Keeping Michigan Mobile

PROVIDING A MODERN, SUSTAINABLE TRANSPORTATION SYSTEM IN THE GREAT LAKE STATE

TRIP
A National Transportation Research Nonprofit

TRIPNET.ORG

Founded in 1971, TRIP ® of Washington, DC, is a nonprofit organization that researches, evaluates and distributes economic and technical data on surface transportation issues. TRIP is sponsored by insurance companies, equipment manufacturers, distributors and suppliers; businesses involved in highway and transit engineering and construction; labor unions; and organizations concerned with efficient and safe surface transportation.

MICHIGAN KEY TRANSPORTATION FACTS

THE HIDDEN COSTS OF DEFICIENT ROADS

Driving on Michigan roads that are deteriorated, congested and that lack some desirable safety features costs Michigan drivers a total of $17 billion each year. TRIP has calculated the cost to the average motorist in the state's largest urban areas in the form of additional vehicle operating costs (VOC) as a result of driving on rough roads, the cost of lost time and wasted fuel due to congestion, and the financial cost of traffic crashes. The chart below shows the cost of deficient roads statewide and for the average driver in the state's largest urban areas.

Location	VOC	Safety	Congestion	TOTAL
Ann Arbor	$751	$377	$466	$1,594
Detroit	$1,148	$447	$1,410	$3,005
Flint	$1,136	$682	$332	$2,150
Grand Rapids	$898	$492	$907	$2,297
Kalamazoo - Battle Creek	$749	$698	$425	$1,872
Lansing	$940	$501	$420	$1,861
Muskegon	$810	$612	$354	$1,776
Saginaw-Bay City-Midland	$943	$549	$352	$1,844
Traverse City	$388	$538	$861	$1,787
MICHIGAN STATEWIDE	**$5.9 Billion**	**$5.4 Billion**	**$5.7 Billion**	**$17 Billion**

MICHIGAN'S TRANSPORTATION FUNDING

Improvements to Michigan's roads, highways and bridges are funded by local, state and federal governments.

In a 2016 report, the state's 21st Century Infrastructure Commission estimated that in order to meet the established goals for state road and bridge quality, Michigan would need to invest an additional $2.2 billion in roads and bridges each year. The annual total rose to $2.6 billion when multimodal transportation needs like bus transit, passenger rail and freight were considered.

Recognizing the need for additional transportation funding, the State of Michigan and the Michigan legislature increased the state's motor fuel tax to 26 cents per gallon in 2017, which increased revenue from fuel taxes by $347 million annually. In 2019 the Rebuilding Michigan Program (RBMP) provided $3.5 billion in one-time bonding for state and federal roads. The five-year federal Infrastructure Investment and Jobs Act (IIJA), signed into law in November 2021, will provide $7.9 billion in road, highway and bridge funding over five years, resulting in a 40 percent increase in federal funding over the first three years of the IIJA. Federal funds currently support 33 percent of the state's transportation department spending on highway and bridge improvements.

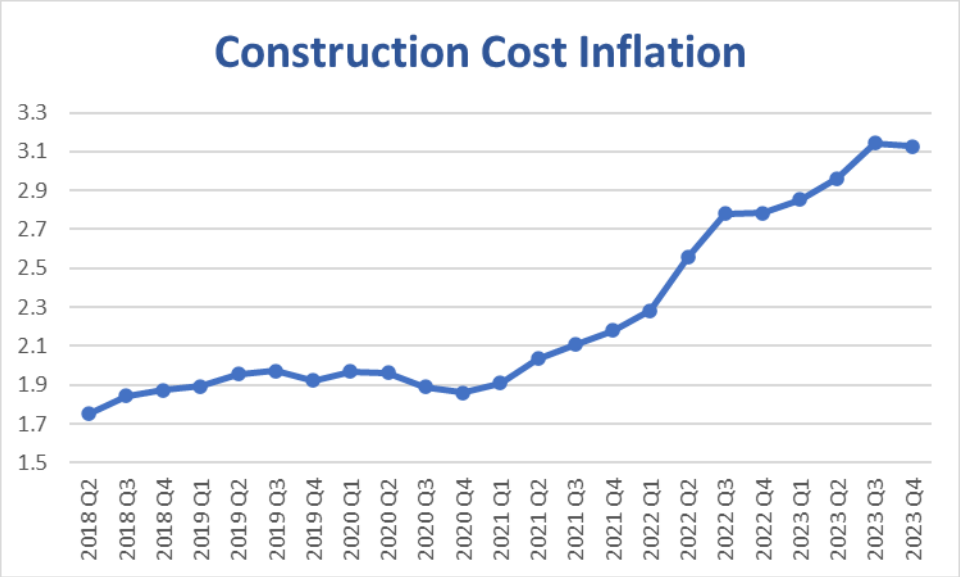
While the additional state and federal funding has been helpful, the Growing Michigan Together Council in 2023 submitted a report to Governor Whitmer, the Michigan House of Representatives and the Michigan Senate noting that Michigan still faces an annual transportation funding gap of $3.9 billion, which could be even higher if maintenance is deferred and repairs become more costly over time.

Highway and bridge spending multiplies through the economy by stimulating additional output. A 2021 macroeconomic analysis by IHS Markit found that that every dollar spent on highway and bridge improvements results in $3.4 dollars in combined direct, indirect and induced output from industries throughout the economy, resulting in a multiplier for highway and bridge investment of 3.4.

The ability of revenue from Michigan's motor fuel tax – a critical source of state transportation funds – to keep pace with the state's future transportation needs is likely to erode as a result of increasing vehicle fuel efficiency, the increasing use of electric vehicles and inflation in highway construction costs.

The average fuel efficiency of U.S. passenger vehicles increased from 20 miles per gallon in 2010 to 24.5 miles per gallon in 2020. Average fuel efficiency is expected to increase another 31 percent by 2030, to 32 miles per gallon, and increase 51 percent by 2040, to 37 miles per gallon. The share of electric vehicles of total passenger vehicle sales in the U.S. is expected to increase to five percent by 2023 and to 60 percent by 2040, by which time electric vehicles will represent approximately 30 percent of the passenger vehicle fleet.

The Federal Highway Administration's national highway construction cost index, which measures labor and materials cost, increased by 43 percent in 2022 and 2023 and by 68 percent since the beginning of 2021.



MICHIGAN ROADS PROVIDE A ROUGH RIDE

Due to inadequate state and local funding, 40 percent of major locally and state-maintained roads and highways in Michigan are in poor or mediocre condition. Driving on rough roads costs the average Michigan driver $758 annually in additional vehicle operating costs – a total of $5.9 billion statewide. The chart below details pavement conditions on major roads in the state's largest urban areas and statewide.

Location	Poor	Mediocre	Fair	Good
Ann Arbor	28%	22%	9%	42%
Detroit	53%	17%	6%	25%
Flint	53%	14%	7%	26%
Grand Rapids	38%	17%	6%	39%
Kalamazoo-Battle Cree	28%	21%	9%	43%
Lansing	40%	16%	9%	35%
Muskegon	34%	14%	6%	46%
Saginaw-Bay City-Midland	39%	22%	7%	32%
Traverse City	11%	10%	20%	59%
MICHIGAN STATEWIDE	**21%**	**19%**	**11%**	**48%**

MICHIGAN BRIDGE CONDITIONS

Eleven percent of Michigan's bridges are rated in poor/structurally deficient condition, the eighth highest share in the nation. Bridges that are rated poor/structurally deficient have significant deterioration of the bridge deck, supports or other major components. Fifty-four percent of the state's bridges are rated in fair condition and the remaining 34 percent are in good condition. Most bridges are designed to last 50 years before major overhaul or replacement, although many newer bridges are being designed to last 75 years or longer. In Michigan, 41 percent of the state's bridges were built in 1969 or earlier. The chart below details bridge conditions statewide and in the state's largest urban areas.

	POOR/STRUCTURALLY DEFICIENT		FAIR		GOOD		TOTAL
	Number	Share	Number	Share	Number	Share	BRIDGES
Ann Arbor	50	19%	146	56%	64	25%	260
Detroit	263	10%	1323	51%	1020	39%	2606
Flint	61	16%	228	61%	83	22%	372
Grand Rapids	55	6%	532	55%	372	39%	959
Kalamazoo - Battle Creek	58	12%	296	60%	138	28%	492
Lansing	84	13%	424	65%	148	23%	656
Muskegon	20	14%	99	69%	25	17%	144
Saginaw-Bay City-Midland	108	17%	329	53%	181	29%	618
Traverse City	3	9%	16	47%	15	44%	34
MICHIGAN STATEWIDE	1,292	11%	6,168	54%	3,881	34%	11,341

MICHIGAN ROADS ARE INCREASINGLY CONGESTED

The Texas A&M Transportation Institute (TTI) annually estimates congestion levels for the nation's urban areas. Based on TTI research, TRIP estimates that congested roads that choke commuting and commerce will cost Michigan drivers $5.7 billion in 2024 in the form of lost time and wasted fuel. The chart below shows the annual number of hours lost to congestion, the cost of lost time and wasted fuel, and gallons of fuel lost to congestion for the average driver in the state's largest urban areas.

Location	Hours Lost to Congestion	Annual Cost Per Driver	Gallons of Fuel Wasted Per Driver
Ann Arbor	18	$466	7
Detroit	63	$1,410	24
Flint	13	$332	5
Grand Rapids	42	$907	16
Kalamazoo - Battle Creek	15	$425	8
Lansing	16	$420	6
Muskegon	14	$354	6
Saginaw-Bay City-Midland	14	$352	6
Traverse City	31	$861	14

Due to the Covid-19 pandemic, vehicle travel in Michigan dropped by as much as 54 percent in April 2020 (as compared to vehicle travel during the same month the previous year). By 2023, vehicle miles of travel in Michigan had rebounded to three percent below 2019's pre-pandemic levels.

MICHIGAN TRAFFIC SAFETY AND FATALITIES

From 2019 to 2023, 5,389 people were killed in traffic crashes in Michigan, an average of 1,078 fatalities each year. In 2023, Michigan had 1.04 traffic fatalities for every 100 million miles traveled, lower than the national average of 1.26. The traffic fatality rate on the state's rural, non-Interstate roads was significantly higher than the fatality rate on all other roads in the state (1.62 vs. 1.01). From 2018 to 2022, 18 percent of the state's traffic fatalities in crashes involving motorized vehicles were of pedestrians or bicyclists, a total of 799 pedestrian fatalities and 146 bicyclist fatalities over the five-year period.

Nationwide, traffic fatalities began to increase dramatically in 2020 even as vehicle travel rates plummeted due to the COVID-19 pandemic, and the number of fatalities continued to increase in 2021. The number of fatalities in Michigan increased significantly between 2019 and 2023, and the fatality rate per 100 million VMT increased sharply in 2020 before declining slightly each year through 2023. This increase in the number of fatalities and the rate of fatalities per 100 million VMT happened while vehicle travel in the state decreased by three percent overall from 2019 to 2022.

MICHIGAN TRAFFIC FATALITY AND VEHICLE MILES OF TRAVEL (VMT) DATA						
	2019	2020	2021	2022	2023	2019-2022 Change
Traffic Fatalities	985	1,084	1,136	1,133	1,040	6%
Fatalities per 100M VMT	0.96	1.25	1.2	1.18	1.04	8%
VMT (Billions)	102.2	86.5	96.7	98.0	99.4	-3%

Traffic crashes imposed a total of $16.3 billion in economic costs in Michigan in 2022 and traffic crashes in which a lack of adequate roadway safety features, while not the primary factor, were likely a contributing factor, imposed $5.4 billion in economic costs. The chart below shows the number of people killed in traffic crashes in the state's largest urban areas between 2018 and 2022, and the cost of traffic cashes per driver.

Location	Average Fatalities 2018-2022	Annual Safety Cost per Motorist
Ann Arbor	27	$377
Detroit	374	$447
Flint	53	$682
Grand Rapids	103	$492
Kalamazoo - Battle Creek	63	$698
Lansing	46	$501
Muskegon	21	$612
Saginaw-Bay City-Midland	40	$549
Traverse City	10	$538

In early 2022 the U.S. Department of Transportation adopted a comprehensive National Roadway Safety Strategy, a roadmap for addressing the nation's roadway safety crisis based on a Safe System approach. The Safe System approach, which is also being adopted by state and local transportation agencies has five objectives: Safer People, Safer Roads, Safer Vehicles, Safer Speeds, and improved Post-Crash Care.

TRANSPORTATION AND ECONOMIC DEVELOPMENT

The health and future growth of Michigan's economy is riding on its transportation system. In 2022 Michigan's freight system moved 756 million tons of freight, valued at $1.1 trillion – the sixth largest value of freight moved of all states. From 2022 to 2050, freight moved annually in Michigan by trucks is expected to increase 80 percent in value (inflation-adjusted dollars) and 56 percent by weight. Twelve percent of travel on Michigan's Interstate highways and 17 percent of travel on its rural Interstate highways is by combination trucks.

According to a report by the American Road & Transportation Builders Association, the design, construction and maintenance of transportation infrastructure in Michigan supports approximately 94,000 full-time jobs across all sectors of the state economy. These workers earn $4.1 billion annually. Approximately 1.9 million full-time jobs in Michigan in key industries like tourism, retail sales, agriculture and manufacturing are completely dependent on the state's transportation network.

Sources of information for this report include AAA, the AAA Foundation for Traffic Safety, the American Association of State Highway and Transportation Officials (AASHTO), the American Road & Transportation Builders Association (ARTBA), the Bureau of Transportation Statistics (BTS), the Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration (NHTSA), the Michigan Department of Transportation (MDOT), Public Sector Consultants, the State of Michigan's 21st Century Infrastructure Commission, the Texas Transportation Institute (TTI), The Transportation Research Board (TRB), the U.S. Census Bureau, and the U.S. Department of Transportation. Cover photo credit: iStockPhoto.com.

INTRODUCTION

Michigan's roads, highways and bridges form vital transportation links for the state's residents, visitors and businesses, providing daily access to homes, jobs, shopping, natural resources and recreation. Modernizing Michigan's transportation system is critical to quality of life and economic competitiveness in the Great Lakes State. Inadequate transportation investment, which will result in deteriorated transportation facilities and diminished access, will negatively affect Michigan's economic competitiveness and quality of life.

To accommodate population and economic growth, maintain its level of economic competitiveness and achieve further economic growth, Michigan will need to maintain and modernize its roads, highways and bridges by improving the physical condition of its transportation network and enhancing the system's ability to provide efficient, reliable and safe mobility for residents, visitors and businesses. Making needed improvements to Michigan's roads, highways, bridges and transit systems could also provide a significant boost to the state's economy by creating jobs in the short-term and stimulating long-term economic growth as a result of enhanced mobility and access.

This report examines the condition, use and safety of Michigan's roads, highways and bridges, and the state's future mobility needs. Sources of information for this report include the Federal Highway Administration (FHWA), the Michigan Department of Transportation (MDOT), the State of Michigan's 21st Century Infrastructure Commission, the American Association of State Highway and Transportation Officials (AASHTO), the Bureau of Transportation Statistics (BTS), the U.S. Census Bureau, the Texas Transportation Institute (TTI), the American Road & Transportation Builders Association (ARTBA), Public Sector Consultants and the National Highway Traffic Safety Administration (NHTSA).

In addition to statewide data, the TRIP report includes regional data for the Ann Arbor, Detroit, Flint, Grand Rapids, Kalamazoo-Battle Creek, Lansing, Muskegon, Saginaw-Bay City-Midland and Traverse City urban areas. An urban area is defined as a region's municipalities and surrounding suburbs for pavement condition and congestion data; bridge and traffic fatality data include a region's major counties.[1]

POPULATION, TRAVEL AND ECONOMIC TRENDS IN MICHIGAN

Michigan motorists and businesses require a high level of personal and commercial mobility. To foster quality of life and spur continued economic growth, it is critical that the state provide a safe and modern transportation system that can accommodate future growth in population, tourism, business, recreation and vehicle travel.

Michigan's population grew to approximately 10 million residents in 2023.[2] Michigan had approximately 7.8 million licensed drivers in 2022.[3] In 2023, Michigan's roads carried 99.4 billion vehicle miles of travel.[4] Due to the COVID-19 pandemic, vehicle travel in Michigan dropped by as much as 54 percent in April 2020 (as compared to vehicle travel during April 2019). By 2023, vehicle miles of travel (VMT) in Michigan had rebounded to three percent below pre-pandemic levels in 2019.[5]

From 2000 to 2021, Michigan's gross domestic product (GDP), a measure of the state's economic output, increased by eight percent, when adjusted for inflation.[6] U.S. GDP increased 48 percent during the same period.[7]

CONDITION OF MICHIGAN ROADS

The life cycle of Michigan's roads is greatly affected by the state and local governments' ability to perform timely maintenance and upgrades to ensure that road and highway surfaces last as long as possible.

The pavement data in this report, which is for all arterial and collector roads and highways, is provided by the Federal Highway Administration (FHWA), based on data submitted annually by the Michigan Department of Transportation on the condition of major state and locally maintained roads and highways. Pavement data for Interstate highways and other principal arterials is collected for all system mileage, whereas pavement data for minor arterial and all collector roads and highways is based on sampling portions of roadways as prescribed by The Federal Highway Administration (FHWA) to ensure the data collected is adequate to provide an accurate assessment of pavement conditions on these roads and highways.

Statewide, 40 percent of Michigan's major roads are in poor or mediocre condition. Twenty-one percent of Michigan's major locally and state-maintained roads are in poor condition and 19 percent are in mediocre condition.[8] Eleven percent of Michigan's major roads are in fair condition and the remaining 48 percent are in good condition.[9]

Thirty-six percent of Michigan's major locally and state-maintained urban roads and highways have pavements rated in poor condition and 19 percent are in mediocre condition.[10] Ten percent of Michigan's major urban roads are rated in fair condition and the remaining 35 percent are rated in good condition.[11]

Thirteen percent of Michigan's major locally and state-maintained rural roads and highways have pavements rated in poor condition and 19 percent are in mediocre condition.[12] Twelve percent of Michigan's major rural roads are rated in fair condition and the remaining 56 percent are rated in good condition.[13]

The chart below details pavement conditions on major urban roads in the state's largest urban areas and statewide.[14]

Chart 1. Pavement conditions on major urban roads in Michigan's largest urban areas and statewide.

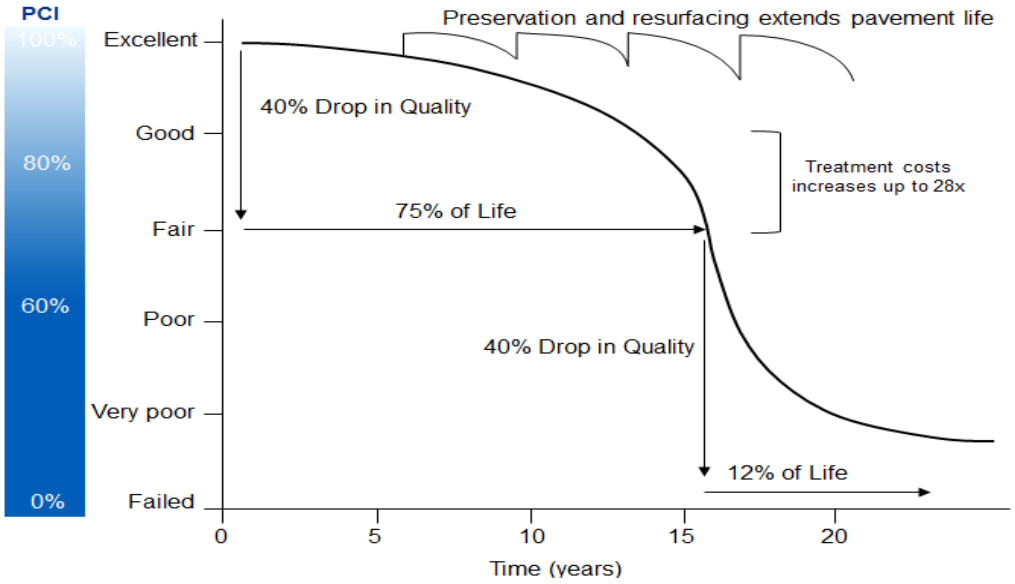
Location	Poor	Mediocre	Fair	Good
Ann Arbor	28%	22%	9%	42%
Detroit	53%	17%	6%	25%
Flint	53%	14%	7%	26%
Grand Rapids	38%	17%	6%	39%
Kalamazoo-Battle Cree	28%	21%	9%	43%
Lansing	40%	16%	9%	35%
Muskegon	34%	14%	6%	46%
Saginaw-Bay City-Midland	39%	22%	7%	32%
Traverse City	11%	10%	20%	59%
MICHIGAN STATEWIDE	**21%**	**19%**	**11%**	**48%**

Source: TRIP analysis of Federal Highway Administration data.

Pavement failure is caused by a combination of traffic, moisture and climate. Moisture often works its way into road surfaces and the materials that form the road's foundation. Road surfaces at intersections are more prone to deterioration because the slow-moving or standing loads occurring at these sites subject the pavement to higher levels of stress. It is critical that roads are fixed before they require major repairs because reconstructing roads costs approximately four times more than resurfacing them.[15] As roads and highways continue to age, they will reach a point of deterioration

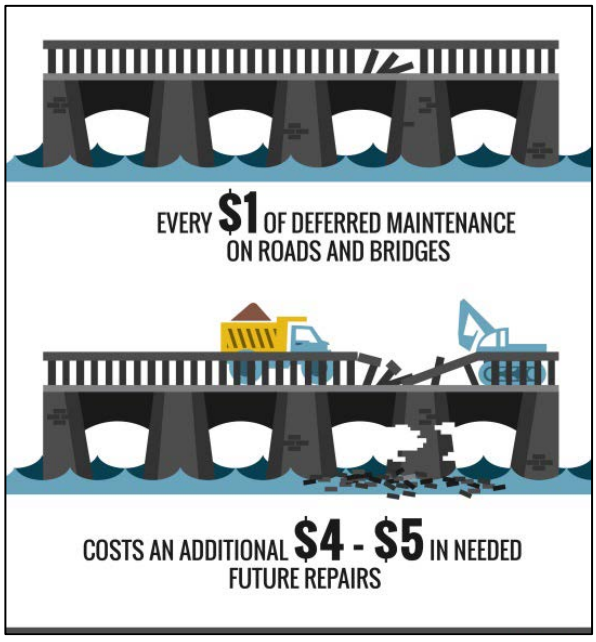
where routine paving and maintenance will not be adequate to keep pavement surfaces in good condition and costly reconstruction of the roadway and its underlying surfaces will become necessary.

Chart 2. Pavement Condition Cycle Time with Treatment and Cost



Source: North Carolina Department of Transportation (2016). [2016 Maintenance Operations and Performance Analysis Report.]

Long-term repair costs increase significantly when road and bridge maintenance is deferred, as road and bridge deterioration accelerates later in the service life of a transportation facility and requires more costly repairs. A report on maintaining pavements found that every $1 of deferred maintenance on roads and bridges costs an additional $4 to $5 in needed future repairs.[16]



THE COST TO MOTORISTS OF ROADS IN INADEQUATE CONDITION

TRIP has calculated the additional cost to motorists of driving on roads in poor, mediocre or fair condition. When roads are in poor, mediocre or fair condition – which may include potholes, rutting or rough surfaces – the cost to operate and maintain a vehicle increases. These additional vehicle operating costs (VOC) include accelerated vehicle depreciation, additional vehicle repair costs, increased fuel consumption and increased tire wear. TRIP estimates that additional VOC borne by Michigan motorists as a result of deteriorated road conditions is $5.9 billion annually, an average of

$758 per driver statewide.[17] The chart below shows additional VOC per motorist in the state's largest urban areas and statewide.

Chart 3. Vehicle operating costs per motorist as a result of driving on deteriorated roads.

Location	VOC
Ann Arbor	$751
Detroit	$1,148
Flint	$1,136
Grand Rapids	$898
Kalamazoo - Battle Creek	$749
Lansing	$940
Muskegon	$810
Saginaw-Bay City-Midland	$943
Traverse City	$388
MICHIGAN STATEWIDE	**$5.9 billion**

Source: TRIP estimates.

Additional vehicle operating costs have been calculated in the Highway Development and Management Model (HDM), which is recognized by the U.S. Department of Transportation and more than 100 other countries as the definitive analysis of the impact of road conditions on vehicle operating costs. The HDM report is based on numerous studies that have measured the impact of various factors, including road conditions, on vehicle operating costs.[18] The HDM study found that road deterioration increases ownership, repair, fuel and tire costs. The report found that deteriorated roads accelerate the pace of depreciation of vehicles and the need for repairs because the stress on the vehicle increases in proportion to the level of roughness of the pavement surface. Similarly, tire wear and fuel consumption increase as roads deteriorate since there is less efficient transfer of power to the drive train and additional friction between the road and the tires.

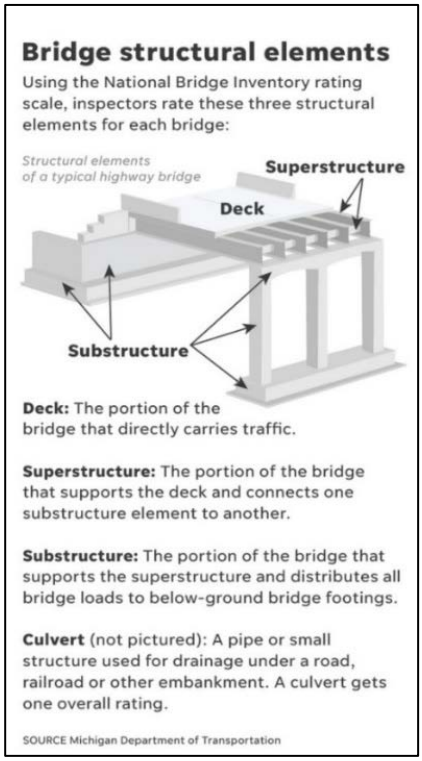
TRIP's additional VOC estimate is based on taking the average number of miles driven annually by a motorist, calculating current VOC based on AAA's driving cost estimates and then using the HDM model to estimate the additional VOC paid by drivers as a result of substandard roads.[19] Additional research on the impact of road conditions on fuel consumption by the Texas Transportation Institute (TTI) is also factored into TRIP's vehicle operating cost methodology.

BRIDGE CONDITIONS IN MICHIGAN

Michigan's bridges form key links in the state's highway system, providing communities and individuals access to employment, schools, shopping and medical facilities, and facilitating commerce and access for emergency vehicles.

Eleven percent (1,292 of 11,341) of Michigan's locally and state-maintained bridges are rated in poor/structurally deficient condition, the eighth highest share in the nation.[20] This includes all bridges that are 20 feet or more in length. A bridge is deemed structurally deficient if there is significant deterioration of the bridge deck, supports or other major components.

Bridges that are structurally deficient may be posted for lower weight limits or closed if their condition warrants such action. Deteriorated bridges can have a significant impact on daily life. Restrictions on vehicle weight may cause many vehicles – especially emergency vehicles, commercial trucks, school buses and farm equipment – to use alternate routes to avoid posted bridges. Redirected trips also lengthen travel time, waste fuel and reduce the efficiency of the local economy.



Fifty-four percent of Michigan's locally and state-maintained bridges have been rated in fair condition.[21] A fair rating indicates that a bridge's structural elements are sound but minor deterioration has occurred to the bridge's deck, substructure or superstructure. The remaining 34 percent of the state's bridges are rated in good condition.[22]

The chart below details the condition of bridges statewide and in Michigan's largest urban areas.

Chart 4. Bridge conditions statewide and in Michigan's largest urban areas.

	POOR/STRUCTURALLY DEFICIENT		FAIR		GOOD		TOTAL
	Number	Share	Number	Share	Number	Share	BRIDGES
Ann Arbor	50	19%	146	56%	64	25%	260
Detroit	263	10%	1323	51%	1020	39%	2606
Flint	61	16%	228	61%	83	22%	372
Grand Rapids	55	6%	532	55%	372	39%	959
Kalamazoo - Battle Creek	58	12%	296	60%	138	28%	492
Lansing	84	13%	424	65%	148	23%	656
Muskegon	20	14%	99	69%	25	17%	144
Saginaw-Bay City-Midland	108	17%	329	53%	181	29%	618
Traverse City	3	9%	16	47%	15	44%	34
MICHIGAN STATEWIDE	1,292	11%	6,168	54%	3,881	34%	11,341

Source: TRIP analysis of Federal Highway Administration National Bridge Inventory (2023).

Most bridges are designed to last 50 years before major overhaul or replacement, although many newer bridges are being designed to last 75 years or longer. In Michigan, 41 percent of the state's bridges were built in 1969 or earlier.[23]

The service life of bridges can be extended by performing routine maintenance such as resurfacing decks, painting surfaces, ensuring that a facility has good drainage and replacing deteriorating components. But most bridges will eventually require more costly reconstruction or major rehabilitation to remain operable.

TRAFFIC SAFETY IN MICHIGAN

A total of 5,389 people were killed in Michigan traffic crashes from 2019 to 2023, an average of 1,078 fatalities per year.[24] Michigan's overall traffic fatality rate of 1.04 fatalities per 100 million vehicle miles of travel in 2023 is lower than the national average of 1.26.[25] The traffic fatality rate on the state's rural, non-Interstate roads was significantly higher than the fatality rate on all other roads in the state (1.62 vs. 1.01).[26]

From 2018 to 2022, 18 percent of the people killed in Michigan in crashes involving motorized vehicles were pedestrians or bicyclists, a total of 799 pedestrian fatalities and 146 bicyclist fatalities over the five-year period.[27]

Chart 5. Non-motorized traffic fatalities in Michigan 2018 – 2022.

Year	Total Fatalities	Pedestrian Fatalities	Bicyclist Fatalities	Share Bike and Ped.
2018	974	142	21	17%
2019	985	141	21	16%
2020	1,084	172	39	19%
2021	1,147	175	29	18%
2022	1,133	169	36	18%
TOTAL	**5,323**	**799**	**146**	**18%**
AVERAGE	**1,065**	**160**	**29**	**18%**

Source: National Highway Traffic Safety Administration.

Nationwide, traffic fatalities began to increase dramatically in 2020 even as vehicle travel rates plummeted due to the COVID-19 pandemic, and the number of fatalities continued to increase in 2021. The number of fatalities in Michigan increased by six percent between 2019 and 2023, and the fatality rate per 100 million VMT increased sharply in 2020 before declining slightly each year through 2023.[28] This increase in the number of fatalities and the rate of fatalities per 100 million VMT happened while vehicle travel in the state decreased by three percent overall from 2019 to 2022.[29]

Chart 6. Traffic Fatalities, Fatality Rate and Vehicle Miles of Travel in Michigan 2019-2022.

MICHIGAN TRAFFIC FATALITY AND VEHICLE MILES OF TRAVEL (VMT) DATA						
	2019	2020	2021	2022	2023	2019-2022 Change
Traffic Fatalities	985	1,084	1,136	1,133	1,040	**6%**
Fatalities per 100M VMT	0.96	1.25	1.2	1.18	1.04	**8%**
VMT (Billions)	102.2	86.5	96.7	98.0	99.4	**-3%**

Source: TRIP analysis of Federal Highway Administration and National Highway Traffic Safety Administration data.

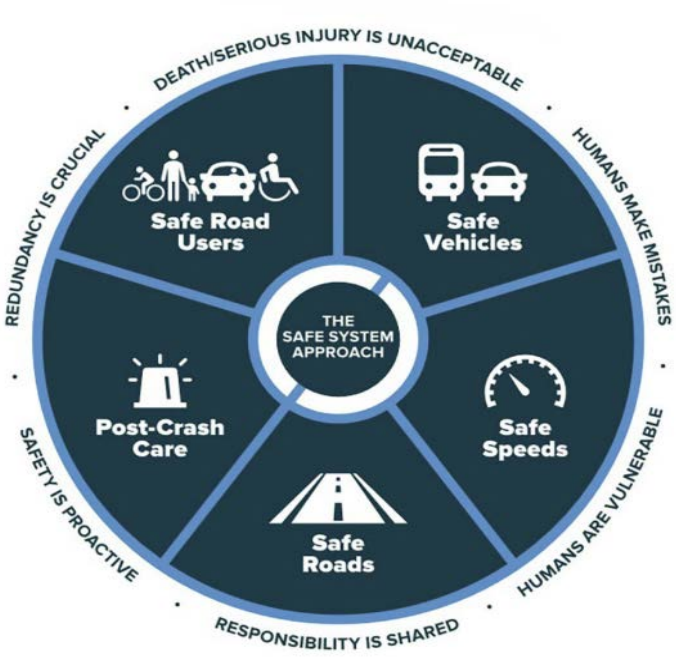
The significant increase in traffic fatalities since the onset of the pandemic appears largely related to increased risks being taken by drivers. In an October 2021 report, the National Highway Traffic Safety Administration found that "after the declaration of the public health emergency in March 2020, driving patterns and behaviors in the United States changed significantly. Of the drivers who remained on the roads, some engaged in riskier behavior, including speeding, failure to wear seat belts, and driving under the influence of alcohol or drugs."[30]

The AAA Foundation for Traffic Safety (AAAFTS) drew similar conclusions about the role of increased risks being taken by drivers during the pandemic. A survey taken of drivers in October and November 2020 by the AAAFTS asked whether their level of driving had decreased, remained the same

or increased since the beginning of COVID-19 related restrictions, and whether the motorist had engaged in a variety of risky driving behaviors in the previous 30 days.[31] In a February 2022 brief about the survey, the AAAFTS noted that drivers who maintained or increased their pre-COVID travel levels indicated that they were more likely to engage in risky driving behavior, including speeding, not wearing a seat belt, being impaired and driving aggressively. "It is possible that many of the individuals who were willing to travel—and even increase their travel—despite the health risks associated with the pandemic were already more willing than average to take other risks," the AAAFTS report found.[32]

In early 2022 the U.S. Department of Transportation adopted a comprehensive National Roadway Safety Strategy, a roadmap for addressing the nation's roadway safety crisis based on a Safe System approach that acknowledges the following: humans make mistakes and are physically vulnerable; traffic deaths and serious injuries are unacceptable; traffic deaths and serious injuries need to be reduced by the provision of a redundant transportation system that reduces or minimizes crashes and ensures that, if crashes do occur, they do not result in serious injury or death.[33]

Chart 7. The Safe System Approach.



Source: Federal Highway Administration.

The Safe System approach, which is also being adopted by state and local transportation agencies has five objectives:

- Safer People: Encourage safe, responsible behavior by people who use our roads, and create conditions that prioritize their ability to reach their destination unharmed.
- Safer Roads: Design roadway environments to mitigate human mistakes and account for injury tolerances, to encourage safer behaviors, and to facilitate safe travel by the most vulnerable users.
- Safer Vehicles: Expand the availability of vehicle systems and features that help to prevent crashes and minimize the impact of crashes on both occupants and non-occupants.
- Safer Speeds: Promote safer speeds in all roadway environments through a combination of thoughtful, context-appropriate roadway design, targeted education and outreach campaigns, and enforcement.

- Post-Crash Care: Enhance the survivability of crashes through expedient access to emergency medical care, while creating a safe working environment for vital first responders and preventing secondary crashes through robust traffic incident management practices.

Improving safety on the nation's roadways will require that additional steps are taken to make further progress in achieving the Safe System's objectives. NHTSA, which provides states with roadway safety grants, requires states to submit annually a state highway safety plan. The state plans outline numerous steps states are taking to improve traffic safety. Elements of these state roadway safety plans aimed at addressing the Safe System objectives include:

- Safer People: education on speeding, impaired or disadvantaged driving; education on safe pedestrian and bicycling behavior; education on driving safely around large commercial vehicles; enforcement of commercial driver license and vehicle weight requirements; extension of safety belt laws and their enforcement to include all passenger vehicle occupants; enhancing enforcement action of speeding, impaired, aggressive and distracted driving, particularly at high-risk locations; increase penalties, particularly for repeat offender drivers; and increased enforcement at work zones.
- Safer Roads: converting intersections to roundabouts; removing or shielding roadside objects; the addition of left-turn lanes at intersections; improved signalization and lighting at intersections; adding or improving median barriers; improved roadway lighting; adding centerline or shoulder rumble strips; improving pedestrian and bicycle facilities, including sidewalks and bike lanes and providing pedestrian crossing islands; improved work zone safety measures; wider lanes and paved shoulders; upgrading roads from two lanes to four lanes; providing or improving lane markings; updating rail crossings; eliminating vertical pavement drop-offs; and providing large truck parking spaces.
- Safer Vehicles: Support the development, testing and deployment of connected and autonomous vehicle technology such as collision avoidance, lane departure avoidance systems and turning detection systems.
- Safer Speeds: Where appropriate, provide roadway features to encourage safer speeds, including traffic roundabouts and curb extensions; improved signage and dynamic speed signing at high-risk locations; education on the consequences of speeding; and increased speeding enforcement, particularly at high-risk locations.
- Post-Crash Care: Reduce crash response time including the use of emergency vehicle preemption technology; improve emergency response to multi-vehicle or hazardous material crashes; and increase access to level one or two trauma centers for seriously-injured crash victims.

Improving safety on Michigan's roadways can be achieved through further improvements in vehicle safety; improvements in driver, pedestrian, and bicyclist behavior; and, a variety of improvements in roadway safety features. The severity of serious traffic crashes could be reduced through roadway improvements, where appropriate, such as converting intersections to roundabouts; removing or shielding roadside objects; the addition of left-turn lanes at intersections; the signalization of intersections; adding or improving median barriers; improved lighting; adding centerline or shoulder rumble strips; providing appropriate pedestrian and bicycle facilities, including sidewalks and bicycle lanes; providing wider lanes, wider and paved shoulders; upgrading roads from two lanes to four lanes; providing better road and lane markings; and updating rail crossings.

The U.S. has a $146 billion backlog in needed roadway safety improvements, according to a 2017 report from the AAA Foundation for Traffic Safety. The report found implementing these cost-

effective and needed roadway safety improvements on U.S. roadways would save approximately 63,700 lives and reduce the number of serious injuries as a result of traffic crashes by approximately 350,000 over 20 years.

Traffic crashes in Michigan imposed a total of $16.3 billion in economic costs in 2022.[34] TRIP estimates that roadway features, while not the primary factor, were likely a contributing factor in approximately one-third of all fatal traffic crashes, resulting in $5.4 billion in economic costs in Michigan in 2022.[35] According to a 2023 National Highway Traffic Safety Administration (NHTSA) report, the economic costs of traffic crashes includes work and household productivity losses, property damage, medical costs, rehabilitation costs, legal and court costs, congestion costs and emergency services.[36]

The chart below shows the average number of people killed in traffic crashes in the state's largest urban areas between 2018 and 2022 and the cost of traffic crashes per driver. According to a 2015 National Highway Traffic Safety Administration (NHTSA) report, the economic costs of traffic crashes includes work and household productivity losses, property damage, medical costs, rehabilitation costs, legal and court costs, congestion costs, and emergency services.[37]

Chart 8. Average fatalities between 2018 and 2022 and the annual cost of crashes per driver.

Location	Average Fatalities 2018-2022	Annual Safety Cost per Motorist
Ann Arbor	27	$377
Detroit	374	$447
Flint	53	$682
Grand Rapids	103	$492
Kalamazoo - Battle Creek	63	$698
Lansing	46	$501
Muskegon	21	$612
Saginaw-Bay City-Midland	40	$549
Traverse City	10	$538

Source: TRIP analysis of NHTSA data.

Three major factors are associated with fatal vehicle crashes: driver behavior, vehicle characteristics and roadway features. Roadway features that impact safety include the number of lanes, lane widths, lighting, lane markings, rumble strips, shoulders, guard rails, other shielding devices, median barriers and intersection design.

Traffic crashes in Michigan imposed a total of $2.8 billion in economic costs in 2022.[38] TRIP estimates that roadway features, while not the primary cause of a crash, were likely a contributing factor in approximately one-third of all fatal traffic crashes, resulting in $919 million in economic costs in Michigan in 2022.

TRAFFIC CONGESTION IN MICHIGAN

Increasing levels of traffic congestion cause significant delays in Michigan, particularly in its larger urban areas, choking commuting and commerce. Traffic congestion robs commuters of time and money and imposes increased costs on businesses, shippers and manufacturers, which are often passed along to the consumer. Increased levels of congestion can also reduce the attractiveness of a location to a business when considering expansion or where to locate a new facility.

The Texas A&M Transportation Institute annually estimates congestion levels for the nation's urban areas. Based on TTI research, TRIP estimates the value of lost time and wasted fuel in Michigan in 2024 will be approximately $5.7 billion. The chart below shows the number of hours lost to congestion annually for each driver in the state's largest urban areas, the per-driver cost of lost time and wasted fuel due to congestion, and the gallons of fuel lost annually.

Chart 9. Annual hours lost to congestion and congestion costs per driver (2024).

Location	Hours Lost to Congestion	Annual Cost Per Driver	Gallons of Fuel Wasted Per Driver
Ann Arbor	18	$466	7
Detroit	63	$1,410	24
Flint	13	$332	5
Grand Rapids	42	$907	16
Kalamazoo - Battle Creek	15	$425	8
Lansing	16	$420	6
Muskegon	14	$354	6
Saginaw-Bay City-Midland	14	$352	6
Traverse City	31	$861	14

Source: TRIP analysis based on TTI Urban Mobility Report.

TRANSPORTATION AND ECONOMIC GROWTH

Today's culture of business demands that an area have well-maintained and efficient roads, highways and bridges if it is to remain economically competitive. Global communications and the impact of free trade in North America and elsewhere have resulted in a significant increase in freight movement, making the quality of a region's transportation system a key component in a business's ability to compete locally, nationally and internationally.

Businesses have responded to improved communications and the need to cut costs with a variety of innovations including just-in-time delivery, increased small package delivery, demand-side inventory management and e-commerce. The result of these changes has been a significant improvement in logistics efficiency as firms move from a push-style distribution system, which relies on large-scale warehousing of materials, to a pull-style distribution system, which relies on smaller, more strategic movement of goods. These improvements have made mobile inventories the norm, resulting in the nation's trucks literally becoming rolling warehouses.

Highways are vitally important to continued economic development in Michigan. As the economy expands, creating more jobs and increasing consumer confidence, the demand for consumer and business products grows. In turn, manufacturers ship greater quantities of goods to market to meet this demand, a process that adds to truck traffic on the state's highways and major arterial roads.

The ability of the nation's freight transportation system to efficiently and safely accommodate the growing demand for freight movement could be hampered by inadequate transportation capacity, a lack of adequate safety features on some transportation facilities, institutional barriers to enhancing the nation's freight facilities, a lack of adequate funding for needed improvements to the freight network and a shortage of drivers.

The need to improve the U.S. freight network is occurring at a time when the nation's freight delivery system is being transformed by advances in vehicle autonomy, manufacturing, warehousing and supply chain automation, increasing e-commerce, and the growing logistic networks being developed by Amazon and other retail organizations in response to the demand for a faster and more responsive delivery and logistics cycle.

In 2022 Michigan's freight system moved 756 million tons of freight, valued at $1.1 trillion – the sixth largest value of freight moved of all states. [39] From 2022 to 2050, freight moved annually in Michigan by trucks is expected to increase 80 percent in value (inflation-adjusted dollars) and 56 percent by weight.[40] Twelve percent of travel on Michigan's Interstate highways and 17 percent of travel on its rural Interstate highways is by combination trucks.[41]

Investments in transportation improvements in Michigan play a critical role in the state's economy. A report by the American Road & Transportation Builders Association found that the design, construction and maintenance of transportation infrastructure supports the equivalent of approximately 94,000 full-time jobs across all sectors of the state economy, earning these workers approximately $4.1 billion annually.[42] These jobs include approximately 47,000 full-time jobs directly involved in transportation infrastructure construction and related activities. Spending by employees and companies in the transportation design and construction industry supports an additional 47,000 full-time jobs in Michigan.[43] Transportation construction in Michigan contributes an estimated $741.3 million annually in state and local income, corporate and unemployment insurance taxes and the federal payroll tax.[44]

Approximately 1.9 million full-time jobs in Michigan in key industries like tourism, retail sales, agriculture and manufacturing are dependent on the quality, safety and reliability of the state's transportation infrastructure network. These workers earn $76.9 billion in wages and contribute an estimated $14 billion in state and local income, corporate and unemployment insurance taxes and the federal payroll tax.[45]

Local, regional and state economic performance is improved when a region's surface transportation system is expanded or repaired. This improvement comes as a result of the initial job creation and increased employment created over the long-term because of improved access, reduced transport costs and improved safety.

Increasingly, companies are looking at the quality of a region's transportation system when deciding where to re-locate or expand. Regions with congested or poorly maintained roads may see businesses relocate to areas with a smoother, more efficient and more modern transportation system. Highway access has a significant impact on the competitiveness of a region's economy. In a 2023 survey of corporate executives by Area Development Magazine, 78 percent of corporate executives said that highway accessibility was an important or very important factor in making decisions about expansion or investment.[46]

IMPROVING TRANSPORTATION SAFETY, RESILIENCY AND EFFICIENCY

Recognizing that extreme weather, sea level change, and changes in environmental conditions may threaten the condition and longevity of the nation's transportation infrastructure, transportation agencies have begun to assess vulnerabilities and consider the resilience of their transportation assets during the transportation planning process. Transportation agencies across the country have begun to incorporate resilience in asset management plans, addressing resilience in project development and design and optimizing operations and maintenance practices.[47]

Based on the importance of maximizing the level and safety of mobility provided by its transportation system, transportation agencies are adopting Transportation Systems Management and Operations (TSMO) practices and incorporating improved resiliency into their transportation network.

While a TSMO program does not eliminate the need for capacity expansions along some routes, it helps enhance the mobility of an existing corridor as much as possible.

A TSMO program adopts an integrated set of strategies to improve traffic flow and safety on a portion of a roadway, including work zone management, traffic incident management, freight management, traveler information, traffic signal coordination, ramp management, transit management and improved bicycle and pedestrian crossings.[48] The benefits of TSMO can include reduced traffic congestion, reduced fuel consumption and reduced emissions.

MICHIGAN TRANSPORTATION FUNDING

Improvements to Michigan's roads, highways and bridges are funded by local, state and federal governments.

In a 2016 report, the state's 21st Century Infrastructure Commission estimated that in order to meet the established goals for state road and bridge quality, Michigan would need to invest an additional $2.2 billion in roads and bridges each year.[49] The annual total rose to $2.6 billion when multimodal transportation needs like bus transit, passenger rail and freight were considered.[50]

Recognizing the need for additional transportation funding, the State of Michigan and the Michigan legislature increased the state's motor fuel tax to 26 cents per gallon in 2017, which increased revenue from fuel taxes by $347 million annually.[51] In 2019 the Rebuilding Michigan Program (RBMP) provided $3.5 billion in one-time bonding for state and federal roads.

In addition to state funds, the federal government is a critical source of funding for Michigan's roads, highways, bridges and transit systems and provides a significant return in road and bridge funding based on the revenue generated in the state by the federal motor fuel tax. Most federal funds for highway and transit improvements in Michigan are provided by federal highway user fees, largely an 18.4 cents-per-gallon tax on gasoline and a 24.4 cents-per-gallon tax on diesel fuel.

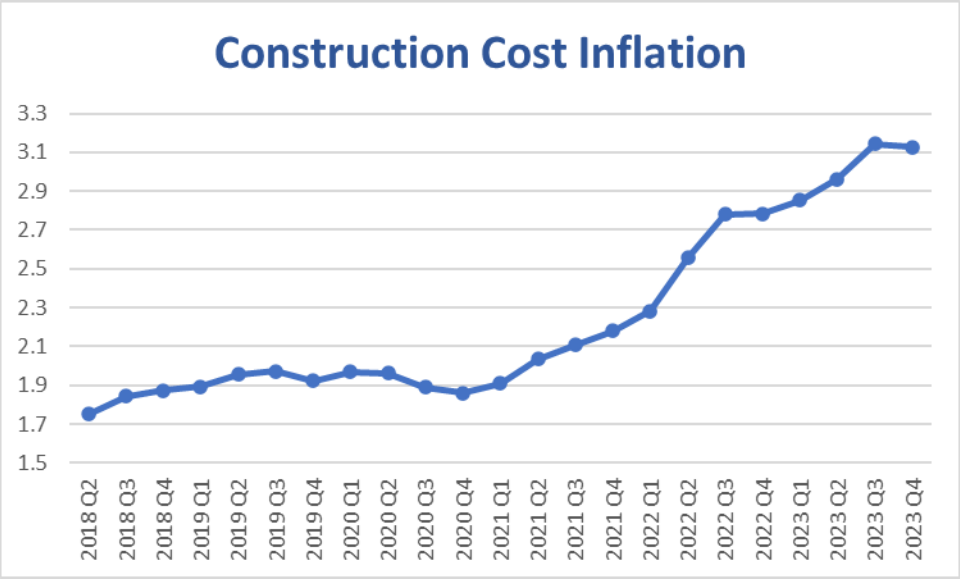
The five-year federal Infrastructure Investment and Jobs Act (IIJA), signed into law in November 2021, will provide Michigan $7.9 billion in road, highway and bridge funding over five years, resulting in a 38 percent increase in federal funding starting in 2022.[52] Federal funds currently support 40 percent of the state's transportation department spending on highway and bridge improvements.

While the additional state and federal funding has been helpful, the Growing Michigan Together Council in 2023 submitted a report to Governor Whitmer, the Michigan House of Representatives and the Michigan Senate noting that Michigan still faces an annual transportation funding gap of $3.9 billion, which could be even higher if maintenance is deferred and repairs become more costly over time.[53] This echoes the findings of a 2023 report by Public Sector Consultants which also noted that construction of transportation assets is five to eight times more expensive per lane mile than preventative maintenance.[54]

Revenue from Michigan's motor fuel tax – a critical source of state transportation funding -- is likely to erode as a result of increasing vehicle fuel efficiency, the increasing use of electric vehicles and the impact of highway construction inflation. The average fuel efficiency of U.S. passenger vehicles increased from 20 miles per gallon in 2010 to 24.5 miles per gallon in 2020. Average fuel efficiency is expected to increase another 31 percent by 2030, to 32 miles per gallon, and increase 51 percent by 2040, to 37 miles per gallon.[55] The share of electric vehicles of total passenger vehicle sales in the U.S. is expected to increase to five percent by 2023 and 60 percent by 2040, by which time electric vehicles will represent approximately 30 percent of the passenger vehicle fleet.[56]

The Federal Highway Administration's national highway construction cost index, which measures labor and materials cost, increased by 43 percent in 2022 and 2023 and increased 68 percent since the beginning of 2021. [57]

Chart 10. National Highway Construction Cost Index, 2018-2023.



Source: Federal Highway Administration National Highway Construction Cost Index.

Highway and bridge spending multiplies through the economy by stimulating additional output. A 2021 macroeconomic analysis by IHS Markit found that that every dollar spent on highway and bridge improvements results in $3.4 dollars in combined direct, indirect and induced output from industries throughout the economy, resulting in a multiplier for highway and bridge investment of 3.4.[58]

According to the Status of the Nation's Highways, Bridges, and Transit, 24th Edition, submitted to Congress by the United States Department of Transportation (USDOT) in 2021, the nation faces a $1 trillion backlog in needed repairs and improvements to the nation's roads, highways and bridges.[59] The USDOT report found that the nation's annual investment in roads, highways and bridges by all levels of government should be increased by 55 percent annually to improve the conditions of roads, highways and bridges, relieve traffic congestion and improve traffic safety.[60]

The USDOT report also found that the nation faces a $105 billion backlog in needed repairs and improvements to the its transit systems.[61] The USDOT report found that the nation's annual investment in transit repairs and improvements by all levels of government should be increased by 30 percent to improve the condition and expand the service of the nation's transit systems.[62]

CONCLUSION

As Michigan works to enhance its thriving, growing and dynamic state, it will be critical that it is able to address the most significant transportation issues by providing a 21st century network of roads, highways, bridges and transit that can accommodate the mobility demands of a modern society.

Michigan will need to continue to modernize its surface transportation system by improving the physical condition of its transportation network and enhancing the system's ability to provide efficient, safe and reliable mobility for residents, visitors and businesses. Making needed improvements to the state's roads, highways, bridges and transit systems would provide a significant boost to the economy by creating jobs in the short term and stimulating long-term economic growth as a result of enhanced mobility and access. Despite federal funding provided by the IIJA and additional Michigan state funding, numerous projects to improve the condition and expand the capacity of the state's roads, highways, bridges and transit systems will not proceed without a substantial boost in funding.

ENDNOTES

[1] Bridge condition data and safety data for each urban area includes the counties noted: Ann Arbor: Washtenaw; Detroit: Lapeer, Livingston, Macomb, Oakland, St. Claire and Wayne; Flint: Genesee; Grand Rapids: Barry, Kent, Montcalm, Ottawa; Kalamazoo-Battle Creek: Calhoun, Kalamazoo, Van Buren; Lansing: Clinton, Eaton, Ingham; Muskegon: Muskegon; Traverse City: Grand Traverse.
[2] U.S. Census Bureau Quick Facts (2023).
[3]Highway Statistics (2022). Federal Highway Administration. DL-1C.
[4] U.S. Department of Transportation - Federal Highway Administration: Highway Statistics 2022.
[5] U.S. Department of Transportation - Federal Highway Administration: Highway Statistics 2022.
[6] TRIP analysis of Bureau of Economic Analysis data (2019).
https://apps.bea.gov/itable/iTable.cfm?ReqID=70&step=1#reqid=70&step=1&isuri=1
[7] Ibid.
[8] TRIP analysis of U.S. Department of Transportation - Federal Highway Administration: Highway Statistics 2022.
[9] Ibid.
[10] Ibid.
[11] Ibid.
[12] Ibid.
[13] Ibid.
[14] Ibid.
[15] Selecting a Preventative Maintenance Treatment for Flexible Pavements. R. Hicks, J. Moulthrop. Transportation Research Board. 1999. Figure 1.
[16] Pavement Maintenance, by David P. Orr, PE Senior Engineer, Cornell Local Roads Program, March 2006.
[17] TRIP calculation.
[18] Highway Development and Management: Volume Seven. Modeling Road User and Environmental Effects in HDM-4. Bennett, C. and Greenwood, I. 2000.
[19] Your Driving Costs. American Automobile Association. 2023.
[20] Federal Highway Administration National Bridge Inventory. 2023.
[21] Ibid.
[22] Ibid
[23] TRIP analysis of Federal Highway Administration National Bridge Inventory data (2023).
[24] Federal Highway Administration National Highway Traffic Safety Administration, 2017-2021.
[25] TRIP analysis of National Highway Traffic Safety Administration and Federal Highway Administration data (2019-2023).
[26] Ibid.
[27] Ibid.
[28] Ibid.
[29] Ibid.
[30] Continuation of Research on Traffic Safety During the COVID-19 Public Health Emergency: January-June 2021. U.S. Department of Transportation National Highway Traffic Safety Administration.
[31] Self-Reported Risky Driving in Relation to Changes in Amount of Driving During the COVID-19 Pandemic. February 2022. AAA Foundation for Traffic Safety.
[32] Ibid.
[33] U.S. Department of Transportation National Roadway Safety Strategy, 2022. https://www.transportation.gov/NRSS
[34] TRIP estimate based on NHTSA report "The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised), 2016. P. 146.
[35] Ibid.
[36] The Economic and Societal Impact of Motor Vehicle Crashes, 2019 (2023). National Highway Traffic Safety Administration.
[37] The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised) (2015). National Highway Traffic Safety Administration. P. 1. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812013
[38] TRIP estimate based on NHTSA report "The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised), 2016. P. 146.
[39] TRIP analysis of Federal Highway Administration Freight Analysis Framework data, U.S. Department of Transportation. Freight Analysis Framework (FAF) (ornl.gov).
[40] Ibid.
[41] U.S. Department of Transportation - Federal Highway Administration: Highway Statistics.

[42] American Road & Transportation Builders Association (2015). The 2015 U.S. Transportation Construction Industry Profile. https://www.transportationcreatesjobs.org/pdf/Economic_Profile.pdf
[43] Ibid.
[44] Ibid
[45] Ibid.
[46] Area Development Magazine, Q1 2023. 37th Annual Corporate Survey. https://www.areadevelopment.com/Corporate-Consultants-Survey-Results/Q1-2023/37th-annual-corporate-survey-decison-makers-feel-economic-pressures.shtml
[47] Federal Highway Administration (2019. Resilience. https://www.fhwa.dot.gov/environment/sustainability/resilience/
[48] Federal Highway Administration (2019). What is TSMO? https://ops.fhwa.dot.gov/tsmo/index.htm#q1
[49] State of Michigan 21st Century Infrastructure Commission Report. November 2016. https://www.michigan.gov/-/media/Project/Websites/formergovernors/Folder10/21st_Century_Infrastructure_Commission_Final_Report_1.pdf?rev=67a4572f5a96407cb335382479ad43b9
[50] Ibid.
[51] Michigan Infrastructure Needs and Funding Solutions. March 2023. Public Sector Consultants. https://thinkmita.org/wp-content/uploads/2023-MITA-Infrastructure-Investment-Needs.pdf
[52] American Road & Transportation Builders Association (2024). Federal Highway Program Impaxt: Michigan Infrastructure Investment & Jobs Act.
[53] Growing Michigan Together Council Report. December 14, 2023. https://growingmichigan.org/wp-content/uploads/2023-12-14-GMTC-Final-Report-2.pdf
[54] Michigan Infrastructure Needs and Funding Solutions. March 2023. Public Sector Consultants. https://thinkmita.org/wp-content/uploads/2023-MITA-Infrastructure-Investment-Needs.pdf
[55] KPMG. (2019). Evaluating Sustainable Transportation Funding Options.
[56] BloombergNEF (2019) New Energy Outlook 2019. https://about.bnef.com/new-energy-outlook/
[57] Federal Highway Administration (2023). National Highway Construction Cost Index. https://www.fhwa.dot.gov/policy/otps/nhcci/
[58] IHS Markit (2021). Economic Impacts of Transportation Infrastructure. ARTBA_EIA_IIJA_Report_Sept2021.pdf
[59] United States Department of Transportation (2021). 24th Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance. Executive Summary, Chapter 7. 24th Ed. Status of the Nation's Highways, Bridges, and Transit Conditions and Performance Report - Policy | Federal Highway Administration (dot.gov)
[60] Ibid.
[61] United States Department of Transportation (2021). 24th Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance. Executive Summary, Chapter 7. 24th Ed. Status of the Nation's Highways, Bridges, and Transit Conditions and Performance Report - Policy | Federal Highway Administration (dot.gov)
[62] Ibid.