economy harness future growth. While there are needs to move freight between modes, there is also a need for more direct rail access to industrial sites, as well as improvements to existing rail facilities in the form of new and upgraded sidings.

Connecting businesses that are not rail-served will require new connections to low-speed, light-density branch lines or more expensive direct connections to high-speed, densely used mainlines like MDOT's Michigan Line between Kalamazoo and Dearborn. MDOT's Freight Economic Development Program can help to fund direct access to shippers, as well as rail-customer infrastructure necessary to directly access the rail system.

Passenger Rail

Michigan's passenger rail system has undergone significant improvements in recent years. Further improvements are being planned or are under consideration:

- Continue to support infrastructure investments that improve service, stations, and safety.
- Continue to support infrastructure investments that reduce conflicts with freight railroad operations.
- Expand the passenger rail system in terms of both frequencies of existing routes and routes to additional markets.

A list of passenger rail projects can be found in Chapter 17, ***Recommended Strategies***.

***Figure 44.* Existing Michigan Intermodal Terminals and Transload Facilities**

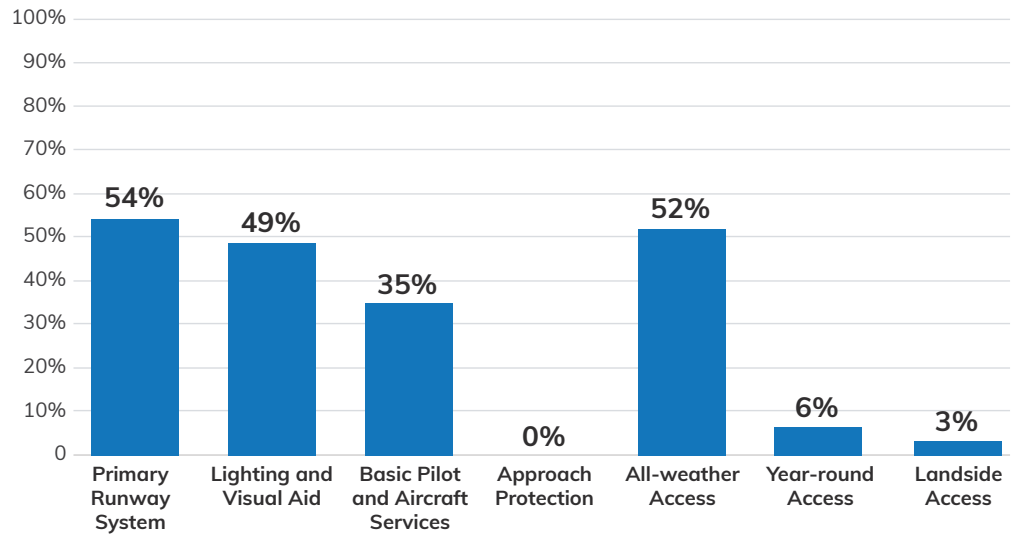
Aviation

The state's aviation system links businesses to customers and rural residents to critical health and emergency services. However, many of the 114 Tier 1 and 2 public airports require additional capital investment to stay open year-round and accommodate anticipated air traffic (to see where Michigan is at in meeting its airport development goals, see ***Figure 45***).

Closing the gap in all-weather and year-round access is particularly important for Michigan's geographically isolated communities who have limited connections to supplies and emergency health care. Investments in instrumentation, navigation systems, runway lighting, and snow clearance equipment are needed to address deficiencies that limit access in poor weather conditions.

To connect local businesses to larger markets and unlock latent economic potential, more than half of the state's Tier 1 and 2 airports need longer primary runways to allow larger aircraft to land and more than one-third need the upgraded fueling, maintenance, and storage facilities to service them.

***Figure 45.* Tier 1 and 2 Airports Not Meeting 2017 MASP Development Goals**



Source: MDOT 2017 Michigan Aviation System Plan

Transit

Many Michiganders who do not own a car depend on transit to get around. Without it, they can become cut off from opportunity and critical services. Connecting riders to transit requires a portfolio of investment in new service, infrastructure, and technology.

Every county in Michigan has some form of transit service (see ***Figure 46***). At the highest level, some rural and urban Michiganders are not currently served by high-quality transit and must choose between the high costs of car ownership or taking a lower paying or less stable job closer to home. In some areas, service may not extend to job centers or may operate only Monday through Friday, leaving workers who work nights and weekends with little to no service. As Michiganders age and zero-car households increase, demand for transit, especially flexible and on-demand services, will rise. Responding to these needs will require stable sources of operating funding that can respond to economic shifts.

An array of transit providers and services operate within many of Michigan's urban regions. Moving across counties and municipal boundaries (where possible at all) may require transferring between providers. To make it easier for riders to move about and to ensure that farebox revenues flow to the right places, integrated fare systems and updated business processes are necessary. Providers of flexible services will need new scheduling and dispatch software to manage larger volumes as well as more complex trips.

Michigan's intercity bus system provides affordable connections within the state and into neighboring states and Canada. Continued funding will ensure access not only within regions but between them as well.

The growing number of shared mobility services necessitate the implementation of a statewide MaaS platform to effectively reap the benefits of new mobility options. If travelers don't know about or aren't certain that they can access a shared scooter or hop onto an awaiting microtransit bus, they may not make the trip. Not only will a statewide platform allow for easier travel across service providers, but it will head off the creation of walled gardens: private platforms that may artificially constrain choices to those provided by a single company or consortium.

Ensuring equitable access to transit and shared mobility services will depend on providers' abilities to serve unbanked users as well as those without smartphones or Internet access. Providers will need to continue to offer cash payment options and ride codes that can be purchased at a retail location or a mobility hub. The public sector will need to establish the ground rules and partnerships to maintain an inclusive system.

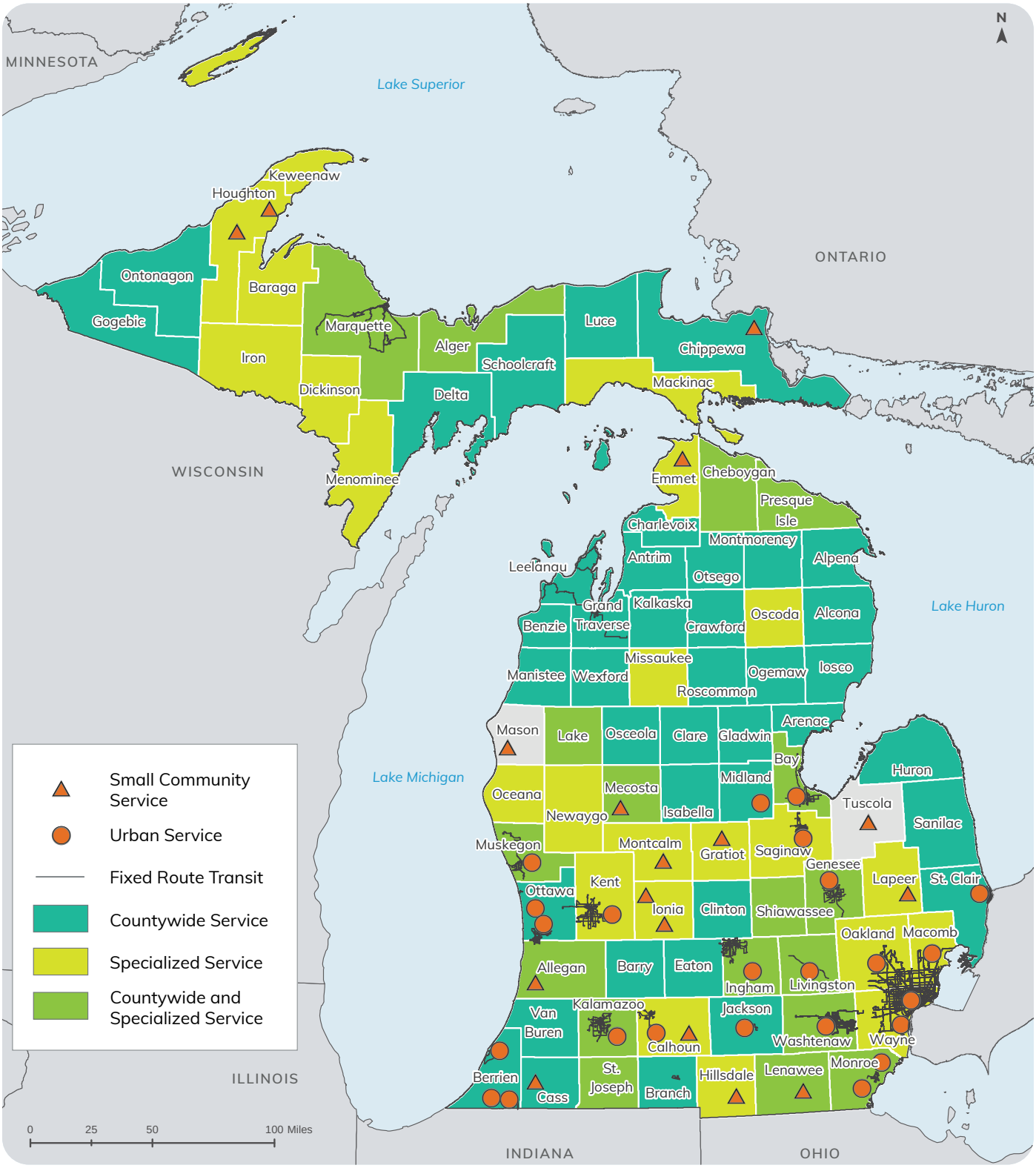
Source: The Ride

Active Transportation

Unlocking healthy behaviors and more transportation options depends on completing low-stress networks that accommodate users of all ages and abilities. Just a few gaps in the sidewalk network or significant distance between crossings can make it nearly impossible for people to travel without a car. Gaps in local bike networks and even statewide routes like the Iron Belle Trail that force riders onto a narrow shoulder of a busy road may dissuade users from taking a trip altogether or dramatically curtail the destinations they can reach. Like first- and last-mile connections, filling gaps in the network is typically implemented at the local level, necessitating collaboration, funding, training, and technical assistance.

Active transportation lags behind many of the other modes in one major respect: no statewide inventory of sidewalks, bike facilities, and trails exists. An upfront effort to collect and standardize data is needed before MDOT and partners can systematically identify gaps and areas of low active transportation access.

Figure 46. **Michigan's Transit Service Coverage, 2021**



CHAPTER 14

Network Resiliency

As Michigan works toward its goal of carbon neutrality by 2050 to mitigate the impacts of climate change, the state's transportation stakeholders must ensure that the statewide system is resilient not only to increasingly severe weather but other potential threats.

According to the National Institute of Standards and Technology, resilience is “the ability to minimize the costs of a disaster, to return to a state as good as or better than the status quo, and to do so in the shortest feasible time.” The need for resilience can come from many sources, including human-caused (e.g., terrorism and cyberattacks) and natural disasters (e.g., extreme heat and cold, precipitation, and flooding).

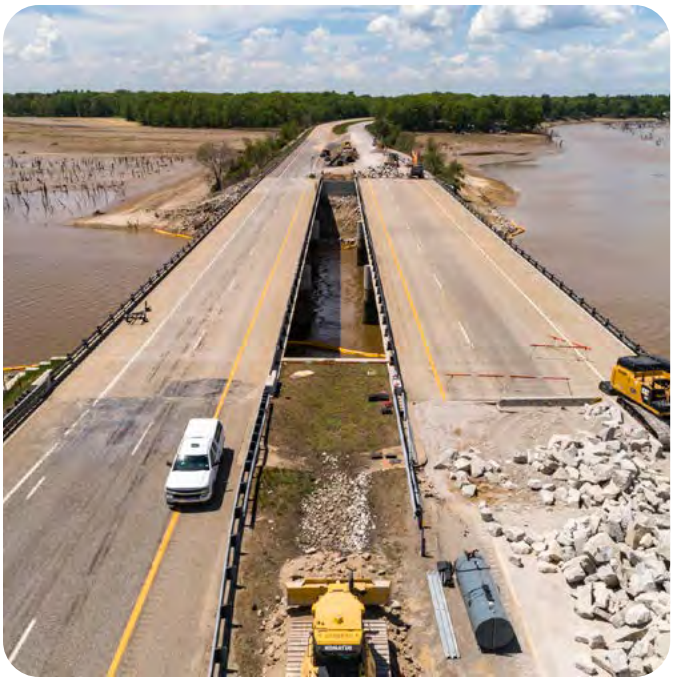
For MDOT, the need for network resilience plays a prominent role in both planning and design. In the 2019 TAMP, MDOT developed a risk management plan to get ahead of potential negative effects that uncertainty or variability would have on MDOT’s objectives.

The TAMP identifies the following principles to improve the statewide transportation network’s resiliency:

- Identify disruptive events and risks.
- Estimate the likelihood that each of those events might actually happen.
- Identify options to minimize the likelihood of negative events occurring or reducing the magnitude of the negative impacts.
- Estimate the costs to implement each of those options; strategies for recovering from unanticipated events.

Recent weather events coupled with decades of underinvestment in the state's infrastructure have brought this issue into focus for many Michiganders. More than 6 inches of rain fell on parts of Detroit in June 2021, quickly overwhelming aging stormwater infrastructure. Flood waters closed parts of all major depressed freeways in the city, including I-94, I-96, and I-75, a close replication of flooding in 2014. In June 2018, catastrophic rain and flooding left two counties in the Upper Peninsula (Houghton and Menominee) in a state of disaster and thousands of residents without crucial roadways. Dozens of roads were washed out, some of them major routes such as US-41, M-203, and M-26. In May 2020, another catastrophic rain event hit the Midland area, which resulted in two dams failing. At its peak, flooding affected more than 20 state and local bridges.

In addition to sudden severe climate events, longer-term flooding issues and coastal erosion have occurred as a result of historic lake levels on the Great Lakes. In 2019 on Mackinac Island, high water and waves washed out 3 miles of M-185, which resulted in a multiyear rebuilding project. And on Old Mission Peninsula in Grand Traverse County, a portion of Peninsula Drive was closed after part of it washed away into the West Arm of the Grand



Traverse Bay. These events illustrate the need for resiliency planning across all transportation agencies due to the impacts on available resources and mobility.

To fully assess the level of vulnerability along Michigan's roads, MDOT proposes conducting a follow-up climate vulnerability study, building on the pilot study MDOT participated in with FHWA in 2013. Since that time, much more detailed elevation data has been collected in Michigan to fill in data gaps for assets such as culverts. This study will also use lessons learned from a recent study the Southeast Michigan Council of Governments completed on how to best ensure that the vulnerability rating is updated as the condition of assets changes.

In addition to the climate vulnerability study, MDOT must build on the risk assessment foundation described in the TAMP. This plan identifies several major risks to MDOT as an agency and to the delivery of MDOT's programs: labor shortages, cyberattacks, revenue shortfalls, changing revenue sources, and spikes in material costs. These risks are not what immediately come to mind when discussing risk but are just as critical if not more threatening to the department and local agencies because they could disrupt the state's ability to deliver the MM2045 Vision and to protect the health, safety, and economy of Michigan residents and businesses. MDOT and local agencies will need to address mitigation strategies for these risks, especially along critical roadways.

Strategic Multimodal Corridor Network

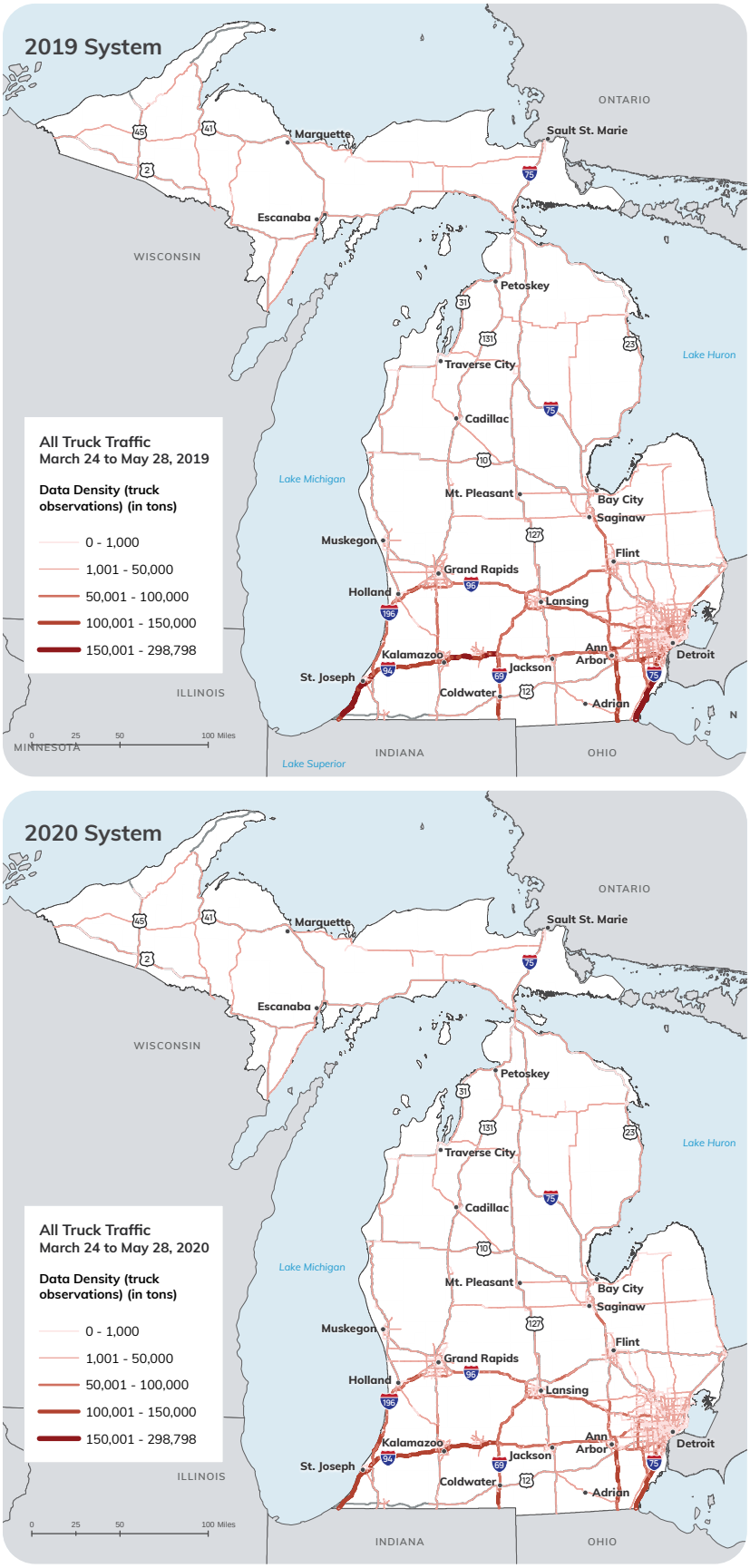
An important part of the work through MM2045 was the designation of an SMC network. SMCs are an integrated, multimodal system that serve the movement of people, services, and goods that are vital to the state, national, and international economies. They link the state's key activity centers based on concentrations of people, jobs, educational and medical services, freight and intermodal facilities, tourist attractions, and other similar destinations. Focusing MDOT's major transportation spending in these strategic corridors allows the state to provide the strongest return on investment, given limited funds.

The SMC framework is generally built on Michigan's freeway network but is defined broadly enough to include parallel major highways that serve as alternate routes, along with Class 1 (the largest) rail lines, passenger rail and intercity bus routes, and U.S. bike routes. MDOT's decision to include rail, intercity transit, and active transportation is based on the recognition that a resilient, equitable transportation system provides multiple ways to connect population and employment centers.

An example of the SMCs' importance to statewide resiliency is the role that these corridors played during the COVID-19 pandemic. To understand how the "Stay Home, Stay Safe" executive orders affected the flow of essential goods throughout the state, MDOT used FHWA's National Performance Management Research Data Set to compare the shipping volume carried via truck during this period versus pre-pandemic 2019 numbers. The results, seen in ***Figure 47***, demonstrate that freight movement during the early phase of the pandemic occurred along the same core roadway network as the SMCs – effectively confirming that the SMCs and the network for essential goods are one and the same. Investments in the corridors thus are protecting the supply of goods to Michigan households, health care facilities, retailers, and other crucial providers.

In the case of natural disasters, it is critical to safeguard the SMCs by keeping them in a state of good repair. By addressing the needs of pavement, bridges, culverts, guard rails, signals, signs, and ITS equipment before they fail, the impact of extreme weather events such as extreme cold, extreme heat, flooding events, and snowstorms can be mitigated. Though it is much harder to plan for the impacts of human-caused disasters such as terrorism, technology failure and cyberattacks can be greatly lessened through redundant and resilient transportation networks.

***Figure 47.* Intensity of Truck Activity, Lockdown 2020 vs. Same Period 2019** (source: USDOT NPMRDS)



Mode-Specific Needs

As mentioned in Chapter 6, ***Mobility and Accessibility***, the need for multiple travel options such as auto, transit, and bicycle is important for providing mobility choices that fit all lifestyles and abilities. However, the understated benefit of multiple transportation options is that they provide system redundancies that people can rely on in the case of human-caused and natural disasters. This "portfolio of options" is a vital part of maintaining a resilient system.

An example of the impact climate events can have on the transportation network occurred in late January 2019 when Michigan experienced a series of heavy snowfall events followed by a dangerous drop in temperature. On Jan. 29, Gov. Whitmer declared a state of emergency, activating more than 100 warming centers around the state. In many locations, people faced transportation challenges that made it difficult or impossible to leave their homes when backups and pileups forced temporary closures along segments of M-40, I-196, I-496, US-127, US-131, and M-37. Some transit agencies, including the Blue Water Area Transit bus system in St. Clair County, were also forced to close.

Roads and Bridges

MDOT's freeway pump stations will require capital investment to protect the transportation system from flooding events. Overall, stand-alone capital improvements of pump stations outside of other roadway projects over the next 25 years is anticipated to cost $109 million. These costs, along with forecast routine maintenance expenditures, are reflected in MDOT's non-winter maintenance needs.

Most pump stations in the Metro Region are more than 50 years old. Funds have been dedicated to improve equipment to mitigate future flooding events. Between 2016 and 2020, MDOT spent $25 million on Metro Region pump station improvements. Additionally, between 2021 and 2025, $27 million has been programmed for further

work. Additional needs include permanent pump station generators to prevent outages, estimated to cost $50 million. Finally, $400 million is expected to be spent on drainage projects in the Metro Region between 2015 and 2026, which will complement work on pump stations.

Freight

Michigan's supply chain managers closely monitor the progress of shipments over a two to three-day horizon and pay careful attention to weather and other disruptions. They depend on Michigan's routine efforts to keep the network flowing and the information relayed to freight carriers. In the case of prolonged disruptions that close portions of the network, alternative routes and modes are crucial. The air cargo system serves as a fail-safe but it cannot replace trainloads and boatloads of freight, nor steady streams of trucks. In addition to the role of the SMC network in safeguarding such traffic, proactive communication with industry about the state of the system is important. Technology improves the ability to do this in real time but the information systems themselves need redundancy to be effective and power supplies to remain operational. Public-private training exercises can be one way to enhance readiness and anticipate difficulties.

Rail

Freight and passenger railroads face disruptions to their operations, both use- and weather-related, similar to other modes. Track and roadway design as well as maintenance are held to rigorous standards set by both the FRA and American Railway Engineering and Maintenance-of-Way Association. Targeted train maximum train speeds, climate, and soil conditions are all design considerations. Track conditions are continually monitored to ensure safe and continuous operations. Monitoring is complemented by frequent inspections using state-of-the-art technologies coupled with predictive failure models. Railroad companies also employ program maintenance practices.

Transit

Human-caused and natural disasters regularly threaten operations and capital assets of transit systems throughout Michigan. For example, extreme weather events such as freezing conditions and heavy snowfalls place excessive stress on transit systems when they are often needed the most. For agencies statewide, resilience means not just being ready for emergencies but also being able to maintain safe operations while they are occurring. A resilient transit network can take many shapes, including having a plan in place to provide free bus trips for passengers reaching safe havens during natural disasters to having a dry parking lot to store buses during flooding events.

During the COVID-19 pandemic, Michigan's passenger rail and transit networks faced an uphill battle in continuing operations. Early on, the decision was made that if Michigan had any hope of flattening the curve, it was absolutely essential to keep providing transportation for essential workers. Although few could have anticipated such a future, agencies quickly moved into motion, shifting flexible funding sources for capital investments (e.g., sprayers and ventilation system upgrades) and, more importantly, operations funding to keep transit going at a level of service that was somewhat robust.

Aviation

Michigan's unique geography (two peninsulas and several islands bounded by four of the five Great Lakes) presents challenges for long-distance travel as well as access, particularly for geographically isolated communities, highlighting the importance of dependable, basic air service coverage. Due to seasonal ice coverage, aviation is the only connection to the mainland for several of Michigan's island communities with year-round residents. Flight disruptions caused by poor weather conditions affect not only the flow of people and goods but also emergency access at airports without appropriate facilities (such as lighting and visual aids) and procedures. Thus, meeting air access goals in all-weather conditions is a priority in the state, as reflected in Michigan's 1996 Island Transportation Policy. According to the 2017 MASP, nearly half of Michigan's Tier 1 and 2 airports do not have all-weather access, and 6 percent do not allow year-round access. Investing in capital improvements like lighting and visual aid systems are critically important to connect these communities to the mainland for economic development as well as public safety reasons, such as ability to access emergency medical care.

How We Get There

CHAPTER 15

Recommended Strategies

Achieving the MM2045 Vision requires coordination between MDOT and its public and private partners over the next 25 years. The MM2045 recommended strategies are Michigan's road map for achieving the MM2045 Vision. Getting there will require public, private, and nonprofit partners to pull together in the same direction.

MM2045 is a statewide policy plan for all modes of transportation

In Michigan, some modes of transportation enjoy a longer history of systematic, long-range statewide planning than others. The information and planning processes necessary to address statewide needs for highway and bridge condition, safety, aviation, and, more recently, maintenance and transportation systems management and operations were in place prior to the development of MM2045. MM2045 represents the first time a Michigan SLRTP has developed statewide strategies for active transportation and transit. As a truly statewide plan, MM2045 encompasses not only all modes but all parts of the transportation system, not just those under MDOT ownership or authority. Bringing all modes and all parts of the network up to parity within the state long-range planning process is an important endeavor that will take more time to bear fruit. MM2045 is a starting point for creating long-term partnerships.

MM2045 adapts long-running policies and federal planning requirements such as safety and preservation to meet the future needs of the state, while also reaching into emerging policy areas. For example, some MM2045 strategies will help Michigan build more resilient infrastructure and organizations.

Adopted MM2045 Strategies

During the development of MM2045, MDOT conducted in-person and virtual meetings with statewide stakeholders to develop the Vision, Guiding Principles, Goals, and Objectives, which together form the MM2045 strategic direction. Input from stakeholders along with peer state best practices were refined, expanded, and validated through meetings with internal MDOT staff and partner experts. The adopted MM2045 Strategies are the result of this process.

The MM2045 Strategies are grouped under eight themes: Prioritizing Safety, Managing Resources Responsibly, Providing Accessibility and Mobility for All, Supporting Michigan's Health, Building Resilience, Working Together, Technology, and Economic Vitality. The themes and strategies correspond to multiple Goals and Objectives and are cut through by all four MM2045 Guiding Principles.

1. Prioritizing Safety

1.1. Promote safe behaviors.

- Through public awareness campaigns, education, and enforcement techniques with proven safety benefits, encourage users, workers, and operators to stay focused on safe use and operation of Michigan's transportation network.

1.2. Prioritize infrastructure and facilities improvements with proven safety benefits.

- Improve research, collection, management, and integration of safety data.
- Leverage new sources of safety data to identify locations that may benefit from safety improvements.
- Integrate intelligent tools to analyze and quantify safety impacts and implement cost-effective, data-informed targeted and systemic safety countermeasures and mitigation strategies.
- Continue to include safety improvements in preservation projects where appropriate.
- Support local safety countermeasures.

1.3. Support and implement state-of-the-art safety technology solutions.

- Continue support for research, development, and integration of life-saving infrastructure and vehicle technology.
- Support the adoption of ADAS and other safety technology in new and existing passenger and freight vehicles.

1.4. Collaborate with transportation partners and emergency medical and trauma services.

- Facilitate multimodal stakeholder and private sector outreach and collaboration to improve transportation safety and performance.
- Continue to improve and promote data sharing and collaboration between transportation partners, human services providers, police, and first responders.

2. Managing Resources Responsibly

2.1. Advance transportation asset management to optimize transportation investments.

- Prioritize preservation and maintenance of Michigan's transportation network.
- Research new materials and products and implement those with proven benefit to extend the life of assets.
- Enhance asset management planning and innovative maintenance strategies, accounting for long-term operational and financial considerations.
- Improve collaboration and coordination throughout the planning and development process to increase efficiency, maximize useful life of assets, and minimize public disruption to the extent practical.
- Provide education and share best practices to enable communities to develop and implement asset management plans and practices.
- Develop methods to share real-time data between asset management systems to improve the accuracy and timeliness of data-informed decisions.

2.2. Streamline and improve data, data management systems, and processes.

- Invest in data, data collection, analytics, and information systems to advance data-informed decisions.
- Extend opportunities to share data and information for improved efficiency, accountability, and transparency across all of Michigan's transportation partners.
- Identify and assess data needs, keep necessary data up-to-date, and incorporate new sources of data.
- Where possible and appropriate, share data with partners and promote open data.

2.3. Right-size Michigan's transportation network and systems.

- Develop a right-sizing policy to manage/reduce life-cycle costs and achieve the best and highest use of assets and revenues.
- Integrate right-sizing objectives and opportunities into existing business practices.
- Develop policy guidance to ensure agency, stakeholders, partners, and the public have a shared understanding of engagement and outcome expectations.

3. Providing Accessibility and Mobility for All

3.1. Improve the reliability of the transportation network and systems.

- Leverage technology and optimize operations to improve travel time reliability and reduce congestion while maintaining safety and accessibility for all users and population demographics.
- Expand the use of signal control and time optimization, including signal priority, incident management programs such as the Michigan Traffic Incident Management Effort (Mi-TIME), safety technology, traveler information systems, work zone technology, and road weather management.

- Use traffic signal detection data to improve performance through active management.

3.2. Enhance the mobility of Michigan's residents and non-residents.

- Leverage technology to improve passenger transportation availability and services.
- Assess mobility needs to develop an appropriate mix of transportation options. Especially consider the mobility needs of low-income persons, persons of all abilities, and others who may have limited transportation options.
- Foster expanded equitable access to transportation options for small, rural and disadvantaged communities.
- Encourage and support integration of land use and transportation policies.
- Support enhanced transportation connections between Michigan communities as a part of an overall economic development strategy to increase employment, household incomes, and property values because of increased accessibility, equity, and mobility choices.
- Continue to improve connections and integration between the passenger transportation and active transportation networks, including first- and last-mile connections.

3.3. Pursue a statewide Mobility as a Service (MaaS) platform.

- Further integrate public and private transportation services into a mobility application that will allow the user to obtain current information about available transportation options in their area, and potentially access more advanced features, such as trip planning, online booking, and mobile payment.

3.4. Support the increased use of the passenger transportation system.

- Support public information campaigns.
- Identify grant opportunities and continue to support grant applications.
- Utilize new and existing sources of data and information to continue to ensure funding is appropriately and equitably distributed.
- Continue to provide technical support and funding to public transportation agencies, and facilitate collaboration among regional and local planning organizations.

3.5. Define, measure, and improve equitable access.

- In collaboration with stakeholder groups, gather input on accessibility and equity issues and identify access- and equity-related objectives. This could include identifying populations of interest, choosing relevant destinations or services (points of interest such as jobs, healthcare, food, businesses, tourist centers, etc.), and selecting an appropriate accessibility measure.
- Identify and collect data needed to calculate accessibility measures.
- Incorporate accessibility and equity into project selection criteria and consider equity when making transportation and investment decisions.

3.6. Develop projects that equitably meet community mobility needs.

- Continue to promote CSS stakeholder engagement process to incorporate community needs and desires early in the project planning and development process.

- Utilize complete streets principles where feasible to design projects that meet the needs of all users.
- Expand internal M2D2 to ensure that MDOT's guidelines and processes encourage complete streets and multimodal transportation.
- Encourage integration of health into local community development and revitalization strategies.

4. Supporting Michigan's Health

4.1. Participate in and contribute to initiatives to improve air quality and reduce emissions.

- Collaborate and coordinate with other public agencies, utilities, the private sector, and neighboring states/provinces to support strategic expansion of electric and low-emissions vehicle infrastructure.
- Continue to support efforts to expand the use of electric public transportation vehicles, including through public-private partnerships and collaboration with other Michigan agencies.
- Encourage and enable the adoption of high-efficiency/low-emission vehicles.
- Reduce the proportion of single occupancy passenger vehicle trips by enabling alternative modes of travel that are convenient, comfortable, affordable.

4.2. Support and implement approaches that preserve Michigan's natural resources.

- Promote pollinator habitats within available and appropriate transportation right of way.
- Implement updated Stormwater Management Program Improvements to improve water quality and lessen the impact of transportation projects and infrastructure.

4.3. Foster collaboration between local transportation providers and public health interests.

- Continue support for innovative transit services that provide equitable access to medical and health-related destinations, including expanding transit's role in non-emergency medical transportation.

4.4. Encourage healthy lifestyles.

- Encourage equitable expansion of a connected active transportation network to promote more active lifestyles across diverse communities.
- Establish methods and approaches for assessing network needs, identifying gaps, and targeting improvements to encourage more walking and bicycling.
- Provide support for planning and design decisions to promote the attractiveness, safety, and ease of mobility and access for persons of all abilities.
- Regularly review and update policies and guidance to recognize the needs of pedestrians and bicyclists and ensure accommodations are considered at all stages of project development.

5. Building Resilience

5.1. Identify and address risks to Michigan's transportation network.

- Conduct a statewide vulnerability assessment.
- Incorporate vulnerability data and information into asset management plans and practices.
- Integrate risk-related data into the Michigan Geographic Framework.
- Develop methods to incorporate risk and resiliency considerations into planning, programming, and project development, especially on multimodal corridors and key supply chain routes.
- Strategically improve infrastructure with targeted betterments to advance the resilience and security of the transportation network.

5.2. Promote and research an implementation plan for transportation infrastructure protection, security, and emergency management.

- Provide timely and accurate information to decision-makers, responders, and community members so they can take informed action to reduce risk and increase resilience.
- Identify and prioritize cyber-dependent critical infrastructure and systems.
- Ensure Michigan transportation data and cybersecurity-dependent infrastructure is protected through best practice credentialing and cybersecurity measures, including tracking new security standards, and collaborating with stakeholders.

5.3. Improve organizational resiliency.

- Strategically recruit, develop, and promote a highly skilled diverse workforce with the capabilities, competencies, and professional leadership needed to advance the future of transportation in Michigan.
- Improve program performance by streamlining business processes, improving systems, and maximizing employee performance, development, and engagement.
- Pursue flexible and sustainable transportation funding sources by leveraging both public and private opportunities.

6. Working Together

6.1. Expand public sector partnerships and collaboration.

- Utilize corridor planning approaches, including improving regional access to passenger transportation.
- Encourage land use consideration in project selection and development.
- Support transit partnerships with the business community to provide transit services that meet workforce needs.
- Support coordination among transit agencies to improve regional connectivity.
- Increase public and agency understanding of Michigan's industries' freight needs and freight industry understanding of Michigan's investment and policies that support it.

- Strengthen partnerships with State of Michigan agencies to help achieve statewide and MDOT goals and priorities.
- Promote collaborative planning and training to ensure a unified emergency and disaster-level response and recovery to anticipated and unexpected events.
- Support and improve collaboration with peer states, regional initiatives, international and federal transportation partners, and regulatory agencies.
- Continue to participate and lead in national organizations to set standards, contribute to research, share knowledge, and adopt best practices.
- Continue to communicate and strategize with partners to remain at the cutting edge of CAV development and deployment.

6.2. Improve and expand relationships with private and nonprofit partners.

- Strengthen cross-sector collaboration in developing innovative transportation solutions, including leveraging private funding to achieve transportation objectives.
- Align public and private sector interests and incentivize the private sector to optimally perform through efficient risk-transfer.
- Continue to support existing rail programs and matching funds for federal grants.
- Support potential future freight partnerships or funding opportunities.

6.3. Ensure decision-makers and stakeholder groups reflect Michigan's character and integrity.

- Expand key stakeholder groups to address diversity challenges and opportunities.
- Establish an MDOT executive office to ensure unambiguous equity and inclusion across all business practices, policies, and procedures.

7. Technology

7.1. Prepare for and enable widespread CAV adoption.

- Continue to advance CAV design and deployment standards, consider potential CAV needs in other projects, and plan for scalability.
- Update data standards with a focus on transparency and accessibility to ensure that new data streams can be used to improve decisions by MDOT and its transportation partners.
- Support ongoing and future efforts to deploy automated transit vehicles to improve safety, reliability, operating efficiency, and customer experience.
- Implement and expand a real-time Transportation Infrastructure Data Exchange (TIDE) system to function as a centralized platform to support continuous exchange of transportation data among MDOT and other stakeholders.
- Identify opportunities to expand fiberoptic, broadband, and 5G connections through coordination or partnerships.

7.2. Regularly evaluate new transportation technology and adopt those that best support Michigan's goals.

- Advance the integration of new transportation technologies and practices into transportation systems to improve safety and performance.
- Prioritize interoperability and standardization when adopting new technology to ensure that all modes and levels of planning can interact efficiently.
- Expand adoption of transit technology and continue to improve dispatching systems and other technology to increase mobility, reliability, and accessibility of transit services.

7.3. Promote standards-based approaches to network technology and deployment.

- Develop and implement specifications and standards that enable appropriate technology to be used on the transportation network and encourage competition among vendors.
- Ensure that diverse and representative stakeholders are included in the decision-making process.

8. Economic Vitality

8.1. Promote freight service, infrastructure improvements, and intermodal connectivity.

- Develop partnerships to improve freight infrastructure and multimodal connections to increase efficiency of freight service and lower transportation costs for Michigan businesses.
- Identify performance improvement opportunities that will strengthen Michigan's competitiveness.
- Improve the reliability of freight transportation on access routes to major freight generators and to gateways, airports, marine ports, and rail facilities by improving critical infrastructure and optimizing operations.
- Facilitate a portfolio of multimodal freight services to support businesses and their supply chains.
- Support upgrading rail corridors to enhance freight and passenger movements.
- Reduce the number and severity of freight bottlenecks on strategic multimodal corridors.
- Incorporate freight reliability and economic benefits as factors in project prioritization.
- Improve freight access in rural areas.

8.2. Continue to partner in transit-oriented development projects.

- Participate in transit-oriented development projects to improve access to economic opportunities and supporting the local community.

8.3. Continue to be a leader in innovative transportation technology and education partnerships.

- Create an environment that encourages entrepreneurship, academic leadership, and equitable growth to improve economic opportunities.

CHAPTER 16

Implementation

Collaborative development of the MM2045 Vision, Guiding Principles, Goals, Objectives, and Strategies reflects a deep stakeholder commitment to Michigan's vibrant multimodal transportation system. The next phase of the project is to transition broader plan strategies into specific actions and investments. Some actions will require collective stakeholder effort, while other actions will need to be developed and implemented by individual stakeholders.

MDOT Implementation Plan

In executing the plan for Michigan's transportation vision of the future, stakeholders will have varying roles. MDOT will continue to lead collaborative strategic efforts where appropriate, serve as a supporting partner when needed, and develop and commit to MDOT-specific actions and investments. Developing an MDOT implementation plan is the first step to internal execution of the strategic framework provided by MM2045.

The implementation plan will advance MM2045 policies through near-, mid-, and long-term strategies focusing first on those most critical to meeting MM2045 goals and objectives. Many of the strategies must be implemented in succession: implementing near-term actions are necessary to move toward the longer-term strategies. MDOTs implementation actions will be organized by the broader MM2045 strategies detailed in Chapter 15.

The types of implementation actions in MM2045 can be described by:

- Resource Allocation
- Program Structure
- Project Prioritization and Decision-making
- Performance Management
- Organizational Structure
- Funding Strategies
- Partnerships
- Processes

The MDOT implementation plan will continue to evolve as metrics are achieved. MDOT will also work with stakeholders to continuously evaluate, adapt, and adopt smart strategies that better achieve the MM2045 Vision, Goals, and Objectives.

***Figure 48.* Categories of Implementation Actions**

Example Process:

MDOT has identified a new process to develop a complete, up-to-date statewide dataset for bicycle and pedestrian facilities in order to implement the MM2045 strategy to 'invest in data, data collection, analytics, and information systems to advance data-informed decisions".

MM2045 serves as a 25-year plan that will be maintained and updated on a five-year time frame. Michigan will continue to integrate the strategies and principles developed in MM2045 into program and project decision-making processes, including parallel statewide and regional efforts, as we invest in Michigan's future.

CHAPTER 17

Freight and Rail Service Investment Plans

MM2045 includes freight and rail investment plans in line with federal state planning requirements. Investments in freight and rail infrastructure and service will diversify Michigan's portfolio of modes, making the state and nation's transportation system more adaptable, resilient, efficient, and equitable.

FHWA and FRA require that states identify recommended freight and rail projects, respectively, and estimated costs for each. Requirements differ between the state freight and rail service investment plans. FHWA requires that state freight plans include projects for the next five years along with a budget showing that the funding is reasonably expected to be available. For the purpose of integration of freight planning within MM2045, MDOT has also chosen to identify project needs for implementation beyond the five-year time frame but has not yet identified funding. How the projects, combined with the adopted MM2045 strategies, advance the national freight goals is discussed in more detail at the end of this chapter. Similarly, FRA requires that state rail service investment plans include at least 20 years of recommended investments but does not require states to demonstrate that funding will be available. In other words, the rail investment plan is financially unconstrained. The proposed freight and rail projects provide aspirational, longer-term perspective that can be achieved through creative coordination.

How MM2045 Advances National Freight Goals

MM2045 will improve Michigan's ability to meet the national multimodal freight policy goals and the national highway freight program goals passed by Congress through the FAST Act.

Enhancing economic efficiency, productivity, and competitiveness is supported by a number of MM2045 goals and objectives around economy and stewardship. Economic vitality strategies, in particular, such as strategy 8.1 "Promote freight service, infrastructure improvements and intermodal connectivity," will help implement this goal. Specific implementing actions include identification of performance improvement opportunities that will strengthen Michigan's competitiveness and facilitating a portfolio of multimodal freight services to support businesses and their supply chains.

National freight goals and policies around **reduction of congestion and bottlenecks and improvement of reliability** are also supported by several goals and objectives but particularly strategies under 8.1, such as "reducing the number and severity of freight bottlenecks on strategic multimodal corridors" and "incorporating freight reliability and economic benefits as factors in project prioritization." Strategy 3.1 calls for "improving the reliability of the transportation networks and systems."

Federal goals and policies to **improve safety, security and resiliency** are supported by MM2045 goals and objectives around safety, security, and network condition. Both safety and resiliency are prioritized throughout the plan. Freight will benefit in particular by strategies in 1.2 "Prioritize infrastructure and facilities improvements with proven

safety benefits." Strategies include those under building resilience, particularly actions under strategy 5.1 "Identify and address risks to Michigan's transportation network," such as conducting a statewide vulnerability assessment, incorporating vulnerability data and information into asset management practices, and developing methods to incorporate risk and resiliency considerations in planning, programming, and project development, especially on multimodal corridors and key supply chain routes.

Federal freight policy and program goals of **achieving and maintaining a state of good repair** are supported by MM2045 safety and security, economy and stewardships, and partnership goals and objectives. MDOT has long prioritized projects related to maintenance and preservation. Strategies related to managing resources responsibly will ensure that MDOT continues to implement these goals and objectives, especially strategy 2.1 "Advance Transportation Asset Management to optimize transportation investments." Specific sub-strategies or actions include prioritizing preservation and maintenance of Michigan's transportation network, researching and implementing products with proven benefits to extend the life of assets, and enhancing asset management planning and innovative maintenance strategies. Strategy 2.3 "Right-size Michigan's transportation network and systems," which specifically advocates for developing a right-sizing policy to manage/reduce life-cycle costs and achieve best and highest use of assets and revenues, will further support a state of good repair.

Michigan has a significant focus on advanced technology and strongly supports federal freight policy and program goals around **using advanced technology to improve the safety, efficiency, productivity, and reliability of the network**. MM2045 strategies related to safety include 1.3 "Support and implement state-of-the-art safety technology solutions." In particular, it supports the adoption of ADAS and other safety technology in new and existing passenger and freight vehicles. Mobility and accessibility strategies call for leveraging technology and optimizing operations to improve travel time reliability and reduce congestion while maintaining safety and accessibility for all users and population demographics. There are also several actions focused on use of signal control and priority and incident management programs that help achieve federal freight goals around use of advanced technology. The strategic theme of technology includes a number of strategies related to freight, including 7.1 "Preparing for and enabling widespread CAV adoption." Finally, strategy 7.2 "Regularly evaluating new transportation technology," recommends advancing the integration of new transportation technologies and practices into transportation systems to improve safety and performance and prioritizing interoperability and standardization when adopting new technology to ensure that all modes and levels of planning can interact efficiently.

Federal freight goals around **reduction of environmental and community impacts** align well with MM2045 goals and objectives. The strategic theme of supporting Michigan's health includes strategy 4.1 "Participate in and contribute to initiatives to improve air quality and reduce emissions." The strategy calls for collaboration and coordination with other public agencies, utilities, the private sector, and neighboring states/provinces to support strategic expansion of electric and low-emissions vehicle infrastructure and encouraging the adoption of high efficiency/low emission vehicles. Further, strategy 4.2 "Support and implement approaches that preserve Michigan's natural resources," calls for implementation updated Stormwater Management Program Improvements to improve water quality and lessen the impact of transportation projects and infrastructure.

Finally, MM2045 supports federal freight goals around **improving the movement of goods across and between rural areas and populations centers, gateways and borders**. The strategic theme of working together includes a number of strategies as part of 6.1 "Expanding public sector partnerships and collaboration that apply to freight." In particular, it calls for increased public and agency understanding of Michigan's industries' freight needs. In addition, it elevates the freight industry's understanding of Michigan's investments and the policies that support it while improving collaboration with peer states, regional initiatives, international partners and federal transportation partners and regulatory agencies. Strategy 6.2 "Improve and expand relationships with private and nonprofit partners," features initiatives around

funding that would also help achieve federal freight access and connectivity goals to and between these key locations.

Freight Investment Plan

For the years 2022-2026, Michigan is anticipated to be eligible for $39.9 million annually in federal NHFP funds, for a total of $199.6 million over the five-year period. This amount is based on Michigan's FY 2021 NHFP apportionment under the current national surface transportation bill.

A review of highway freight performance issues (including bottlenecks and truck crash locations) was completed during the development of MM2045. Top performance issues based on truck user delay costs per day and the number of truck crashes were identified statewide, and their locations compared to projects in Michigan's 5YTP. Projects that addressed these top performance issues were determined to merit NHFP funds and a subset of such projects was selected for each of the five years through 2026, subject to annual fiscal constraints.

Table 11 lists the selected projects by year. In each year, the table identifies the location and description of individual projects, their total project cost and the total contribution to cost from federal and state funding sources. The amount of NFHP funding to be dedicated to each project in each year is shown in the column on the far right, along with an annual subtotal of NHFP funds applied. Route locations of projects that are not currently part of the NHFN nevertheless represent one of the top concentrations of freight user costs in the state and will be designated a critical urban freight corridor or critical rural freight corridor to become eligible for NHFP funds. These projects are indicated in the table and represent a total of 29 urban miles and 1 rural mile.

There are two projects that are designated to receive NHFP funding over two years, indicated with an asterisk. For the year 2026, the annual amount is not fully allocated. Only $26.7 million is invested for that year, leaving $13.2 million in funding available for allocation to eligible freight projects in the future. ***Table 11*** represents the fiscally constrained five-year investment plan for freight.

Non-highway modes are eligible to receive up to 10 percent of total NHFP funding in any given year. Freight performance issues for non-highway (rail and maritime) modes were also studied as part of the development of this plan. A number of non-highway freight needs have been identified. Due to the enormous highway needs confronting the state, MDOT has chosen not to allocate funds to non-highway projects at this time. However, it is investigating the viability of establishing a grant program with this funding in the future.

The Freight Investment Plan addresses projects where NHFP funds will be employed but it does not reflect the full range of Michigan's investments responding to freight needs, nor the full scope of Michigan's need for freight investment. Considering just the top highway performance issues based on delay costs and crashes, Michigan has more than $3 billion in responsive projects planned and funded from non-NHFP sources, with most of the investment in urban areas. Additional needs that remain unfunded have an estimated total of at least $340 million - $380 million for the top issues in urban and rural areas. Beyond this, investments in maintenance and development for requirements such as roadway striping and ITS technology that are discussed elsewhere in this plan incorporate the needs of the freight system. Road access to ports, airports and rail facilities also are reflected in these financial projections but investments in marine and rail systems are not. The critical upgrade of the Soo Locks is already underway. The marine system has further needs that have not been quantified but a standing pool of funds in the tens of millions has been effective in other states. MDOT is considering how to support one.

Rail Service Investment Plan

The Rail Service Investment Plan (RSIP) consists of 120 projects with a total cost of $2.1 billion.

Of the 120 projects, 101 are freight railroad projects. Fourteen of these projects also benefit Amtrak operations. The total cost of the 101 freight railroad projects is $1.3 billion. The upgrade of the CP Tunnel connecting Detroit and Windsor ($446.2 million) is the costliest project, followed by the upgrade to the Trenton interlocker to improve Canadian National and Conrail operations ($89.2 million). The state's short-line railroads account for 80 of the 101 freight railroad projects, with a combined cost of $306 million. The largest short-line project is the upgrading of 73 miles of track on the Lake State Railway at a cost of $33 million.

There are 19 projects identified as passenger rail-only. Costs have been developed for nine of those projects, which total $880.8 million. The costliest is the establishment of a Detroit-Cleveland passenger rail service.

Table 10 describes the principal benefits of the projects in the RSIP. The greatest number of projects were dedicated to improved network condition followed by improved mobility. Mobility had the highest cost, attributed, in part, to the CP Tunnel improvement. The complete list of RSIP projects is shown in ***Table 12***.

***Table 10.* Principal Benefits of the Projects in the RSIP**

Benefit	Number of Projects	Cost (Millions)
Network Condition	37	$85
Mobility	28	$1,558
Economy and Stewardship	16	$224
Brings Infrastructure to a State of Good Repair	11	$87
Improves Efficiency	7	$26
Increases Capacity	6	$19
Quality of Life	6	$81
Safety and Security	3	$3
Economy and Stewardship, Mobility	2	$18
Partnership	1	$15
Safety and Security, Network Condition	1	$0
Mobility, Quality of Life	1	$8
Mobility, Safety, Quality of Life	1	$19
Total	**120**	**$2,143**

Table 11. **Projects Using NHFP Funds for FY 2022-2026**

Year	Job Number	Region	County	Route	Location	Work Description	Estimated Total Funding	Total Federal	Total Non-Federal	NHFP Fund in Year
2022	206118	Metro	Wayne	I-94	I-96 to Conner Avenue	I-94 Modernization - real estate	$8,000,000	$6,548,000	$1,452,000	$6,548,000
2022	206121	Metro	Wayne	I-94	I-96 to Conner Avenue	I-94 Modernization - engineering	$7,000,000	$5,729,500	$1,270,500	$5,729,500
2022	210987	Metro	Wayne	I-94	Lemay Street bridge	I-94 Modernization - engineering	$100,000	$81,850	$18,150	$81,850
2022	205227	Grand	Ottawa	US-31[1]	Hayes Road to M-104	ITS installation	$1,698,243	$1,390,011	$308,232	$1,390,011
2022	123138	Metro	Wayne	M-153[1]	Shelden Road to Lotz Road	Rebuilding	$37,625,000	$33,740,000	$3,885,000	$1,911,643
2022	200202	University	Washtenaw	US-12[1]	US-23/US-12 interchange	Intersection, operations improvements	$29,650,000	$24,268,525	$5,381,475	$24,268,525
Subtotal FY 2022										**$39,929,529**
2023	202543*	Metro	Wayne	I-94	Burns Avenue to Barrett Avenue	I-94 Modernization - rebuilding	$300,000,000	$245,550,000	$54,450,000	$26,652,684
2023	210984	Metro	Wayne	I-94	Conner Avenue bridge	I-94 Modernization - bridge	$14,260,000	$11,671,810	$2,588,190	$11,671,810
2023	201942	Grand	Kent	US-131[1]	44th Street to Post Drive	Queue management system	$1,783,372	$1,605,035	$178,337	$1,605,035
Subtotal FY 2023										**$39,929,529**
2024	202543*	Metro	Wayne	I-94	Burns Avenue to Barrett Avenue	I-94 Modernization - rebuilding	$300,000,000	$245,550,000	$54,450,000	$26,127,760
2024	204309*	Metro	Wayne	M-39 (Southfield Freeway)[1]	McNichols Road to Plymouth Road	Rebuilding	$57,200,000	$46,818,200	$10,381,800	$13,801,769
Subtotal FY 2024										**$39,929,529**
2025	204309*	Metro	Wayne	M-39 (Southfield Freeway)[1]	McNichols Road to Plymouth Road	Rebuilding	$57,200,000	$46,818,200	$10,381,800	$33,016,431
2025	209147	University	Washtenaw	M-14[1]	US-23 to Wayne County Line	ITS installation	$2,522,050	$2,064,298	$457,752	$2,064,298
2025	210799	North	Otsego	M-32[2]	Dickerson Road to I-75	Rebuilding, turn lane	$2,001,152	$1,637,943	$363,209	$1,637,943
2025	210775	North	Grand Traverse	US-31[2]	10th Street to Front Street	Widening, turn lanes	$1,942,779	$1,590,165	$352,614	$1,590,165
2025	210765	Bay	Lapeer	M-53 (Van Dyke Avenue)[2]	M-53 at St. Clair Street	Signal control system	$447,700	$447,700	$0	$447,700
2025	209377	Grand	Ionia	I-96	Bliss Road to Peake Road	ITS installation	$1,433,099	$1,172,992	$260,107	$1,172,992
Subtotal FY 2025										**$39,929,529**
2026	211694	Grand	Kent	US-131[1]	I-96 to Post Drive	Active traffic management system	$32,621,914	$26,701,037	$5,920,877	$26,701,037
Subtotal FY 2026										**$26,701,037**

* = project funded by NHFP over more than one year
[1] = route to be designated as Critical Urban Freight Corridor
[2] = route to be designated as Critical Rural Freight Corridor

***Table 12.* RSIP Projects**

Railroad Type	Category	County	Sponsor	Railroad	Project	Description	Costs in $2020	Benefit	Source	Project Type
Class I Interlocker	Infrastructure	Wayne	MDOT	CN, CR	CN Coolidge and CP YD interlocker (CN, CR)	The proposed turnout at CN Coolidge between the two mainlines will give trains operating on the CN the ability to access either mainline track at CN Coolidge. The mainline track between CN Coolidge and CN Victoria will be eliminated; the proposed improvement at CP YD will allow CN trains a choice of two tracks between CP YD to the Delray interlocking. This will also provide an additional area for holding trains less than 5,280 feet off the Conrail and CN mainlines.	$4,100,000	Economy and stewardship	MDOT DIFT Alternative Report	Interlocker
Class I Interlocker	Infrastructure	Wayne	MDOT	CN, CR	Vinewood interlocker (CN, CR)	Modifications are proposed at the Vinewood interlocking to allow trains operating through the corridor to use any one of the four mainlines (two CN mainlines and two Conrail mainlines). The old connection at Vinewood between the CN and Conrail has been removed. The proposed connection will allow Amtrak trains to cross from the CN mainlines to the Conrail mainlines.	$2,300,000	Economy and stewardship	MDOT DIFT Alternative Report	Interlocker
Class I Interlocker	Infrastructure	Wayne	MDOT	NS, CN	Oakwood Junction interlocker (NS, CN)	The proposed improvement at Oakwood Junction will allow NS Triple Crown trains to access the new facility at Livernois-Junction Yard via the Schaefer and New Rotunda interlockings. A new connection is proposed in the northwest quadrant between the NS and CN mainlines. To increase flexibility, a universal crossover has also been included in the proposal north of the junction to allow NS trains the ability to utilize either of the CN mainlines.	$5,300,000	Economy and stewardship	MDOT DIFT Alternative Report	Interlocker
Class I Interlocker	Infrastructure	Wayne	MDOT	CN, CR	Schaefer interlocker (CN, CR)	The proposed improvements at the Schaefer interlocking are required to accommodate the NS Triple Crown facility at the Livernois-Junction Yard as defined in the Preferred Alternative. A new connection will be provided to allow NS Triple Crown trains the ability to get from the CN mainlines to the Conrail mainlines.	$5,300,000	Economy and stewardship	MDOT DIFT Alternative Report	Interlocker
Class I Interlocker	Infrastructure	Wayne	MDOT	CR, NS	New Rotunda interlocker (CR)	The proposed improvements at New Rotunda will allow complete flexibility with the Conrail Detroit mainline. Some trackwork will be required to tie the existing Conrail storage tracks together.	$6,200,000	Economy and stewardship	MDOT DIFT Alternative Report	Interlocker
Class I Interlocker	Infrastructure	Wayne	MDOT	CN, CR, Amtrak	Beaubien interlocker (CN, CR, Amtrak)	The diamond crossing between the CN and Conrail will be eliminated. CN's two northbound tracks would remain, while the two Conrail tracks would be reduced to one through Beaubien.	$4,300,000	Economy and stewardship	MDOT DIFT Alternative Report	Interlocker
Class I Interlocker	Infrastructure	Wayne	MDOT	CN, CR	Mill interlocker (CN, CR)	The proposed improvement will provide a connection between the CN mainline and the Conrail mainline at this location. This allows CN trains a choice of tracks to use between CP Mill and CP YD. This connection also creates more track for holding full-length trains without blocking mainlines in the area or adding additional track.	$2,900,000	Economy and stewardship	MDOT DIFT Alternative Report	Interlocker

Railroad Type	Category	County	Sponsor	Railroad	Project	Description	Costs in $2020	Benefit	Source	Project Type
Class I Interlocker	Infrastructure	Wayne	MDOT	CN, CR	Trenton interlocker (CN, CR)	The proposed improvements will eliminate all the diamond crossings and provide a connection between the CN mainlines either side of the Conrail mainline. The improvements to the interlocking will result in a universal crossover between all the mainlines, allowing trains to operate on any mainline between Trenton and the CP YD interlocking.	$89,200,000	Economy and stewardship	MDOT DIFT Alternative Report	Interlocker
Class I Interlocker	Infrastructure	Wayne	MDOT	CN, CR	Milwaukee Junction interlocker	With the proposed improvements at Beaubien, CN mainline trains will use the westernmost two tracks, allowing Pontiac trains (including Amtrak) to diverge without crossing over Conrail. CN trains to Port Huron and Conrail trains to North Yard can pass through crossovers south or north of the CN Riverfront Wye and utilize either one of the Conrail mainlines.	$17,500,000	Economy and stewardship; mobility	MDOT DIFT Alternative Report	Interlocker
Class I Intermodal	Facility	Wayne	MDOT	CP	Canadian Pacific terminal	CP terminal relocated to Livernois Junction yard.	$64,100,000	Mobility	MDOT DIFT Project List	Intermodal
Class I Intermodal	Facility	Wayne	MDOT	CSX	CSX terminal	CSX terminal would be located south of the existing Conrail mainlines.	$57,200,000	Mobility	MDOT DIFT Project List	Intermodal
Class I Intermodal	Infrastructure	Wayne	MDOT	Detroit railroads	Civil work outside terminal		$82,400,000	Mobility	MDOT DIFT Project List	Intermodal
Class I Intermodal	Infrastructure	Wayne	MDOT	Detroit railroads	Civil work inside terminal		$38,900,000	Mobility	MDOT DIFT Project List	Intermodal
Class I Intermodal	Infrastructure	Wayne	MDOT	CP	CP tunnel	Increase the clearance of the CP tunnel between Windsor, Ontario, and Detroit to allow unrestricted double stack trains to pass.	$446,200,000	Mobility	2015 Michigan State Rail Plan	Intermodal
Class I Intermodal	Infrastructure	Wayne	NS	NS	Pave NS Livernois-Junction yard	Plan includes paving 135,985 SY of trailer parking area with 3-inch asphalt pavement and 36,985 SY of container stacking area with 9-inch asphalt, with new drainage connecting to the existing drainage network and a new retention pond.	$13,845,000	Quality of life	Michigan SLRTP - NS comments	Intermodal
Class I Intermodal	Infrastructure		MDOT	Detroit railroads	Design civil work outside terminal		$8,000,000	Mobility, Quality of Life	MDOT DIFT Project List	Intermodal
Class I Intermodal	Infrastructure	Wayne	NS	NS	NS domestic service	Adding lift equipment, rehabbing and installing more pad and support tracks.	$50,000,000	Economy and stewardship		
Class I Track	Infrastructure	Wayne	Detroit Region Aerotropolis Corporation	CSX	Grade Separation CSX/ Pennsylvania Road	Grade separate Pennsylvania Road and CSX rail line in Romulus.	$19,000,000	Mobility, Safety, Quality of Life	Detroit Region Aerotropolis Corporation	Crossing
Class I Track	Infrastructure	Lenawee	NS	NS	New rail track	New, dual rail track between Adrian and Morenci.	$20,000,000	Mobility	Michigan SLRTP - NS comments	New track
Class I Track	Infrastructure	Wayne	MDOT	CN, CR	Track from Oakwood to Schaefer (CN)		$16,500,000	Mobility	MDOT DIFT Project List	New track
Class I Track	Infrastructure	Wayne	NS	CR, NS	DRIC connection (CR, NS)	Connection track from the Conrail Toledo main curving under the I-75 bridges and onto the Detroit River lead track using proposed easement from MDOT between existing ITC transmission line and southbound I-75 ramp.	$3,000,000	Safety and security	Michigan SLRTP - NS comments	New track

Railroad Type	Category	County	Sponsor	Railroad	Project	Description	Costs in $2020	Benefit	Source	Project Type
Passenger Rail Service Expansion	Passenger Service		MARP, Other	Uncertain	Ann Arbor - Detroit commuter rail	Implement the long-sought commuter rail service in southeast Michigan, including service in the Detroit area, service to Detroit Metro Airport, and service on the Ann Arbor-Howell-Brighton route.	$329,000,000	Mobility	MARP input for MM 2045	Commuter rail
Passenger Rail Service Expansion	Passenger Service		MARP, Other	Uncertain	Holland/Grand Rapids commuter rail		TBD	Mobility		Commuter rail
Passenger Rail Service Expansion	Facility	Washtenaw	City of Ann Arbor	Amtrak	Ann Arbor Multimodal Station	MDOT continues to work with the City of Ann Abor, FRA, and Amtrak to build a new station that is functional for both current and future multimodal demand.	TBD	Mobility	MARP; Local Effort	New passenger station
Passenger Rail Service Expansion	Facility	Wayne	Amtrak	Amtrak	Michigan Central Station	Now owned by Ford Motor Co. under full restoration into transportation innovation headquarters; Ford and MDOT interested in exploring use of building as train station again.	TBD	Mobility	Amtrak Updated Michigan Vision Deck February 2021	New passenger station
Passenger Rail Service Expansion	Infrastructure		Amtrak	Amtrak	Reroute Lake Shore Limited to Michigan Line / improve Michigan connection to Toledo	Several 40-50 mile paths from Toledo available, either to Ann Arbor or Dearborn; strong eastbound OTP from Chicago through Michigan because of 100 percent passenger railroad dispatching control; creates Michigan-Chicago frequency opportunities at new times of day; lays groundwork for Michigan-Ohio-Buffalo service with improved infrastructure.	$98,400,000 - $300,000,000	Mobility	Amtrak Updated Michigan Vision Deck February 2021	Passenger service improvement
Passenger Rail Service Expansion	Passenger Service	Wayne	Amtrak	Amtrak, VIA	Potential new service to Toronto	Potential to quickly and inexpensively establish bus connection between routes. Longer-term potential for through-rail service requires: CBSA/CBP border facility to be built/funded; agreements with CP, Conrail, and Essex Terminal Railroad; and joint operating agreement with VIA rail.	TBD	Mobility	Amtrak Updated Michigan Vision Deck February 2021	Passenger service improvement
Passenger Rail Service Expansion	Passenger Service		Amtrak	Amtrak	Cleveland - Detroit service		$300,000,000	Mobility	Amtrak Updated Michigan Vision Deck February 2021	Passenger service improvement
Passenger Rail Service Expansion	Passenger Service		MARP, Other	Amtrak	Additional frequencies - all routes		TBD	Mobility	Various	Passenger service improvement
Passenger Rail Service Expansion	Passenger Service		MARP, Other	Uncertain	Ann Arbor - Traverse City	Launch “excursion” or special event trains to test the market; create a nonprofit management structure that would be responsible for developing the operating plans and schedules, fundraising, and promotion; advance a detailed and extensive feasibility study to more accurately predict how the various train speed and associate ticket costs would affect rider numbers. The plan recommends establish regular 60 mph service in the next five to 10 years and gradually upgrade the service to 110 mph, hourly service over the next 20 years.	$40,000,000 - $10,051,000,000	Mobility	MARP input for MM 2045; A2TC report summary	Passenger service improvement
Passenger Rail Service Expansion	Passenger Service		MARP, Other	Amtrak	Chicago – Grand Rapids via Kalamazoo	Add service between Chicago and Grand Rapids on a route that operates on the corridor via Kalamazoo.	TBD	Mobility	MARP input for MM 2045	Passenger service improvement
Passenger Rail Service Expansion	Passenger Service		MARP, Other	Amtrak	Daily service to Bay City - Blue Water Route	Add service to the Blue Water route. Terminate at least one new train on this route in Bay City instead of Port Huron.	TBD	Mobility	MARP input for MM 2045	Passenger service improvement

Railroad Type	Category	County	Sponsor	Railroad	Project	Description	Costs in $2020	Benefit	Source	Project Type
Passenger Rail Service Expansion	Passenger Service		MARP, Other	Amtrak	Detroit - Ann Arbor - Lansing - Grand Rapids/Holland/ Muskegon	Complete the required environmental and engineering studies and implement new service connecting Detroit, Ann Arbor, Lansing, and Grand Rapids/Holland/Muskegon. Extend this route to Toledo to provide vitally important connections to the rest of the Amtrak system.	TBD	Mobility	MARP input for MM 2045	Passenger service improvement
Passenger Rail Service Expansion	Passenger Service		MARP, Other	Amtrak, VIA	Through-trains between Canada and US	Initiate through-trains between southeast Michigan and Windsor and between Port Huron and Sarnia to allow convenient and efficient travel between Canada and the U.S.	TBD	Mobility	MARP input for MM 2045	Passenger service improvement
Passenger Rail Service Expansion	Passenger Service		MDOT	Amtrak	Chicago – Detroit	Increase service between Detroit-Chicago from three round trips a day to six to ten round trips per day.	TBD	Mobility	MDOT	Passenger service improvement
Passenger Rail Improvements - Existing Routes	Infrastructure	Jackson	Amtrak	Amtrak	Jackson station reconfiguration	Wider platform, track reconfiguration, and pedestrian overpass.	$33,300,000	Mobility	Amtrak Updated Michigan Vision Deck February 2021	Passenger stations
Passenger Rail Improvements - Existing Routes	Infrastructure		City of Detroit		Detroit New Center Station		$50,000,000	Quality of life	MDOT	Passenger stations
Passenger Rail Improvements - Existing Routes	Infrastructure	Calhoun	MDOT, Amtrak	Amtrak	Battle Creek connector bypassing CN	3/4-mile project will start at Gord interlocking with CN and include new track serving Battle Creek station, which then merges with CN for 3/4 mile until Baron interlocking; MDOT/ Amtrak discussing possibilities to expand project to include consideration of eastern half of bypass that would avoid CN entirely; could move forward with western project PE/NEPA since it's funded, and then use MDOT/Amtrak funds to add scope for PE/NEPA of eastern half.	$40,500,000	Mobility	Amtrak Updated Michigan Vision Deck February 2021	Track upgrade
Passenger Rail Improvements - Existing Routes	Infrastructure	Berrien	Amtrak	Amtrak, CSX	CSX/Michigan Line connector east of New Buffalo	Position Pere Marquette to use south shore for access to Chicago; add Pere Marquette service to New Buffalo.	$27,500,000	Mobility	Amtrak Updated Michigan Vision Deck February 2021	Track upgrade
Passenger Rail Improvements - Existing Routes	Infrastructure	Berrien, Cass	Amtrak	Amtrak	Niles-Glenwood Road double tracking	16 miles of new track, saving estimated five minutes.	$100,500,000	Mobility	Amtrak Updated Michigan Vision Deck February 2021	Track upgrade
Short-Line Equipment	Equipment		ELS	ELS	Rail cars	75 new or re-engineered pulpwood cars.	$8,750,000	Economy and stewardship	Michigan SRP Short-Line Railroad Survey	Equipment
Short-Line Equipment	Equipment		ELS	ELS	Rail cars	100 new 60-foot all purpose box cars 286,000 GWR.	$16,000,000	Economy and stewardship	Michigan SRP Short-Line Railroad Survey	Equipment
Short-Line Equipment	Equipment		GLC	GLC	Production tamper	Replace old machine for surfacing.	$600,000	Network condition	Michigan SRP Short-Line Railroad Survey	Equipment
Short-Line Equipment	Equipment		GLC	GLC	Ballast regulator snow fighter	Clear snow in the winter and regulate in the summer.	$500,000	Network condition	Michigan SRP Short-Line Railroad Survey	Equipment
Short-Line Equipment	Equipment		GLC	GLC	Track equipment	ES trucks, backhoe.	$260,000	Network condition	Michigan SRP Short-Line Railroad Survey	Equipment
Short-Line Equipment	Equipment	Hillsdale	IN	IN	Relocate good quality signal cabinets from Hillsdale	Flasher signal cabinets in Reading and Hillsdale in poor condition.	$40,000	Network condition	Michigan SRP Short-Line Railroad Survey	Signal

Railroad Type	Category	County	Sponsor	Railroad	Project	Description	Costs in $2020	Benefit	Source	Project Type
Short-Line Equipment	Equipment	Bay	HESR	HESR	Track upgrade	Bay City repair track.	$86,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track rehab
Short-Line Facility	Facility	Bay	HESR	HESR	Bay City car shop upgrade	Add walls, end doors, heating, and insulation.	$200,000	Network condition	Michigan SRP Short-Line Railroad Survey	Building
Short-Line Facility	Facility	Shiawassee	HESR	HESR	Durand car shop upgrade	Add walls, end doors, heating, and insulation.	$200,000	Network condition	Michigan SRP Short-Line Railroad Survey	Building
Short-Line Facility	Facility	Shiawassee / Wexford	GLC	GLC	Shop insulation Owosso and Cadillac	Insulate walls in both locations.	$150,000	Network condition	Michigan SRP Short-Line Railroad Survey	Building
Short-Line Facility	Facility	Shiawassee	GLC	GLC	Heating loco and car shop Owosso	Change heaters in the building.	$50,000	Network condition	Michigan SRP Short-Line Railroad Survey	Building
Short-Line Facility	Facility		GLC	GLC	Drop table upgrade	Upgrade drop table to handle locomotive work.	$50,000	Network condition	Michigan SRP Short-Line Railroad Survey	Building
Short-Line Facility	Facility	Wexford	GLC	GLC	Engine house Cadillac	Renovate office space, storage space and crew quarters.	$25,000	Network condition	Michigan SRP Short-Line Railroad Survey	Building
Short-Line Facility	Facility	Bay	HESR	HESR	Bay City office/breakroom	Upgrade facilities.	$600,000	Quality of life	Michigan SRP Short-Line Railroad Survey	Building
Short-Line Facility	Facility	Hillsdale	IN	IN	Move the HQ and associated facilities to a different industrial location away from the downtown area in Hillsdale	Operating HQ and associated facilities in Hillsdale are outdated, inefficient and in varying states of disrepair and have been surrounded by residential and commercial businesses over the past few decades.	$975,000	Quality of life	Michigan SRP Short-Line Railroad Survey	Building
Short-Line Facility	Facility		ELS	ELS	E&LS car shop	20 welding machines, four Bobcat portable welders, skid steer, 12 overhead job cranes, two shop trucks, dual axle trailer for hauling parts from paint shop, two office spaces, 50-foot by 150-foot covered storage, two heavy duty fork trucks for unloading heavy materials.	$619,000	Quality of life	Michigan SRP Short-Line Railroad Survey	Equipment
Short-Line Facility	Facility	Hillsdale	IN	IN	Remove underutilized tracks in Hillsdale and relocate to Jonesville	No workable pass track in Jonesville to effectively switch customer traffic.	$510,000	Economy and stewardship	Michigan SRP Short-Line Railroad Survey	Siding
Short-Line Facility	Facility	Branch	IN	IN	Construct team track facility in Coldwater	Lack of location to effectively offer transload services to new customers.	$298,000	Economy and stewardship, mobility	Michigan SRP Short-Line Railroad Survey	Transload
Short-Line Facility	Facility	Alcona County, Greenbush	LSRC	LSRC	Transload at Greenbush for Forest Products		$500,000	Increases capacity	Michigan SRP Short-Line Railroad Survey	Transload
Short-Line Facility	Facility	Otesgo County, Gaylord	LSRC	LSRC	Transload improvements at Gaylord		$1,500,000	Increases capacity	Michigan SRP Short-Line Railroad Survey	Transload
Short-Line Facility	Facility	Oakland County, Wixom	LSRC	LSRC	Transload improvements at Wixom		$1,000,000	Increases capacity	Michigan SRP Short-Line Railroad Survey	Transload
Short-Line Facility	Facility	Alpena County, Alpena	LSRC	LSRC	Transload improvements at Alpena		$750,000	Increases capacity	Michigan SRP Short-Line Railroad Survey	Transload

Railroad Type	Category	County	Sponsor	Railroad	Project	Description	Costs in $2020	Benefit	Source	Project Type
Short-Line Facility	Facility	Saginaw County, Saginaw	LSRC	LSRC	Saginaw Multimodal and Intermodal Terminal - facility to accommodate various rail-to-truck and truck-to-rail transload opportunities and to accommodate intermodal container operations		$5,000,000	Increases capacity	Michigan SRP Short-Line Railroad Survey	Transload
Short-Line Facility	Facility	Dickinson	ELS	ELS	Bulk transload	New project at Channing.	$750,000	Mobility	Michigan SRP Short-Line Railroad Survey	Transload
Short-Line Facility	Facility	Dickinson	ELS	ELS	Transload improvement	Transload improvement and expansion for inbound and outbound commodities at Kingsford.	$1,300,000	Mobility	Michigan SRP Short-Line Railroad Survey	Transload
Short-Line Facility	Facility		ELS	ELS	Escanaba intermodal freight terminal	Feasibility study to determine a new rail to tug barge freight land for moving rail cars to a lower Michigan port such as Muskegon to bypass Chicago.	$300,000	Mobility	Michigan SRP Short-Line Railroad Survey	Transload
Short-Line Infrastructure	Infrastructure	Bay County, Pine River	LSRC	LSRC	Huron sub bridge 23.7 - replace 60-foot through - girder span		$750,000	Brings infrastructure to a state of good repair	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Bay County, Pine River	LSRC	LSRC	Huron sub bridge 27.9 – replace 106-foot through-girder span		$1,300,000	Brings infrastructure to a state of good repair	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Arenac County, Omer	LSRC	LSRC	Huron sub bridge 32.04 – replace 110-foot pony truss span		$1,400,000	Brings infrastructure to a state of good repair	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Iosco County, Turner	LSRC	LSRC	Huron sub bridge 42.98 – replace 130-foot through - girder spans		$1,500,000	Brings infrastructure to a state of good repair	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Iosco County, Oscoda	LSRC	LSRC	Huron sub bridge 74.73 – replace 96-foot through girder span		$1,200,000	Brings infrastructure to a state of good repair	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Alpena County, Alpena	LSRC	LSRC	Huron sub bridge 124.3 replace 51-foot deck girder span		$600,000	Brings infrastructure to a state of good repair	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Saginaw County, Shields	LSRC	LSRC	Tittabawasee Bridge rehabilitation - repair bridge to counter potential scour		$1,250,000	Brings infrastructure to a state of good repair	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure		LSRC	LSRC	Cass River bridge - replace the existing structure across Cass River		$2,500,000	Brings infrastructure to a state of good repair	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Bay County, Essexville/ Bay City	LSRC	LSRC	Bay City swing bridge - horizontal and vertical clearances limit load configurations		$10,000,000	Increases capacity	Michigan SRP Short-Line Railroad Survey	Bridge

Railroad Type	Category	County	Sponsor	Railroad	Project	Description	Costs in $2020	Benefit	Source	Project Type
Short-Line Infrastructure	Infrastructure	Bay	HESR	HESR	Bridge	Bay City swing span rehabilitation steel and mechanics.	$1,250,000	Network condition	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure		HESR	HESR	Bridge	Bridge removal and fill.	$200,000	Network condition	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Manistee	MQT	MQT	Bridge	Manistee and Stronach pin truss rebuild.	$4,000,000	Network condition	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Ottawa	MS	MS	Bridge	Ferrysburg swing span rehabilitation of steel and mechanics.	$1,250,000	Network condition	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure		MS	MS	Bridge	Waterway remediation.	$3,000,000	Network condition	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Hillsdale	IN	IN	Replace old bridge with new bridge over the highway	End bents on the Hallett Street railroad bridge are sinking.	$2,235,000	Network condition	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure		IN	IN	Develop detailed work plans and have qualified bridge contractor upgrade bridges to eliminate several deferred maintenance problems	Long-term rail bridge maintenance issues like tuck-point work on masonry blocks, stringer replacement, deck and shim replacement, and similar problems.	$420,000	Network condition	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Branch	IN	IN	Replace bridge with new structure	Scour issue undermined abutment on rail bridge over Coldwater River.	$770,000	Network condition	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure	Menominee	ELS	ELS	Menominee River bridge	Replace deck on bridge.	$264,500	Network condition	Michigan SRP Short-Line Railroad Survey	Bridge
Short-Line Infrastructure	Infrastructure		ELS	ELS	CR-426 crossing rebuild	Rebuild two crossings.	$150,000	Safety and security	Michigan SRP Short-Line Railroad Survey	Crossing
Short-Line Infrastructure	Infrastructure	Ontonagon	ELS	ELS	Rousseau Road crossing rebuild	Rebuild two crossings.	$150,000	Safety and security	Michigan SRP Short-Line Railroad Survey	Crossing
Short-Line Infrastructure	Infrastructure		IN	IN	Rebuild with MDOT three-rail surfaces	Grade crossing surface rebuilds of deteriorating surfaces on several heavy-use highways.	$175,000	Safety and security, network condition	Michigan SRP Short-Line Railroad Survey	Crossing
Short-Line Infrastructure	Infrastructure	Shiawassee	GLC	GLC	1-mile siding Owosso	Build siding for meets and set outs.	$3,500,000	Economy and stewardship	Michigan SRP Short-Line Railroad Survey	Siding
Short-Line Infrastructure	Infrastructure	Washtenaw	GLC	GLC	1-mile siding Ann Arbor district	Build siding for meets and set outs.	$3,500,000	Economy and stewardship	Michigan SRP Short-Line Railroad Survey	Siding
Short-Line Infrastructure	Infrastructure	Wexford	GLC	GLC	2-mile sidings Cadillac district	Build siding for meets and set outs.	$7,000,000	Economy and stewardship	Michigan SRP Short-Line Railroad Survey	Siding
Short-Line Infrastructure	Infrastructure	Oakland County, Holly	LSRC	LSRC	Holly Diamond - replace with powered turnouts		$3,000,000	Improves efficiency	Michigan SRP Short-Line Railroad Survey	Siding
Short-Line Infrastructure	Infrastructure	Saginaw County, Saginaw	LSRC	LSRC	Gavilon Grain, LLC - Carrolton Direct Connection - construct direct connection to Gavilon Grain's Carrolton facility and rehabilitate remaining lead track		$850,000	Improves efficiency	Michigan SRP Short-Line Railroad Survey	Siding

Railroad Type	Category	County	Sponsor	Railroad	Project	Description	Costs in $2020	Benefit	Source	Project Type
Short-Line Infrastructure	Infrastructure	Saginaw, Genesee, Oakland	LSRC	LSRC	Upgrade CTC and Poleline removal - renew CTC controls and wayside equipment		$18,000,000	Brings infrastructure to a state of good repair	Michigan SRP Short-Line Railroad Survey	Signal
Short-Line Infrastructure	Infrastructure	Saginaw	LSRC	LSRC	Dean subdivision joint elimination		$3,000,000	Improves efficiency	Michigan SRP Short-Line Railroad Survey	Track upgrade
Short-Line Infrastructure	Infrastructure	Branch	IN	IN	Tie and surface project, bridge upgrade and miscellaneous grade crossing work	Poor track conditions on the Quincy to Coldwater RUA line, with a portion of the line only 263K-capable.	$1,790,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track rehab
Short-Line Infrastructure	Infrastructure	Hillsdale / Branch	IN	IN	Mainline rehab from Jonesville to Quincy	T&S project with selected grade crossing rebuilds 9.4 miles.	$850,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track rehab
Short-Line Infrastructure	Infrastructure		IN	IN	Mainline rehab from Indiana state line to Reading	T&S project, ditch cleaning and selected grade crossing rebuilds.	$840,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track rehab
Short-Line Infrastructure	Infrastructure	Shiawassee	GLC	GLC	Owosso Yard	6,000 ties to change in 5 miles, five turnouts to upgrade track and rail.	$2,000,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track rehab
Short-Line Infrastructure	Infrastructure	Washtenaw	GLC	GLC	Ann Arbor district	Rail, tie and crossing program.	$10,000,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track rehab
Short-Line Infrastructure	Infrastructure	Wexford	GLC	GLC	Cadillac district	Tie and crossing program.	$5,000,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track rehab
Short-Line Infrastructure	Infrastructure	Grand Traverse	GLC	GLC	Williamsburg district	6,000 ties to change.	$75,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track rehab
Short-Line Infrastructure	Infrastructure	Dickinson	ELS	ELS	Iron Mountain track rehab	Rail, ties, four switches, ballast and tamping.	$851,400	Network condition	Michigan SRP Short-Line Railroad Survey	Track rehab
Short-Line Infrastructure	Infrastructure		ELS	ELS	O&B Line tie rehab	Ties, ballast and tamping.	$7,418,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track rehab
Short-Line Infrastructure	Infrastructure	Dickinson	ELS	ELS	Channing to Iron Mountain tie rehab	Ties, ballast and tamping.	$2,415,200	Network condition	Michigan SRP Short-Line Railroad Survey	Track rehab
Short-Line Infrastructure	Infrastructure	Saginaw, Bay	LSRC	LSRC	Saginaw-Bay City route consolidation - consolidate the LSRC Bay City subdivision onto the HESR parallel route		$7,100,000	Improves efficiency	Michigan SRP Short-Line Railroad Survey	Track relocation
Short-Line Infrastructure	Infrastructure	Kalamazoo	GDLK	GDLK	Downtown rail consolidation	Rail consolidation in downtown Kalamazoo.	$15,000,000	Partnership	Michigan SRP Short-Line Railroad Survey	Track relocation
Short-Line Infrastructure	Infrastructure	Manistee	MQT	MQT	Track	Manistee area rail relocation.	$15,000,000	Quality of life	Michigan SRP Short-Line Railroad Survey	Track relocation
Short-Line Infrastructure	Infrastructure		LSRC	LSRC	LSRC Huron subdivision relay - replace 85- and 90-pound rails with 115-pound continuous welded rail		$25,000,000	Brings infrastructure to a state of good repair	Michigan SRP Short-Line Railroad Survey	Track upgrade

Railroad Type	Category	County	Sponsor	Railroad	Project	Description	Costs in $2020	Benefit	Source	Project Type
Short-Line Infrastructure	Infrastructure		LSRC	LSRC	LSRC Mackinaw Subdivision Relay - replace 73 miles of joined 105-pound rail with 115-pound continuous welded rail		$33,000,000	Brings infrastructure to a state of good repair	Michigan SRP Short-Line Railroad Survey	Track upgrade
Short-Line Infrastructure	Infrastructure	Bay	LSRC	LSRC	Rail replacement of jointed rail on joint LSRC/HESR Line between Bay City and Kawkawlin		$3,300,000	Improves efficiency	Michigan SRP Short-Line Railroad Survey	Track upgrade
Short-Line Infrastructure	Infrastructure	Huron	HESR	HESR	Track	Bad Axe subdivision class 3 upgrade.	$20,000,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track upgrade
Short-Line Infrastructure	Infrastructure	Kent / Allegan / Kalamazoo	GDLK	GDLK	Mainline rehabilitation	Improve train speeds to 40 mph Kalamazoo to Grand Rapids.	$8,000,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track upgrade
Short-Line Infrastructure	Infrastructure	Houghton	MR	MR	Rehabilitation of main line	Relay substandard old rail with newer heavier rail, install ties, surface track, 10 miles.	$5,000,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track upgrade
Short-Line Infrastructure	Infrastructure	Wexford	GLC	GLC	Cadillac Yard	Upgrade ties, rail and turnouts.	$2,000,000	Network condition	Michigan SRP Short-Line Railroad Survey	Track upgrade
Short-Line Infrastructure	Infrastructure	St. Joseph	GDLK	GDLK	Yard capacity expansion	New rail yard built south of Three Rivers.	$15,000,000	Economy and stewardship	Michigan SRP Short-Line Railroad Survey	Yard
Short-Line Infrastructure	Infrastructure	Genesee, Flint	LSRC	LSRC	Flint classification yard reconstruction		$7,000,000	Improves efficiency	Michigan SRP Short-Line Railroad Survey	Yard
Short-Line Infrastructure	Infrastructure	Bay	LSRC	LSRC	North Bay City yard reconstruction		$2,000,000	Improves efficiency	Michigan SRP Short-Line Railroad Survey	Yard
Short-Line Infrastructure	Infrastructure		HESR	HESR	Track	Yard rehabilitation at three locations with ties, timbers and turnouts.	$1,750,000	Network condition	Michigan SRP Short-Line Railroad Survey	Yard
Short-Line Infrastructure	Infrastructure	Menominee	ELS	ELS	Menominee yard	Rail, ties, 10 switches, ballast and tamping.	$1,213,116	Network condition	Michigan SRP Short-Line Railroad Survey	Yard
Short-Line Infrastructure	Infrastructure	Dickinson	ELS	ELS	Channing yard rehab	Ties, ballast and tamping.	$388,350	Network condition	Michigan SRP Short-Line Railroad Survey	Yard

Michigan Department of Transportation

Michigan Mobility 2045

A transportation plan for a connected future #MM45

Adopted by the State Transportation Commission Nov. 4, 2021