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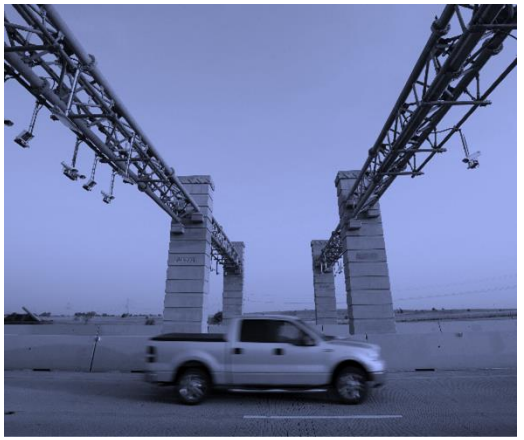
Michigan Statewide Tolling Study: Feasibility Analysis

IN ACCORDANCE WITH
PUBLIC ACT 140 OF 2020 AND
PUBLIC ACT 73 OF 2022



MDOT

HNTB

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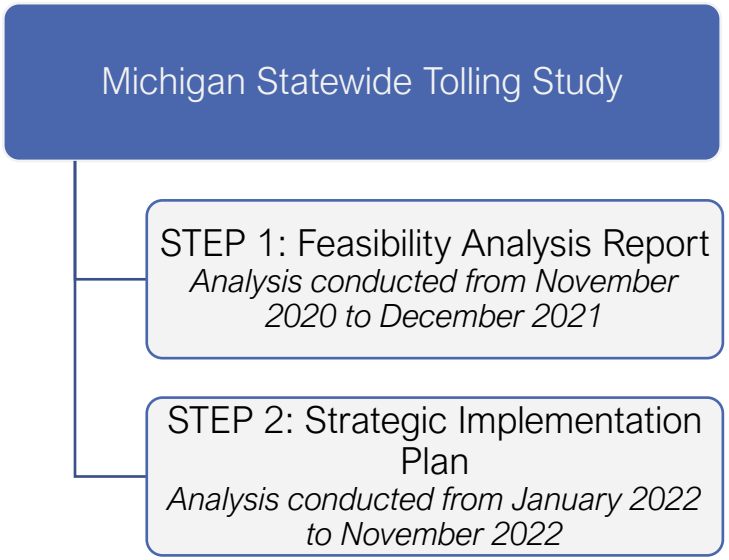
December 21, 2022

Table of Contents

1. Introduction to the Michigan Statewide Tolling Study

The overall Michigan Statewide Tolling Study was conducted in accordance with Public Act 140 of 2020 and Public Act 73 of 2022. These Acts require the Michigan Department of Transportation (MDOT) to engage an outside consulting firm to conduct a Feasibility Analysis and Strategic Implementation Plan on tolling highways in Michigan. The consulting team that worked with MDOT to prepare the Michigan Statewide Tolling Study was led by HNTB and supported by CDM Smith, Cincar Consulting Group (C2G), PFM, Tyme Consulting Engineers, RSG, Alphavue, and Streetlight Data. The elements of the Michigan Statewide Tolling Study are shown in **Figure 1**. As shown, the first step was to conduct the Feasibility Analysis. This report addresses the Feasibility Analysis, and a separate report addresses the Strategic Implementation Plan.

Figure 1: The Michigan Statewide Tolling Study



As is documented in the remainder of this report, the Feasibility Analysis found that tolling existing highways could help address Michigan's roadway and bridge needs as part of a long-term, financially stable transportation program. Four "supporting documents" are also referenced in this report that support the Feasibility Analysis process and findings.

The separate step two Strategic Implementation Plan discusses the process to implement tolling on existing highways in Michigan if a future decision to move forward with tolling is made. Michigan has not made the decision to implement a new tolling program at the time of the issuance of this report. Such a decision would take action by the legislature and governor and would be supported by more detailed planning work, analysis, and outreach.

With the overarching Michigan Statewide Tolling Study, Michigan now joins at least four other states, including Connecticut, Indiana, Minnesota, and Wisconsin that have completed major studies of tolling all lanes of existing highways in the last decade. A new statewide tolling program could generate significant transportation revenue – enough to sustain the life-cycle costs of the tolled roadways – but would be complicated and would require a careful approach to implementation. It would involve a wide range of technical, social, environmental, financial, and regulatory steps. The separate Strategic Implementation Plan details strategies that draw from decades of tolling experience across the United States and reflect the latest best practices in tolling technology and operations.

2. This report assesses the feasibility of potentially tolling Michigan's highways

The analysis included in this report was conducted between late 2020 and late 2021. This report is not a recommendation to toll or not toll Michigan's highways but rather a data-driven analysis of feasibility. Tolling should be considered in comparison with other potential future transportation funding sources. Table 1 shows the pages in this report that address the requirements of Public Act 140 of 2020 and Public Act 73 of 2022. Figure 2 and Table 2 show and list all the limited-access highways in Michigan that were included in the analysis.

Table 1: Required Content from Public Act 140 of 2020

Required Content	Addressed in this Report?	Refer to these Pages
(1) Revenue projections based on an analysis of optimal tolling rates, vehicle counts and types by state of registration, and traffic diversion.	Yes	17-20, 30-31
(2a) The economic impact and feasibility of tolling particular highways of this state.	Yes	Entire document
(2b) The ability to provide discounts or credits or otherwise lessen the impact of tolling on local, commuter, and in-state operators.	Yes	21-22
(2c) Information related to the number and impact of out-of-state operators expected to use highways of this state.	Yes	19
(2d) The rationale for the federal authorization of any tolling plan that may be submitted by this state to the United States Department of Transportation.	Yes	15
(2e) The optimal levels at which tolls may reasonably be expected to be set for passenger vehicles and other vehicles.	Yes	11, 30
(2f) Appropriate tolling rules regarding population center local traffic.	Yes	21-22
(2g) This state's ability to enter into monetization agreements or long-term contracts for initial construction, long-term maintenance, installation, and operation of tolling facilities.	Yes	36
(2h) Any estimates of which highway facilities would be conducive to tolling operations.	Yes	26-29
(2i) Ways to maximize the use of Michigan workers and products made in this state.	Yes	37

Figure 2: Michigan Limited Access Highways Studied

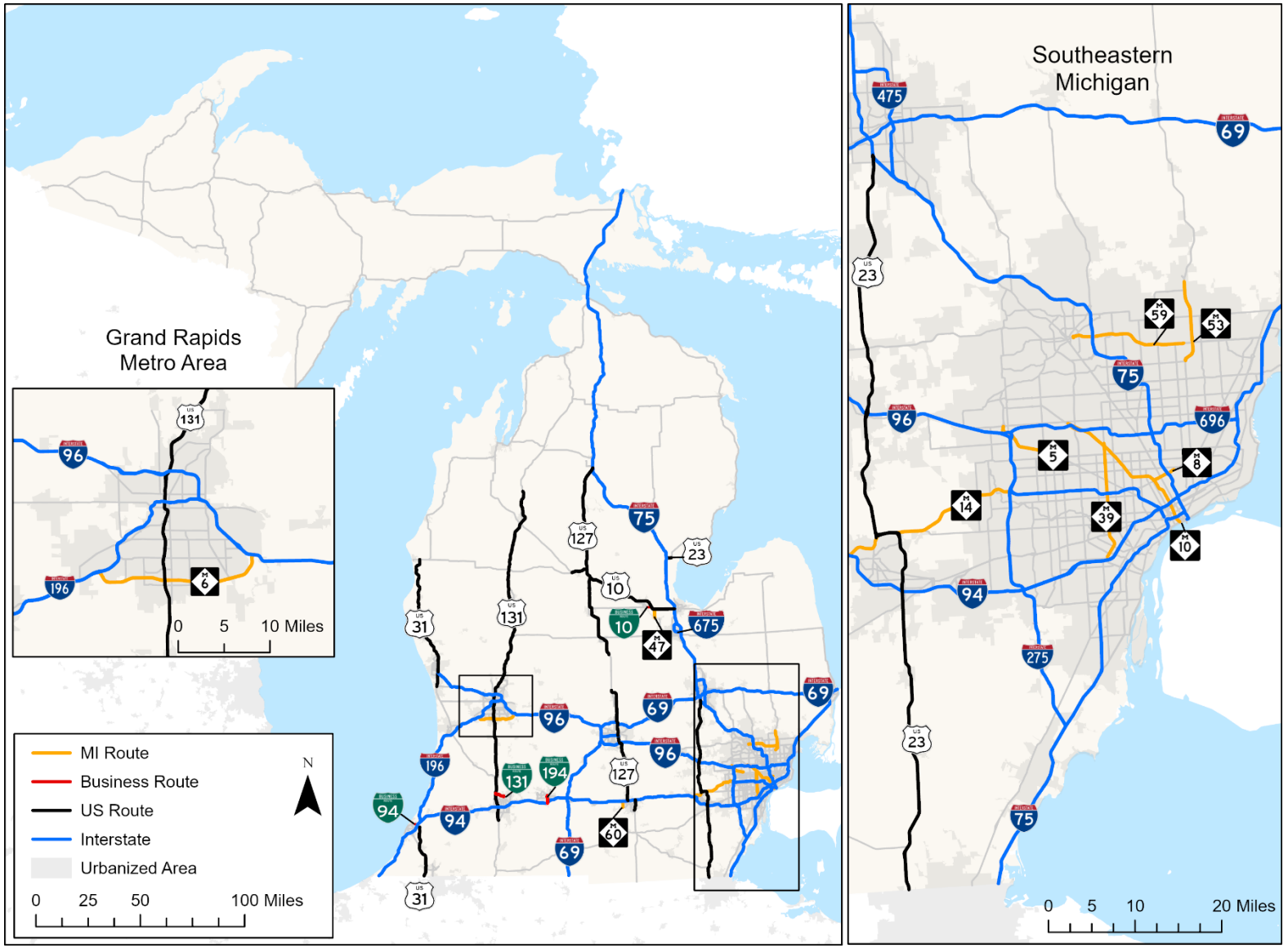


Table 2: Michigan Limited Access Highways in this Feasibility Analysis

No.	Route	Centerline Mileage[1]	General Location
1	I-69	203.5	Indiana Border to Ontario Border
2	I-75	395.5	Ohio Border to Ontario Border
3	I-94	271.0	Indiana Border to Ontario Border
4	Bus. I-94	1.0	Benton Harbor
5	I-96	184.5	Muskegon to Detroit
6	I-194	3.4	Battle Creek
7	I-196	80.7	Benton Harbor to Grand Rapids
8	I-275	30.6	Western Detroit Suburbs
9	I-375	1.2	Detroit
10	I-475	16.8	Flint
11	I-496	11.5	Lansing
12	I-675	7.8	Saginaw
13	I-696	29.1	Northern Detroit Suburbs
14	US-10	57.9	Farwell to Bay City
15	Bus. US-10	2.6	Midland
16	US-23	90.5	Ohio Border to Flint
17	US-23 Connector	1.9	Standish
18	US-31	94.0	Indiana Border to Benton Harbor; Grand Haven to Ludington
19	US-127	152.6	Jackson to Grayling
20	US-131	168.8	Portage to Manton
21	Bus. US-131	4.2	Kalamazoo
22	M-5	7.6	Northwestern Detroit Suburbs
23	M-6	18.2	Southern Grand Rapid Suburbs
24	M-8	2.7	Detroit
25	M-10	18.2	Southfield to Detroit
26	M-14	20.2	Ann Arbor to Plymouth
27	M-39	13.9	Southfield to Allen Park
28	M-47	4.1	Midland
29	M-53	11.7	Northern Detroit Suburbs
30	M-59	13.2	Northern Detroit Suburbs
31	M-60	3.0	Jackson
Total Interstate		**1,236.6**	**Entire State**
Total US-Route		**572.6**	**Entire State**
Total M-Route		**112.8**	**Entire State**
Grand Total		**1,922.0**	**Entire State**

[1]Mileage for concurrent highway segements is included only in the first route listed in this table. For example, mileage for I-69/I-94 near Port Huron is included only in I-69.

3. The rationale for assessing the feasibility of tolling in Michigan is to explore options for more stable transportation revenue sources

The short-term transportation funding outlook for Michigan has increases compared to recent years based on state and federal transportation funding measures:

- 2015 Michigan Road Funding package: This package included one-time fuel tax increases on gasoline and diesel as well as vehicle registration increases that went into effect on January 1, 2017, income tax revenue (General Fund) transfers to the Michigan Transportation Fund beginning in fiscal year 2018-2019, and annual fuel tax increases based on consumer inflation that began on January 1, 2022.
- 2020 Rebuilding Michigan Bond Program: This program is funding major transportation projects in Michigan between 2020 and 2024.
- 2021 Federal Infrastructure Investment and Jobs Act (IIJA): The IIJA is increasing federal transportation funding to the states, including to Michigan, over five years beginning in 2022 compared to previous federal funding levels.

However, revenue shortfalls remain for transportation funding in Michigan, especially in the mid- to long-term:

- Related to performance measures and goals, the percentage of the Michigan Trunkline pavement in good or fair condition in 2021 was about 75 percent, under the MDOT goal of 90 percent. The share is expected to further decline to about 50 percent by 2028.
- Declining fuel consumption leading to lower fuel tax revenues has been a challenge in Michigan and other states. The issue is expected to compound in the coming years as the adoption of electric vehicles increases on top of continued improvements in the fuel economy of new internal combustion vehicles. An estimate of the impact of electric vehicles and fuel economy changes on transportation revenue from fuel taxes in Michigan is illustrated in Figure 3 and Figure 4. These impacts will be offset somewhat by vehicle registration revenue increases from surcharges on electric vehicles and hybrid vehicles that have been implemented in Michigan. However, revenue declines are still anticipated. The change from usage-based fees like fuel taxes to more reliance on system entry fees like vehicle registration fees may also impact the relative amount that different user groups pay for transportation.
- Other challenges related to transportation revenue include debt service requirements in Michigan and high transportation construction cost inflation. There is also uncertainty regarding the federal transportation funding approach and sources beyond IIJA.

Figure 3: Michigan Total Vehicle Miles Traveled and Fuel Consumption Estimates

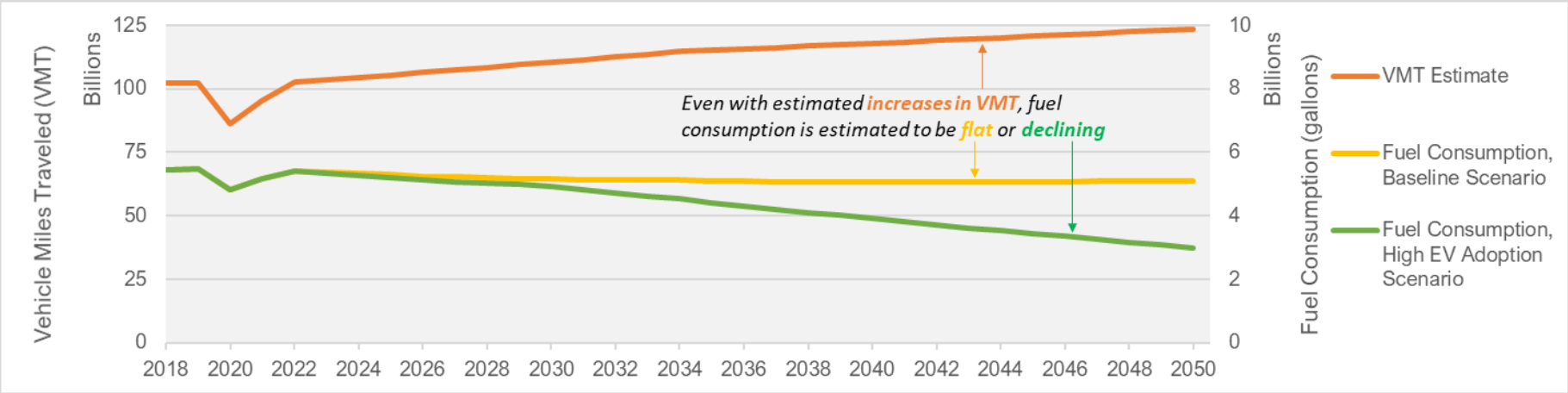
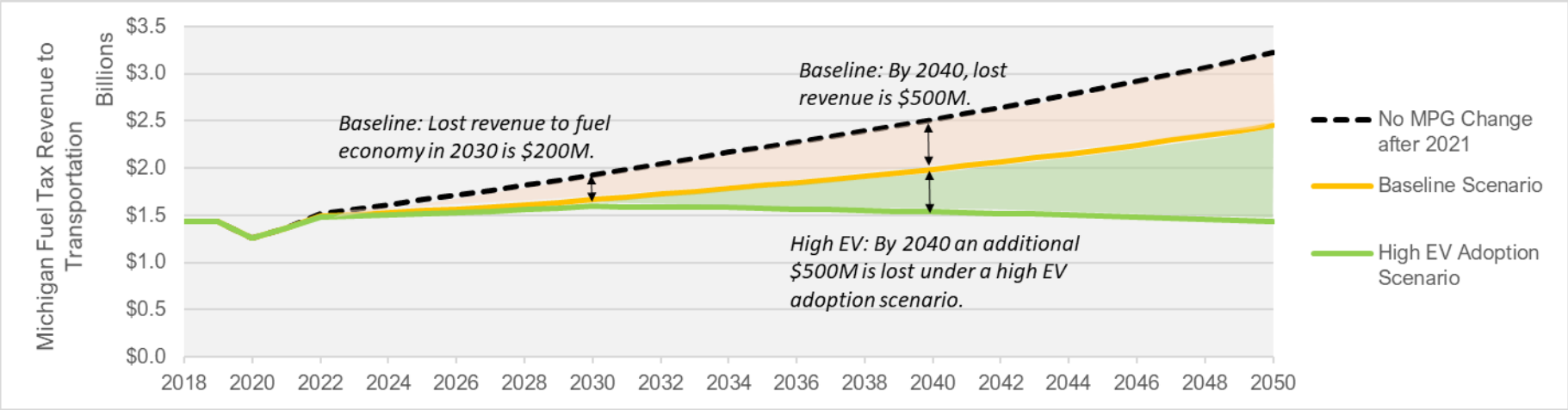


Figure 4: Michigan Fuel Tax Revenue Estimates



Sources: Figures 1 and 2 were compiled using the latest sources at the time of the Feasibility Analysis: MDOT Michigan Transportation Fund reports for tax receipts to transportation through August 2021, MDOT vehicle miles traveled (VMT) reports through 2020, future VMT growth assumptions based on FHWA projections, current fuel tax rates to transportation ($0.263 per gallon), future inflation assumptions from the September 2021 Federal Reserve Open Market Committee meeting, future fuel economy assumptions from Energy Information Administration 2021 Annual Energy Outlook, and high scenario electric vehicle penetration estimates from Bloomberg New Energy Finance 2021 projections.

Options are available to help Michigan prepare for and address transportation funding shortfalls. Broadly, transportation funding options can be considered in two main categories: User fee funding sources and general tax funding sources. General tax funding sources can include income taxes, sales taxes, and property taxes to fund transportation. Considering user fees, there are different categories – vehicle licensing, registration, and purchase fees that allow legal entry to the transportation system and user fees based on amount of usage of the system. The latter can include motor fuel taxes (which indirectly are linked to usage of the system based on gallons of fuel used and a vehicle's fuel economy); traditional road, bridge, and tunnel tolling; and the relatively newer concept of mileage-based user fees (MBUF), which can also be referred to as vehicle miles traveled (VMT) fees or road usage charges (RUC). MBUF systems include per mile charges for use of a roadway system than can be assessed using a variety of technologies from odometer readings (a low-tech approach) to global positioning system readings (a high-tech approach). User fees based on the amount of usage of the system can encourage drivers to be more selective and efficient with their travel decisions compared to methods of funding transportation that don't change with usage. This can result in reduced pollution and lead to other positive impacts.

"It is recommended that tolling, including the findings in this Feasibility Analysis Report and in the separate Strategic Implementation Plan, be considered in context of other current and future transportation funding options available to Michigan."

A tolling program as examined in this Feasibility Analysis would introduce a user fee funding source directly linked to usage of the system. Compared to motor fuel taxes, tolling would not be subject to usage-based revenue declines due to adoption of electric vehicles and continued improvements in the fuel economy of new internal combustion vehicles. A widespread tolling program on limited-access highways in Michigan could also be considered a form of a MBUF system on Michigan's highways using the latest available tolling technology. The latest tolling technology, specifically all-electronic tolling, is described in more detail in Section 7. A tolling program could fund portions of the existing highway system planned for costly improvements, thereby freeing up available transportation funding for other projects. It is recommended that tolling, including the findings in this Feasibility Analysis Report and in the separate Strategic Implementation Plan, be considered in the context of other current and future transportation funding options available to Michigan.

For context related to the revenue estimates in this report, in fiscal year 2021 about $3.4 billion of revenue was generated for the Michigan Transportation Fund. This included about 81 percent user fee-type funding sources (broken down to 39 percent motor fuel tax and 42 percent vehicle licensing and registration fees) and about 19 percent General Fund sources (mostly from income taxes).

4. The analysis uses assumptions and methodologies that reflect modern best practices for a tolling feasibility analysis

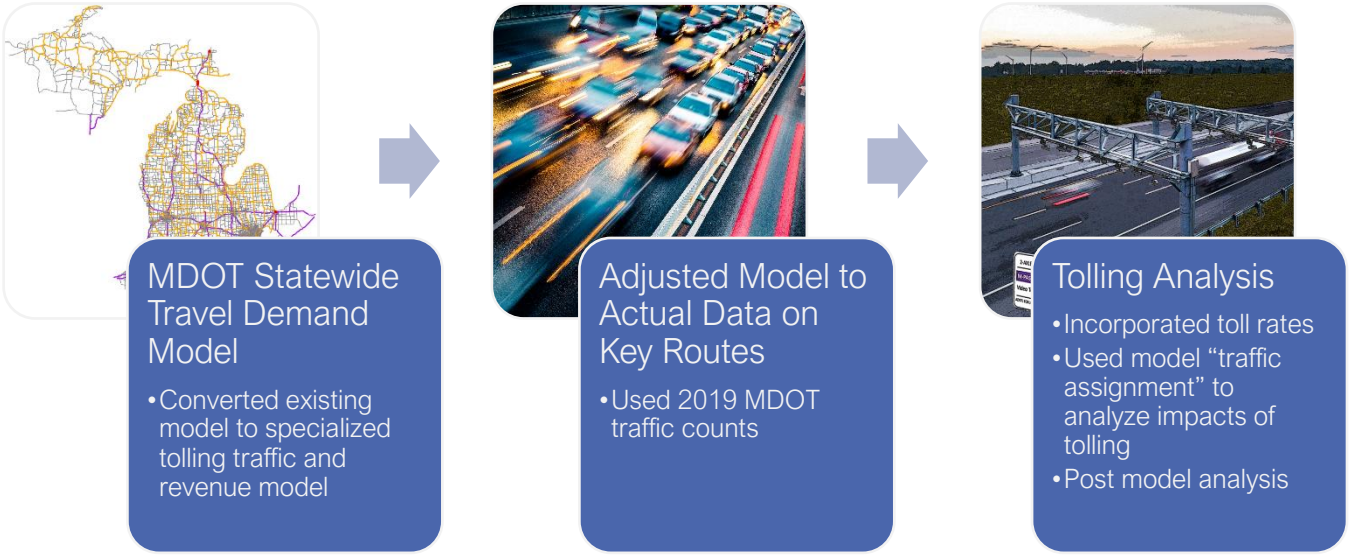
The following is a list of key assumptions and methodologies used throughout this document.

- MDOT has developed state-of-the-art traffic models and works continually to enhance them. **The traffic and revenue analysis for the Feasibility Analysis was based on MDOT's Statewide Travel Demand Model as it existed in January of 2021** with adjustments and enhancements including matching the model to 2019 traffic levels and adding a toll diversion process into the model. **Section 9** includes more information on toll diversions. **Figure 5** shows a summary of the traffic and revenue analysis process. Matching to 2019 traffic levels was preferred due to high levels of uncertainty in the continued impact of the COVID-19 pandemic on traffic patterns when initial model analysis was performed in early 2021. Estimates of COVID-19 impacts on traffic in Michigan will be included as part of the Strategic Implementation Plan. These estimates will be supported by over two years of traffic trend data being available since the start of the pandemic when the Strategic Implementation Plan analysis is conducted in 2022.

> *"Estimates of COVID-19 impacts on traffic in Michigan will be included as part of the Strategic Implementation Plan."*

- **All revenue and financial figures in the Feasibility Analysis are in constant 2020 dollars.** The results do not reflect future year dollars.
- **Revenue estimates are based on 2030 traffic levels.** Changes in traffic out to 2030 were based on those inherent in the Michigan Statewide Model. As indicated previously, the Strategic Implementation Plan will consider potential impacts on traffic due to the COVID-19 pandemic. This will include adjusting future traffic levels, if necessary.
- **Three toll rate scenarios were analyzed**, with passenger car rates of $0.04 per mile, $0.06 per mile, and $0.08 per mile (all in 2020 dollars). Single-unit (assumed to be FHWA vehicle classes five to seven) and multi-unit (assumed to be FHWA vehicles classes eight and higher) trucks were assumed to have toll rates of 1.5 times and 4 time higher than passenger car rates, respectively. Considering all toll roads nationally, these rates are similar to existing long-distance midwestern toll roads. Toll rates were assumed to increase annually at the rate of inflation.

Figure 5: Summary of the Traffic and Revenue Analysis Process



- **The analysis assumed all-electronic toll (AET) collection**, so vehicles do not have to stop or slow down to pay tolls. To reasonably simplify the analysis, all vehicles were assumed to have "transponders" in this Feasibility Analysis. Transponders are small devices placed in the front windshield of vehicles to automatically collect tolls. If tolling were implemented in Michigan, vehicles without transponders could pay via a video payment process, which involves a bill mailed to the registered vehicle owner's address. As is common in the toll industry, video payment surcharges would be set to cover the additional cost of administering this payment type.
- **Toll locations were assumed between every other interchange**. For example, a corridor with four interchanges would have two toll locations in each direction, or four total tolling locations. Each tolling location would have a set of two toll gantries as is required for all-electronic toll collection equipment. This is shown and defined in more detail in **Section 7** of this report. The assumption of toll locations between every other interchange was made after considering the competing factors of minimizing toll collection infrastructure costs and minimizing potential travel without paying tolls. Toll locations will be analyzed in more detail in the Strategic Implementation Plan. Toll location capital costs were considered on a unit cost (per tolling location) basis with contingencies.

- **Net revenue was estimated** by subtracting highway operations and maintenance (O&M) costs (estimated at $25,000 annually per lane mile for a toll facility in the Feasibility Analysis), tolling O&M costs (refer to **Section 16**), and a set aside amount assumed to cover toll discount programs from gross revenue. The toll discount set aside amount was budgeted to be 5 percent of gross revenue in the Feasibility Analysis. Highway O&M includes minor roadway repairs, mowing, litter pickup, snow and ice removal, highway courtesy patrol, and incident detection and management at the Traffic Management Center. Tolling O&M includes customer service center operations including call center and walk-up centers as well as transaction processing including image review, credit card fees, payment processing, and transponder fulfillment. Toll discount programs are discussed in more detail in **Section 12** of this report. Net revenue is discussed and shown visually in graphics in **Section 16** of this report.
- **Highway capital costs were estimated** by considering different improvements based on current highway condition in terms of remaining service life (RSL), bridge condition in terms of National Bridge Inventory ratings, unit costs for assumed improvement types (per lane-mile or per bridge), and cost contingencies. More specific details related to highway capital cost assumptions are included in the Phase 2B Screening Results Presentation supporting document.
- **The costs of toll communications infrastructure using fiber optic cables were considered** on a unit cost basis with contingencies for sections of routes where fiber was not already in place.
- **A comparative surplus/shortfall financial metric was used as an indicator of self-supporting financial feasibility for comparison purposes.** The comparative surplus/shortfall was measured by comparing revenues with costs, specifically the 2030 estimated net toll revenue times 20 years minus two times the capital cost. The equation is shown in the callout box below. The factor of two applied to the capital cost was intended to cover debt service requirements and additional contingency. Assuming only 20 years of toll revenue and not assuming any toll revenue growth over time were both conservative assumptions. If the resulting comparative surplus/shortfall metric was greater than zero, it would indicate higher probability that the system could be financially self-supporting.

$$Comparative\ surplus\ or\ shortfall\ financial\ metric = \frac{2030\ estimated\ net\ toll\ revenue \times 20}{Capital\ cost \times 2}$$

5. This Feasibility Analysis is designed to inform discussions about the potential impacts of a statewide highway tolling program

The analytical approaches used are appropriate for a feasibility-level analysis. Currently accepted professional practices and procedures were used in the development of the estimates in this Feasibility Analysis. While the analysis team believes that the projections and other forward-looking statements contained within the report are based on reasonable assumptions as of the date of the report, such forward-looking statements involve risks and uncertainties that may cause actual results to differ materially from the results predicted. Certain variables such as future developments, economic cycles, global pandemics and impacts related to advances in automotive technology etc. cannot be predicted with certainty and may affect the estimates or projections expressed in this report.

Although the analysis team relied on best practices, industry standards, MDOT's travel demand model, and other MDOT data to conduct this analysis, the results are not guaranteed. The results should be refined and may change as policies and market conditions evolve. This is a Feasibility Analysis, designed to inform discussions about the feasibility of a statewide tolling program. This Feasibility Analysis is not an investment-grade study that can be used to support financing for a tolling project.

A full disclaimer related specifically to the traffic and revenue analysis is provided in the Tolling Feasibility Analysis Phase 1 Traffic and Revenue supporting document.

"Currently accepted professional practices and procedures were used in the development of the estimates in this report."

"The results should be refined and may change as policies and market conditions evolve."

6. Federal programs would allow for tolling projects in Michigan

There are six federal tolling programs, all of which would enable tolling in Michigan. These programs are listed in Table 3. The applicability of different programs for different corridors will be analyzed in more detail in the Strategic Implementation Plan.

Table 3: Summary of Federal Tolling Programs[1]

Program	Description/Requirements	Construc-tion Project Required?	Toll Existing Capacity Allowed?	Use of Revenue?	Timing of Tolls?
MAINSTREAM PROGRAMS (Federal permission to toll not required)					
Section 129 New Capacity	• Tolling of new capacity (lanes or full facilities)	Yes	No	Corridor, then any federally-eligible project	Construction Completion
Section 129 Bridge and Tunnel	• Comply with the Federal Highway Administration guidance on minimum amount of work required • Bridge defined as a span greater than 20 feet • Multiple bridges/tunnels for a "corridor"	Yes	Yes		Construction Contract Execution
Section 166 High-Occupancy Vehicle Facilities to High-Occupancy Toll	• Conversion of existing high-occupancy vehicle facilities to high-occupancy toll • Metropolitan planning organization consultation • Performance reporting	No	No[2]		Construction Completion
PILOT PROGRAMS (Must secure a slot, more nuanced requirements and reporting are required)					
ISRRPP (Interstate Reconstruction and Rehabilitation Pilot Program)	• Enables tolling of all reconstructed lanes • Three provisional slots for the program; all three available	Yes	Yes	One corridor only	Construction Completion
VPPP (Value Pricing Pilot Program)	• Congestion and time-of-day toll rates • Metropolitan planning organization consultation and performance reporting • 15 slots for program; slots are available	No	Yes	Corridor, then any federally-eligible project	Construction Completion
Congestion Relief Program	• New grant program for areas with at least 1M population • Optimizing existing capacity and multimodal solutions • Gives tolling authority for up to 10 urban areas	Detailed guidance not yet available			

[1]See for more detail and location in U.S. code of relevant laws: https://www.fhwa.dot.gov/ipd/tolling_and_pricing/tolling_pricing/federal_tolling_programs.aspx

[2]This program allows for tolling of existing high-occupancy vehicle capacity, but not existing general-purpose lane capacity.

7. Modern All Electronic Tolling has made tolling more viable

All Electronic Tolling uses toll collection equipment on gantries over the roadway to collect tolls at highway speeds, such as shown in Figure 6. Toll booths that require vehicles to stop or slow down to pay their tolls are not used with All Electronic Tolling and are not allowed in current federal tolling programs. This reduces the physical space needed for a tolling system and eliminates congestion, vehicle emissions, and additional time associated with toll booth-based toll collection.

There are different options for implementing a toll system as can be seen in the toll systems on existing toll roads around the country:

- Fully "closed" systems: All possible trips on the toll road are tolled.
- "Open" systems: Allow certain trips to travel untolled on the toll road. Two reasons for implementing an open system are to minimize tolling impacts on certain users and to reduce toll collection and toll infrastructure costs.

Figure 6: Example of a Set of All Electronic Tolling Gantries

Source: HNTB, Location is on the SH-550 toll road in Texas

All Electronic Tolling:
Toll collection equipment on gantries over the roadway to collect tolls at highway speeds.

8. Michigan could generate between $1.5B and $2.8B in annual gross toll revenue if the entire limited access highway system was tolled

The traffic and revenue analysis conducted as part of the Feasibility Analysis considered adding tolling on all limited access highways in Michigan at the different toll rate scenarios previously summarized in **Section 4**. The traffic and revenue analysis process is described in more detail in the Tolling Feasibility Analysis Phase 1 Traffic and Revenue supporting document. **Figure 7** shows the 2030 gross toll revenue results of the traffic and revenue analysis by highway in millions of 2020$.

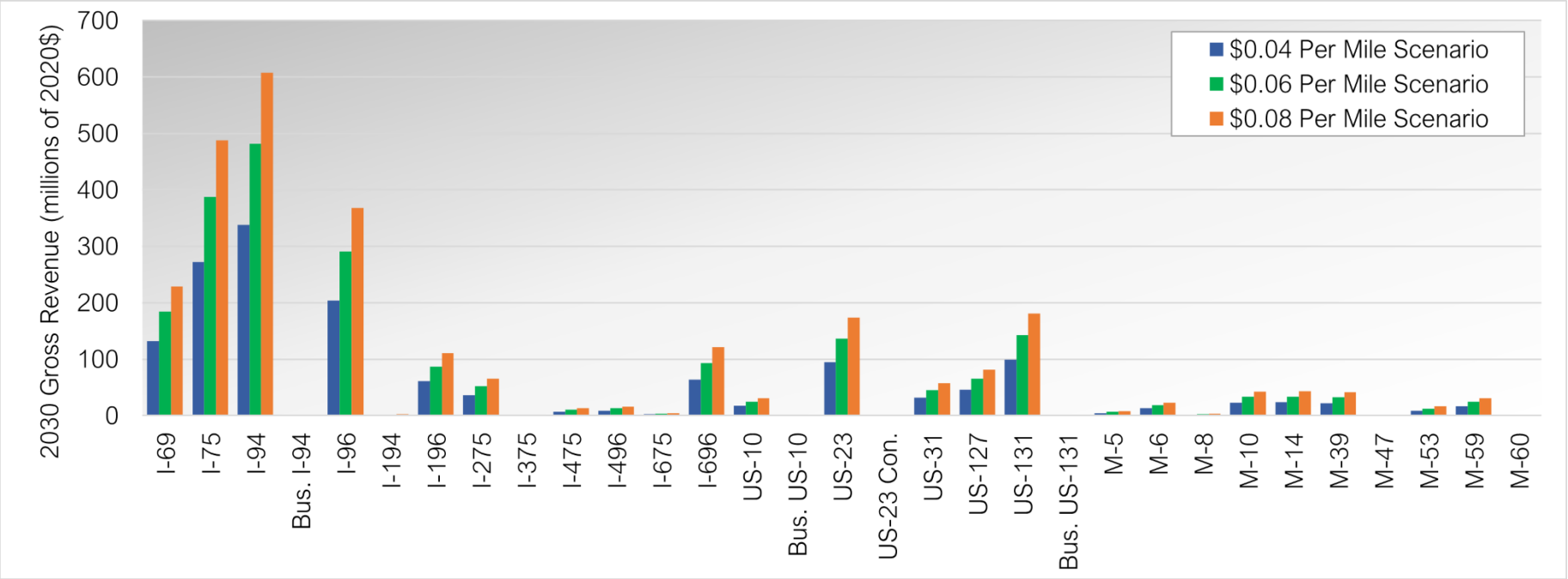
Total Annual Gross Toll Revenue on All Routes:

$1.5B ($0.04 per mile scenario)

$2.2B ($0.06 per mile scenario)

$2.8B ($0.08 per mile scenario)

Figure 7: Estimated 2030 Gross Toll Revenue on Michigan Limited Access Highways

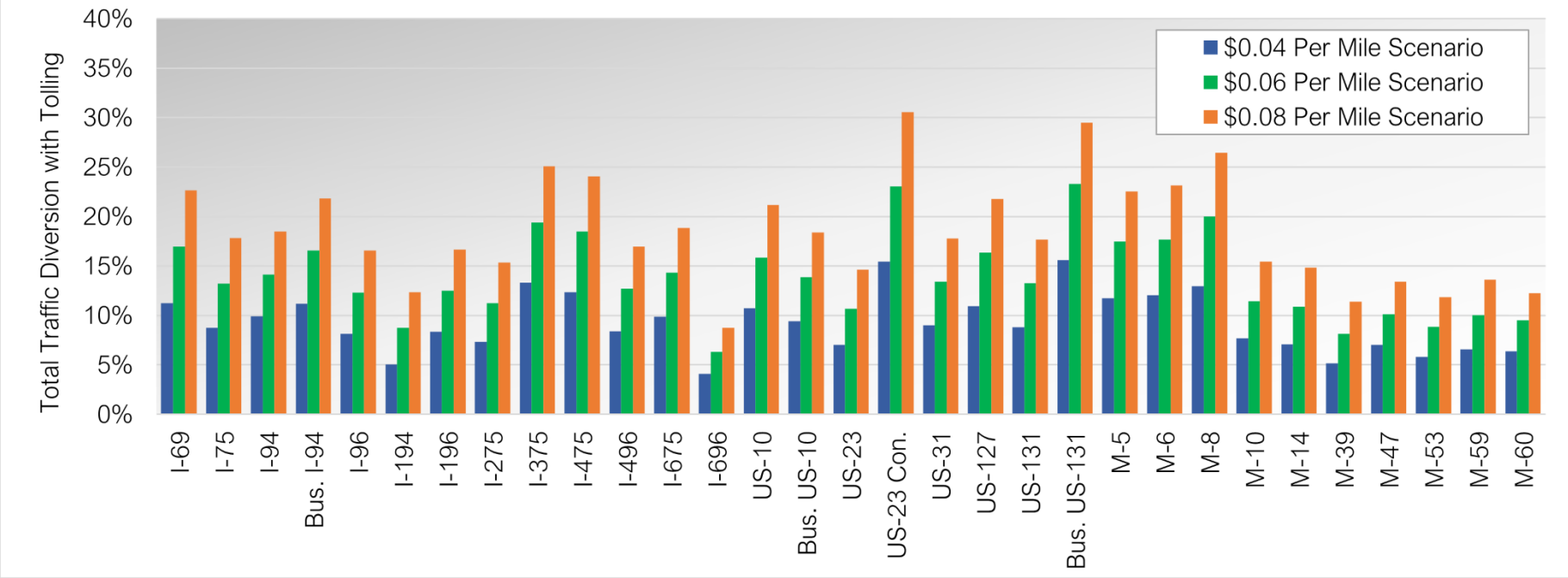


9. Tolling would cause traffic diversions

Traffic diversions from a tolled to non-tolled alternate routes are caused by drivers who determine the toll rate is not worth the benefits of traveling on a tolled route. The benefits of a tolled route compared to an alternative route can include faster travel times, more reliable travel times, or better roadway conditions. **Figure 8** shows the 2030 diversion estimates by highway. Diversion increases as toll rates increase. In addition to toll rate levels, diversion rates between different segments and routes can be impacted by other factors including the proximity, speed, and capacity of alternative routes and the sensitivity to delay by auto and truck drivers on each segment.

Average Statewide Diversion Rates:
9% ($0.04 per mile scenario)
13% ($0.06 per mile scenario)
17% ($0.08 per mile scenario)

Figure 8: Estimated 2030 Total Traffic Diversion on Michigan Limited Access Highways

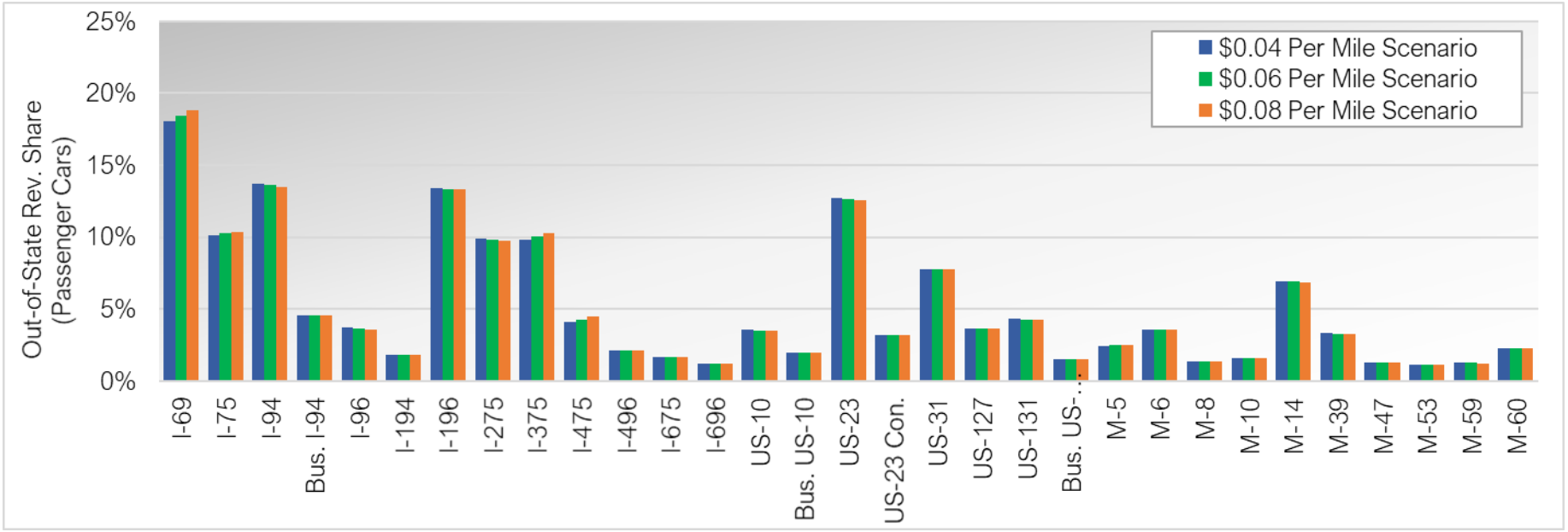


10. Michigan would not have a high out-of-state share of passenger car toll revenue

The share of passenger cars driven by Michigan residents versus out-of-state residents was estimated for the different toll rate scenarios using cellular-based and survey data from the Michigan Statewide Model. These residential shares are important to consider related to how much toll revenue would be from Michigan residents and related to payment rates associated with the video toll payment type. Owners of out-of-state vehicles without a transponder typically are less likely to pay video toll invoices than owners of in-state vehicles. Figure 9 shows the resulting out-of-state passenger car share of gross toll revenue. The shares range from 1 percent to 19 percent by route, with Interstate and U.S. routes that are at or near the Indiana, Ohio, or Ontario borders showing the highest out-of-state resident shares for passenger cars. The shares on specific routes show little to no variation between the different tolling scenarios.

Average Statewide Revenue Share:
About 9% out-of-state passenger car revenue share with little variation between scenarios.

Figure 9: Estimated 2030 Out-of-State Passenger Car Revenue Share on Michigan Limited Access Highways



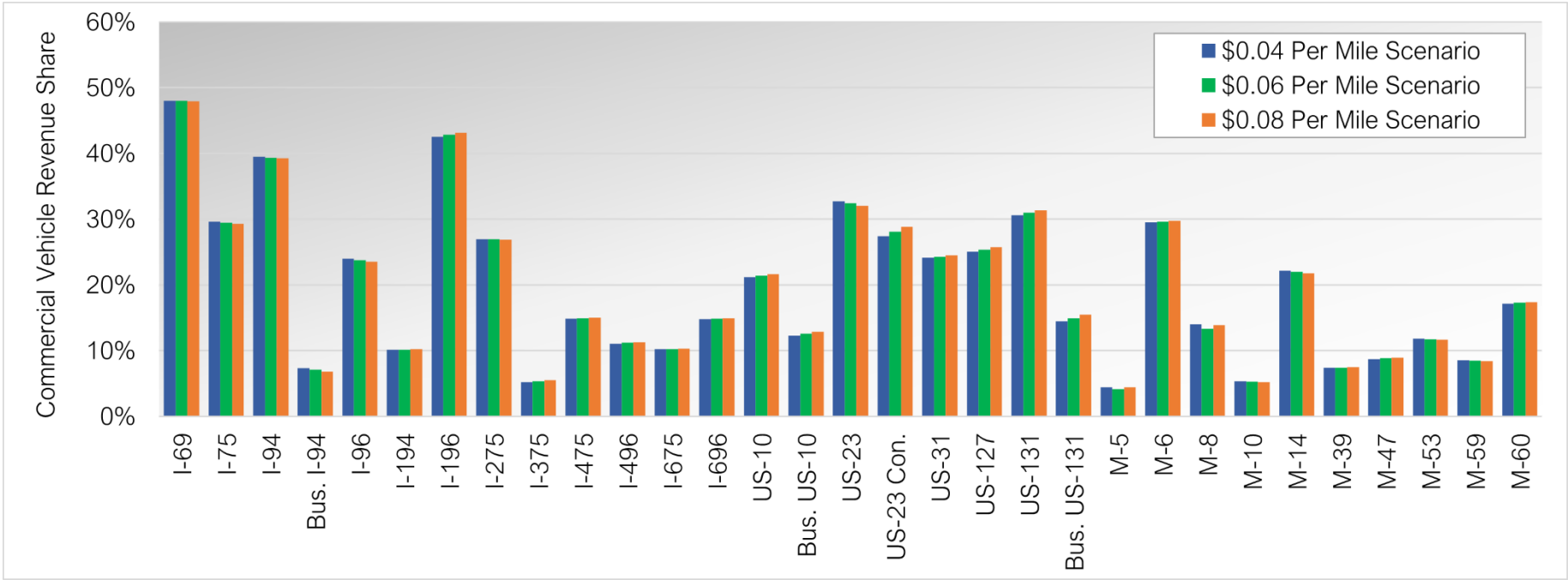
11. Passenger car and commercial vehicle toll revenue shares would vary by route

Because the share of commercial vehicle traffic varies considerably by route and because commercial vehicles were analyzed at higher toll rates compared to passenger cars (see Section 4 for toll rate assumptions), the share of passenger car versus commercial vehicle toll revenue would also vary considerably by route. Figure 10 shows the estimated commercial vehicle share of total gross revenue. The shares on a specific route show little to no variation for the three tolling scenarios. However, variation exists between different routes. I-69, I-196, and I-94 were estimated to have the highest commercial vehicle shares.

Average Statewide Commercial Vehicle Revenue:

About 31% of total revenue would be from commercial vehicles with little variation between scenarios.

Figure 10: Estimated 2030 Commercial Vehicle Share of Total Gross Revenue on Michigan Limited Access Highways



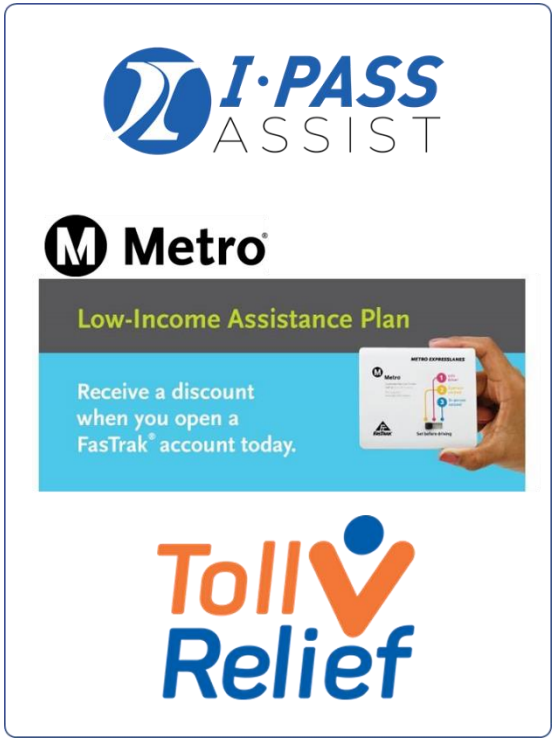
12. Discount programs could be used to mitigate impacts on local, commuter, in-state, or low-income users

For the Feasibility Analysis, the total gross toll revenue was reduced by five percent to account for potential lower toll rates or rebates for certain drivers using discount programs. For example, if $1 billion in gross toll revenue without discount programs was estimated, $50 million lower revenue was assumed resulting from discount programs.

Specific recommendations on the preferred types and guidelines of discount programs are not made in the Feasibility Analysis. More specific discussion of which discount programs may be most applicable in Michigan will be made in the Strategic Implementation Plan. A wide variety of discount programs have been applied around the country by existing toll agencies. Broadly, these can be grouped into the following:

- Frequency discounts: This type of discount allows drivers or account holders to purchase large number of trips at a per trip rate that is discounted compared to the regular toll rate. Time limits are sometimes also included as part of frequency discount programs. For example, 30 trips that must be used in a month. Frequency discounts can also include unlimited trips for a certain duration such as monthly or annually. Frequency discounts are often marketed to commuters who make regular work trips on a toll facility.
- Equity discounts and programs: Direct equity programs include offering qualified low-income users a certain number of free or reduced cost tolls and/or free or reduced cost account or transponder fees. Three examples of direct programs are shown in Figure 11. Indirect equity programs can include transit and community investments made using toll revenue. Equity-based discount programs have been less frequently implemented compared to other discount program types. However, in response to public feedback, interest from toll agencies and federal regulatory agencies in equity discount programs has been growing in recent years.

Figure 11: Examples of Direct Toll Equity Programs for Qualified Low-Income Users in Illinois, California, and Virginia



- Geographic discounts: Geographic discount programs offer discounted toll rates to customers that are residents of specific cities or regions. Home-based transponder program discounts also can be considered a proxy for geographic discount programs. In home-based transponder discount programs, a customer could register for a toll payment account in a specific state and then be eligible for discounted toll rates in that state. Home-based transponder discount programs are common in the northeastern United States. Caution should be taken when considering geographic-based discount programs as they could be the target of litigation based on interstate commerce or other laws.
- Rebate discounts: Rebate-type discount programs typically offer money back when a specific number of trips or total toll cost thresholds over a specific time are met. Sometimes the rebate levels are tiered such that drivers or account holders with higher numbers of trips or total tolls paid receive a progressively higher rebate. One rebate program that has been discussed and researched in context of more widespread tolling implementation is offering a fuel tax rebate when traveling on a toll facility. This type of discount may be challenging to implement on a widespread basis. Currently, fuel tax rebate programs have only been offered for heavy trucks on two existing toll systems. The downside of rebate discounts is they could reduce the revenue potential of tolling, or revenue to the overall transportation system in the case of fuel tax rebates. For example, if a specific amount of revenue is needed, large rebate discounts could increase the base toll rates needed to achieve the revenue objectives of a toll program.
- High occupancy vehicle (HOV) discounts: These discounts are common with tolling individual lanes or groups of lanes but are not common with tolling all lanes. HOV discounts include discounted or free travel to vehicles with a minimum number of occupants, commonly at least two or at least three occupants. The 2021 Federal Infrastructure Investment and Jobs Act included language related to requirements for HOV discounts and future tolling projects. Based on guidance from the Federal Highway Administration, these requirements only apply to facilities that operate with HOV usage requirements before tolling.
- A combination of programs: Discount programs can combine multiple program types. For example, the Virginia Department of Transportation Toll Relief Program offers 50 percent discounts on up to 10 trips per week on the Downtown and Midtown Tunnels for Norfolk or Portsmouth, Virginia residents who make $30,000 per year or less. This is a combination of frequency, equity, and geographic discounts.

13. Twenty-one different criteria were considered when selecting routes where tolling may be feasible

Two phases of feasibility screening were applied during the Feasibility Analysis as illustrated in Figure 12.

Phase 1 applied nine specific criteria listed in Table 4 to each of the 31 limited-access highway routes in the screening process. Phase 2 screening applied an analysis of financial performance with 11 other qualitative and quantitative criteria shown in Table 5. Maps illustrating data related to criteria used in the Phase 1 and Phase 2 screening are included in the Screening Criteria Data supporting document. The application of the screening criteria in Phase 1 and Phase 2 are discussed in more detail in Section 14 and Section 15, respectively.

Figure 12: Screening of Routes for Feasibility

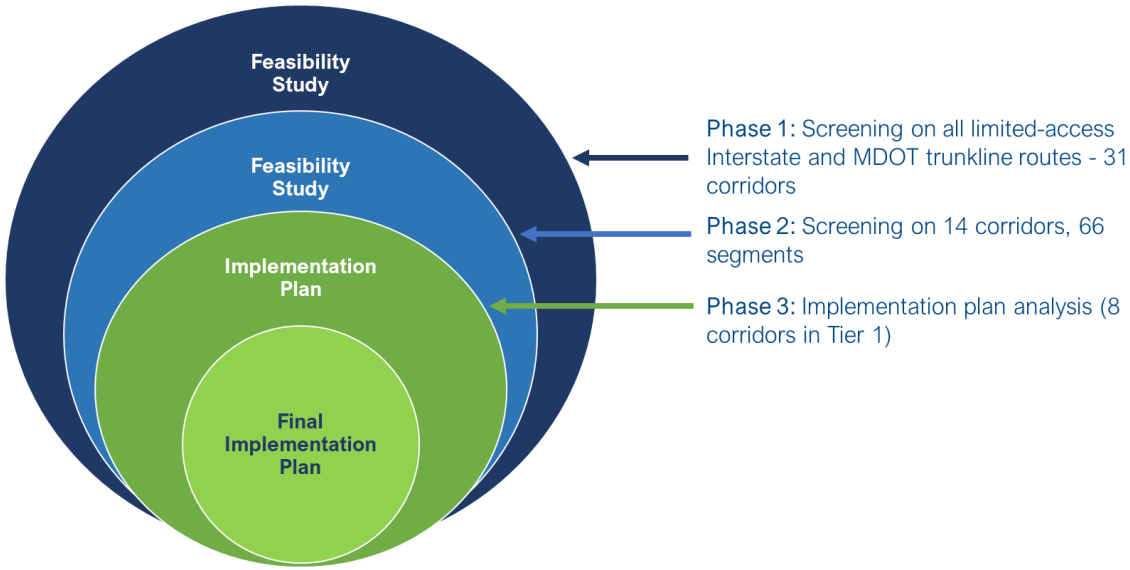


Table 4: The Nine Criteria Considered in the Phase 1 Screening

#	Criteria	Criteria Passing Definition
1	Existing limited access highway	Public Act 140 of 2020 specified that the analysis would be conducted on highways in Michigan. This was further clarified to be only limited access highways. This was definied as any roads ways in National Functional Classification data layers of 1 (Interstate) and 2 (Other Freeway) in the existing State of Michigan Trunkline Network.
2	Still limited access in the future?	Limited access highway routes that are planned to be converted to full access roadways or boulevards in the future were removed. For example, this includes I-375 in Detroit.
3	Minimum length	A minimum centerline length criteria of five miles was applied to ensure there would be a reasonable length of roadway to establish a value proposition with tolling. Routes with lengths less than five miles failed this criteria.
4	Minimum total Average Annual Daily Traffic (AADT)	A minimum 2019 total AADT of 30,000 was applied to screen routes with the strongest probability of supporting future feasibile tolled corridors. Tolled corridors with low traffic may not generate enough revenue beyond toll infrastructure capital costs and toll operation and maintenance costs to make tolling worthwhile. AADT of 30,000 was determined to be a reasonable threshold for this criteria. This criteria was applied on a segment by segment basis. If at least one segement of a route passed this criteria the entire route would pass. Routes with all segments less than 30,000 AADT failed this criteria.
5	Minimum commercial AADT	A minimum 2019 commercial AADT of 2,500 was applied to screen routes with the strongest commercial traffic profiles. This criteria was applied on a segment by segement basis. If at least one segement of a route passed this criteria the entire route would pass. Routes with all segments less than 2,500 commercial AADT failed this criteria.
6	Network connectivity	Routes that provide connections to two or more other limited access highways would pass this criteria.
7	Economic connectivity	Routes in at least one county with a total 2030 employment forecast of greater than 68 jobs per square mile based on Woods & Poole 2030 total employment forecast data passed this criteria. The 68 jobs per square mile threshold was determined by the analysis team to be a natural break point between low and medium employment density when reviewing the data. Routes in all counties with an employment forecast lower than this threshold failed this criteria.
8	Roadway Condition	A route passed this criteria if less than 50 percent of the route was reconstructed between 2015 and 2025. This is important as most federal tolling programs require an element of reconstruction in the proposed tolling segment. This was calculated by reviewing the implemented reconstruction projects included in MDOT's 2015 to 2020 five year transportation plan and the planned reconstruction projects in the 2021 to 2025 plan. Routes with more than 50 percent reconstructed failed this criteria.
9	Gross Toll Traffic and Revenue	The schedule of the Feasibility Analysis required that Phase 1 screening be started before the Phase 1 traffic and revenue forecasts for the analysis were completed. Therefore, the "Minimum total AADT" criteria listed above was used as a proxy for gross toll traffic and revenue until the actual gross toll traffic and revenue estimates were available. The initial screening results were reviewed in light of the actual traffic and revenue estimates for confirmation before finalizing the Phase 1 screening.

Table 5: The 12 Quantitative and Qualitative Criteria Considered in the Phase 2 Screening

Criteria	Notes
Financial performance	An overall toll system that was financially self-supporting was assumed for the Feasibility Analysis
Gross and net revenue	Corridors with low gross revenue may not generate enough revenue beyond toll infrastructure capital costs and toll operation and maintenance costs to make tolling worthwhile, especially as a stand-alone toll project.
Roadway condition	A tolling program could address roadway condition needs on the corridors being tolled. Also, corridors with roadway needs may be eligible for the Interstate Reconstruction and Rehabiliation Pilot Program (ISRRPP).
Bridge condition	A tolling program could address bridge condition needs on the corridors being tolled. Also, corridors with bridge needs may be eligible for the Section 129 Bridge and Tunnel Tolling Program.
Operational issues	Toll revenue could be used to fund operational improvements. Also, corridors with recurring congestion may be eligible for the Value Pricing Pilot Program (VPPP).
Safety issues	Toll revenue could be used to fund safety improvements.
Disadvantaged communities	All else the same, avoiding toll corridors near disadvantaged communities was preferable.
System continuity	All else the same, having a system of connected toll roads was perferable to disconnected toll road projects.
Interchange density	All else the same, having a lower interchange density was preferable to higher as it requires fewer toll locations and thus lowers toll collection costs.
Geographic equity	All else the same, spreading potential toll roads throughout multiple regions of Michigan was preferred over concentrating potential toll roads in fewer regions.
Outreach group feedback	Feedback received during meetings with outreach groups was considered in the analysis. This includes feedback summarized in Section 19 of this report.
Tolling Eligibility	An existing untolled corridor is eligible for tolling under federal programs only if it has roadway capital needs, bridge capital needs, or congestion.

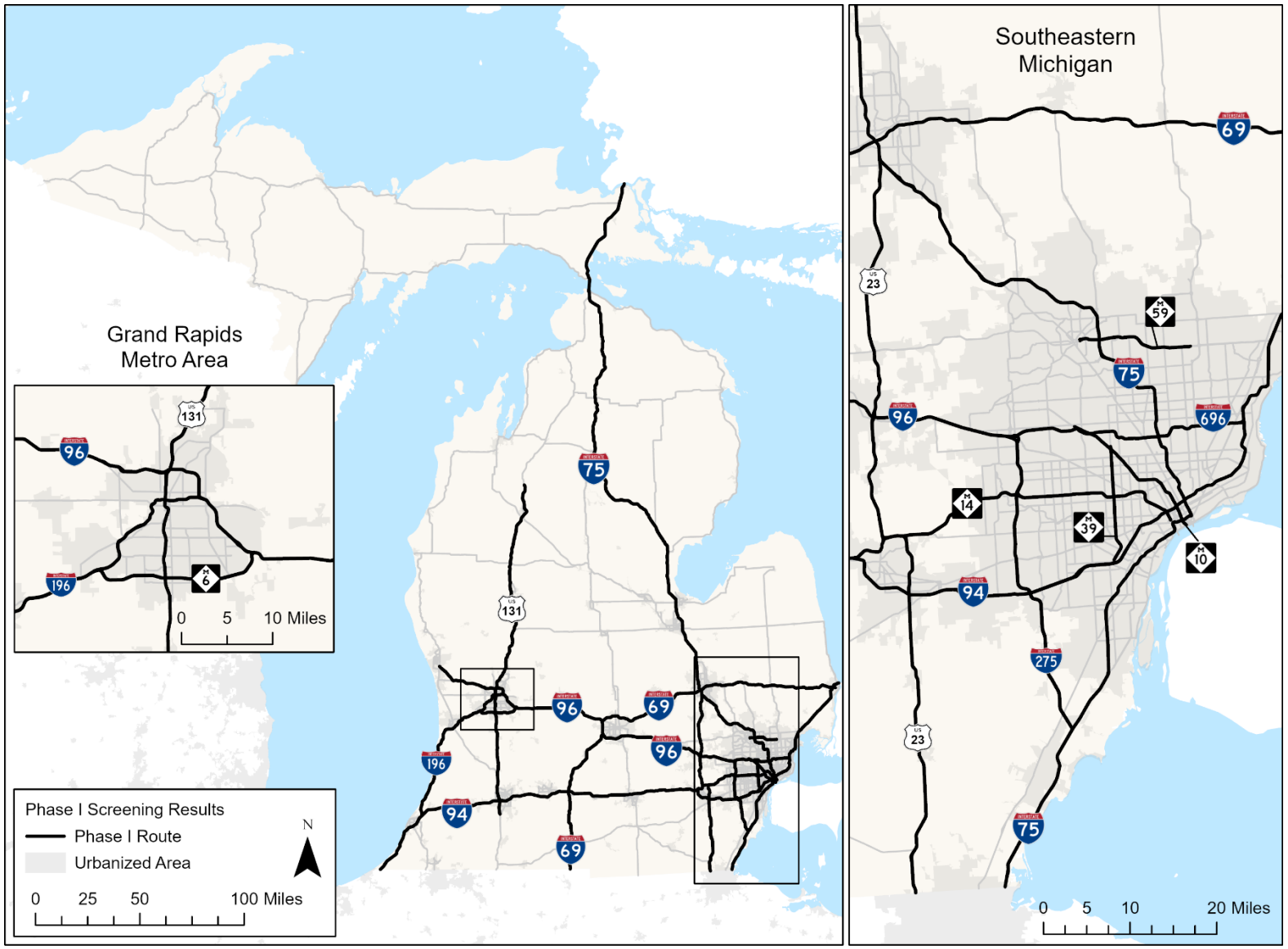
14. A Phase 1 feasibility screening process narrowed the 31 limited-access highway routes in Michigan down to 14 routes

The goal of the Phase 1 screening was to identify the limited-access highway routes in Michigan that had a higher probability of being feasible. The nine different screening criteria used in Phase 1 and what allowed a route to "pass" the criteria were previously shown in Table 4. Table 6 summarizes the Phase 1 screening results. The retained routes after Phase 1 screening are shown in Figure 13. A total of 1,538 centerline miles of highways were retained after Phase 1 screening.

Table 6: Summary of the Phase 1 Screening Process

Category	Screening Results	Number of Routes	Details
Routes that passed all nine Phase 1 screening criteria	Retained	10	I-69, I-75, I-94, I-96, I-196, US-23, US-131, M-6, M-10, and M-14
Routes that failed one of the nine Phase 1 – Case 1	Retained	3	I-275, I-696, and M-39 These routes failed the screening criteria of roadway condition which is more than 50 percent will be reconstructed between 2015 and 2025. However, these routes would still be eligible for the Value Pricing Pilot Program since they have recurring congestion.
Routes that failed one of the nine Phase 1 screening criteria – Case 2	Retained	1	M-59 This route failed the screening criteria of having a commercial AADT of at least 2,500. However, given high total AADT it was retained for further analysis.
Other Routes that failed one of the nine Phase 1 screening criteria – Case 3	Screened out	2	M-8 and M-53 M-8 did not meet the minimum length threshold in the screening. M-53 does not connect with any other limited access highways.
Routes that failed at least two of the nine Phase 1 screening criteria	Screened out	15	Bus. I-94, I-194, I-375, I-475, I-496, I-675, US-10, Bus. US-10, US-23 Connector, US-31, US-127, Bus. US-131, M-5, M-47, and M-60
Total	**Retained**	**14**	I-69, I-75, I-94, I-96, I-196, I-275, I-696, US-23, US-131, M-6, M-10, M-14, M-39, and M-59
Total	**Screened out**	**17**	Bus. I-94, I-194, I-375, I-475, I-496, I-675, US-10, Bus. US-10, US-23 Connector, US-31, US-127, Bus. US-131, M-5, M-8, M-47, M-53, and M-60

Figure 13: Phase 1 Screening Results (Used as Inputs to Phase 2 Screening)



15. The 14 routes were further screened and tiered in Phase 2 of the Feasibility Analysis to determine corridors for further study in the Implementation Plan

The overarching factor in Phase 2 screening was financial performance, specifically having a tolling system that would be financially self-supporting. This was measured using the Comparative Surplus/Shortfall metric that was described previously in Section 4. Eleven other quantitative and qualitative criteria were also considered as shown previously in Table 5. Phase 2 screening focused more on developing a feasible system for tolling and considering all criteria in combination with each other.

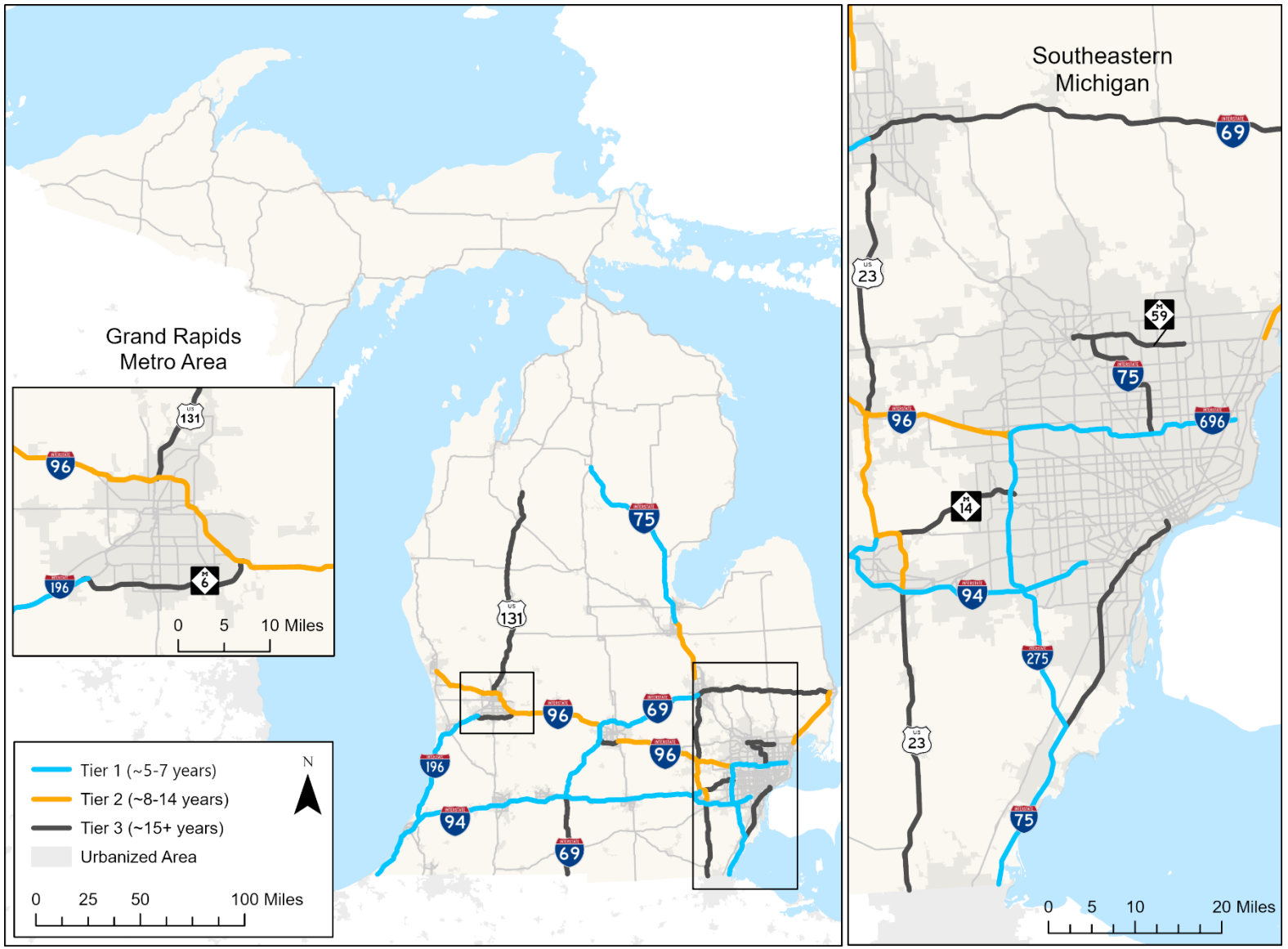
The Phase 2 screening results are shown in Figure 14. Regarding what was not included in the system, much of urban Grand Rapids and Detroit metro regions were not included due to disadvantaged community considerations, existing toll bridges (for example the Mackinac and Blue Water) were not included since they are already tolled, segments in the upper peninsula and northern lower peninsula were not included due to low gross toll revenue, and other segments were not included so the system would be financially self-supporting. More specific details on the Phase 2 screening including detailed tables of the corridors included and the Comparative Surplus/Shortfalls for the system are included in the Phase 2B Screening Results Presentation supporting document.

The corridors included in the Phase 2 resulting toll system were broken down into different "Tiers" based on their readiness for tolling deployment. The tiering focused on the financial performance, road condition, bridge condition, and geographic equity screening criteria. The Tiers are defined in Table 7.

Table 7: Phase 2 Screening Results

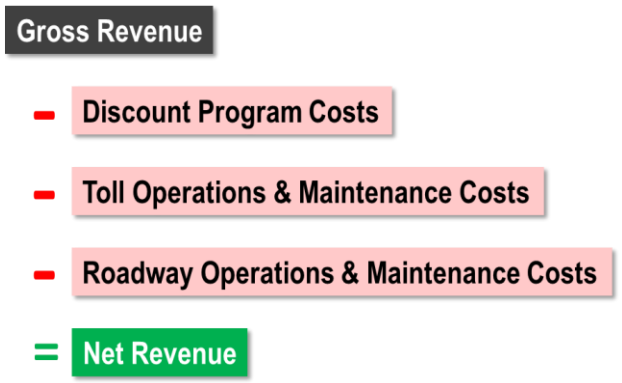
Category	Miles of Roadway	Assumed Deployment Timeframe	Notes
Tier 1	545	Around 5 to 7 years	Tier 1 will be the focus of the Strategic Implementation Plan Includes parts or all of I-69, I-75, I-94, I-196, I-275, I-696, and M-14
Tier 2	232	Around 7 to 14 years	Includes parts of I-75, I-94, I-96, US-23
Tier 3	379	Around 15 or more years	Includes parts or all of I-69, I-75, I-96, US-23, US-131, M-6, M-14, M-59
Total	1,156		

Figure 14: Phase 2 Screening Results



16. $1.0B annual net toll revenue could be generated by a 1,200-mile toll system after considering operations and maintenance and potential toll discount program costs in the Feasibility Analysis

Figure 15: The Process Used to Estimate Net Revenue for the Feasibility Analysis



The process for calculating net revenue from gross revenue used for the Feasibility Analysis is illustrated in Figure 15. As shown, discount program costs, toll operations and maintenance (O&M) costs, and roadway O&M costs are deducted from gross revenue to calculate net revenue. The net revenue would be available for uses including debt service and ongoing road and bridge improvement projects on the toll system.

During Phase 2 of the screening process, it was determined that the $0.06 per mile toll rate scenario was most feasible for further analysis. Figure 16 shows the estimated 2030 gross toll revenue breakdown by toll O&M costs, the discount program costs, roadway O&M costs, and remaining net revenue for the 14 routes retained after the Phase 1 screening. The O&M costs and discount program costs are described in more detail in Section 4 and Section 12 of this report.

The $0.04 per mile toll scenario was less feasible than the $0.06 per mile scenario because it would not result in enough net revenue relative to the operations and maintenance costs associated with tolling. The $0.08 per mile toll scenario was less feasible because the level of diversion, which was estimated to exceed 15 percent on 22 of the 31 routes as shown previously in Section 9. There was concern that the diversion associated with the $0.08 per mile scenario may be too high when considering a broad toll system without more detailed consideration of the impacts on specific routes. For these reasons the $0.06 per mile toll rate scenario was determined to be most feasible as the starting point for more detailed study in the Strategic Implementation Plan. The estimated 2030 gross toll revenue breakdown for the $0.06 per mile toll rate scenario associated with the toll system shown previously in Figure 14 is shown in Figure 17. About $1.5 billion (2020$) of gross revenue was estimated with 19 percent being used for tolling O&M, 5 percent being used for discount programs, and 9 percent being used for roadway O&M, leaving about $1.0 billion (2020$) in net toll revenue.

Figure 16: Estimated 2030 Gross Toll Revenue Breakdown for Phase 1 Resulting 14 Corridors (1,538 Centerline Miles, in 2020$)[1]

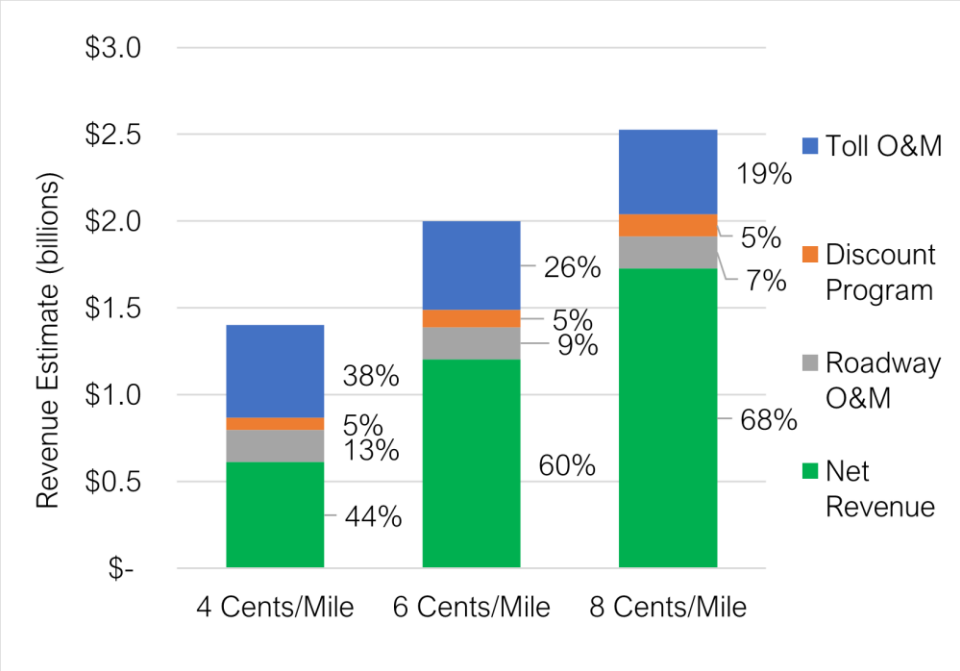
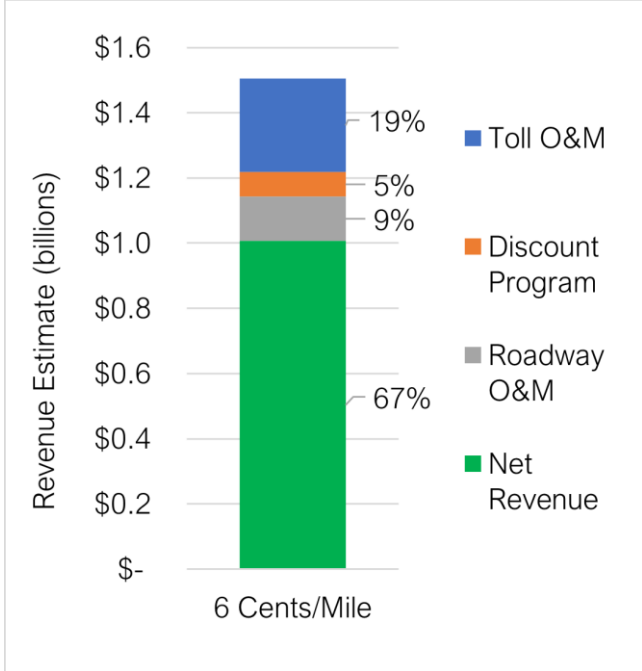


Figure 17: Estimated 2030 Gross Toll Revenue Breakdown for Phase 2 Resulting Total Tier 1, Tier 2, and Tier 3 Toll System (1,156 Centerline Miles, in 2020$)



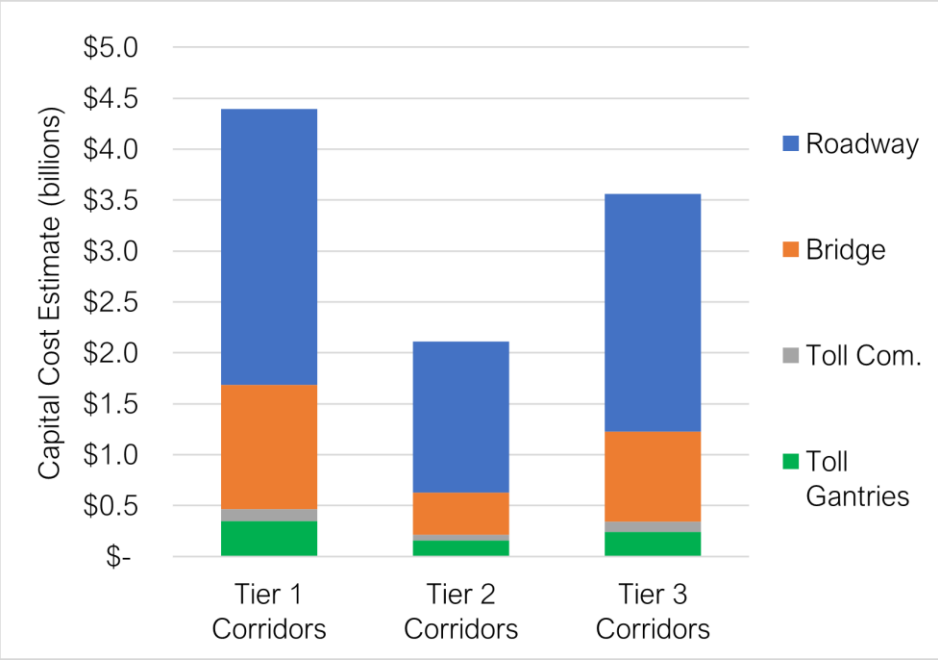
[1]Percentages may not add to 100 percent due to rounding

The net revenue estimates will be further refined in the Strategic Implementation Plan, for example by using a context sensitive cost model to estimate toll operations and maintenance (O&M) costs instead of the more conservative, broad assumptions for toll O&M costs used in this Feasibility Analysis.

17. $10.1B in total capital costs were estimated for the Feasibility Analysis Phase 2 resulting toll system

To assess how toll revenue could modernize Michigan highways, four different categories of capital cost were analyzed as part of the Feasibility Analysis: roadway, bridge, toll communications (fiber), and toll location capital costs. Assumptions related to these capital costs were described previously in Section 4. A total capital cost of about $10.1 billion was estimated for the Phase 2 resulting toll system. It was also estimated that these capital costs could be fully covered by the net toll revenue on theses corridors based on the feasibility metric described previously in Section 4, indicating a self-supporting toll system. Figure 18 shows the estimated capital costs by category and corridor Tier for the Phase 2 resulting toll system. This includes the total Tier 1, Tier 2, and Tier 3 Toll System, or about 1,156 Centerline Miles.

Figure 18: Estimated Capital Costs for the Phase 2 Resulting Toll System (in 2020$)



"Toll revenue could also free existing transportation revenue in Michigan for other highway or off-highway projects. This could extend the transportation benefits of a tolling program beyond the highways directly included in the program itself to other regions, roadway types, and transportation modes."

The Strategic Implementation Plan will include a more detailed planning-level financial analysis on the Tier 1 corridors. If excess revenue is identified as part of the Implementation Plan analysis, the funding of additional operational improvement projects may be considered such as:

- Flex Lanes or Priced Managed Lanes on mainline corridors with operational issues.
- Interchange improvements on interchanges with operational issues.
- Improvements to adjacent arterial routes that would carry additional diverted traffic from the tolled highway after tolling.
- Addressing safety and/or operational issues, for example by adding a third general purpose lane on two-lane sections of I-94 which was specifically mentioned during economic interviews.

By providing funding to cover the roadway and bridge capital costs described above as well as the roadway operations and maintenance costs considered in the net revenue calculation, toll revenue could also free existing transportation revenue in Michigan for other highway or off-highway projects. This could extend the transportation benefits of a tolling program beyond the highways directly included in the program itself to other regions, roadway types, and transportation modes. For example, if a $100M road and bridge reconstruction project is needed on a highway that is tolled, the $100M would be covered by toll revenue. If the corridor costs $1M annually to operate and maintain (O&M), that O&M cost would also be covered by toll revenue. Any existing transportation funds that had been programmed for the reconstruction project and the $1M annually being used for O&M from existing transportation funds could both be redirected to other transportation needs.

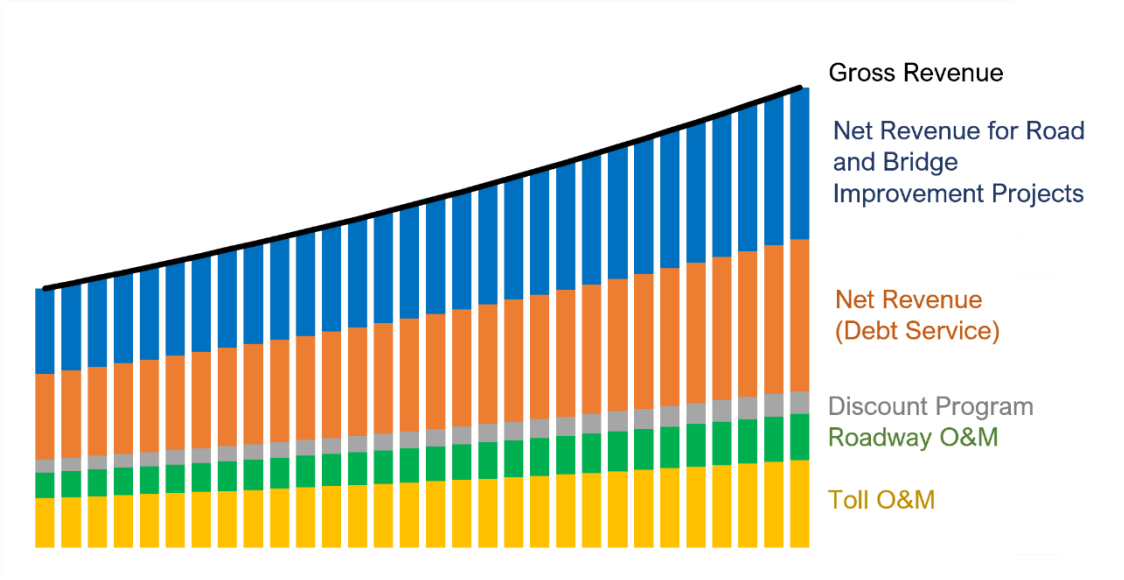
18. Tolling could provide funding and financing opportunities for modernizing the transportation network and improving mobility in Michigan

Tolling can provide an ongoing funding stream that could support a financially stable highway system in Michigan. The revenue would provide a funding source that can be leveraged through initial debt financings to make large, up-front capital investments. Tolling could also provide a dedicated revenue stream to provide proactive operations and preventative maintenance, potential net revenue for road and bridge improvement projects, and a potential source for other future debt financings for future capital investments.

A net revenue analysis establishes the annual cash flows of a project and is a key input to the financial feasibility of a project. The Feasibility Analysis described in this report includes a financial evaluation criterion to compare net revenue performance with capital needs. The comparative surplus/shortfall metric (described in Section 4) was used to simulate financial feasibility for comparison purposes.

The Strategic Implementation Plan will include a more detailed simulation of financial feasibility. Financial feasibility utilizes the net revenue forecast to simulate the amount of debt the project can support through a toll revenue financing and compare it to estimated capital costs. Figure 19 shows an illustrative gross toll revenue forecast, including an example of the net revenue available to support repayment of debt.

Figure 19: Illustrative Example of Net Revenue Available for Debt Service



19. Overall, tolling could have a positive impact on Michigan's economy

Economic analysis interviews were conducted from August 2021 through February 2022 with outreach groups including researchers, business associations, tourism and economic development associations, chambers of commerce, and logistics providers. The interviews were organized into four categories that tolling could impact – geography, business costs, policy factors, and future considerations.

The feedback from the interviews was used when considering where and how tolling implementation could take effect. Additionally, key insights on public messaging were considered when planning potential engagement processes for tolling in Michigan. A full supporting document is available with more detailed findings of the interviews. In summary, the qualitative feedback gathered from outreach groups identified concerns on the impact on businesses, low-income areas, and perceived double taxation. All outreach groups also understood the need for a stable revenue stream for Michigan's roads and highways. Key themes from different organization types are provided below.

- Business Associations and Chambers of Commerce see the value in a stable transportation revenue source that will fix certain Michigan roads now and in the future. These organizations are also concerned about double taxation and additional fees that could negatively impact certain people or businesses. Rebate programs or similar relief should be considered for certain groups, including low-income drivers, for tolling to be supported.
- Logistics organizations face various transportation challenges such as travel time reliability, congestion, winter road conditions, and equipment wear and tear that tolling could improve. However, these organizations have been facing rapidly increasing costs in the past few years for their businesses. The benefits and costs should be weighed and communicated effectively.
- Modern tolling systems and improved roadways would likely have a mixed impact on tourism. There were minimal concerns on the impacts tolling would have on in-state tourism travel. However, Tourism and Economic Development organizations noted the potential of tolling being a deterrent for out-of-state tourists. Regardless, these organizations expected recovery in the medium and long-term due to improved roads and driving experience even with out-of-state tourists. The responses were mixed, as some organizations perceived having better travel time reliability with tolling as a positive for tourism due to less congestion and delays.

20. Tolling would require analysis of existing statutes and new statutes and policy

New policy and authorizing legislation can be established through direct statute(s) and administrative rules. The following list outlines the major policy elements to consider in the development of a new tolling program. The approach to these elements can potentially have operational and financial market implications so consideration should be given to industry best practices. These elements will be evaluated in more detail in the Strategic Implementation Plan.

- Tolling Authority / Governance / Rate Setting: This category considers who has the authority to toll and set toll rates. This could include MDOT, a special enterprise division or agency within MDOT, or a governmental entity independent from MDOT.
- Toll Collection / Video Billing / Information Release: This covers the ability to collect toll revenue, use cameras to collect images, and use the Secretary of State registration data to identify the vehicle owner.
- Enforcement: This category establishes ability to collect for non-payment and the enforcement process. Certain elements of the enforcement process can be delegated to administrative rules rather than legislation.
- Additional Powers: This includes options to grant special powers for the tolling entity. Examples of special powers on other existing toll agencies are debt issuance, public-private partnership (P3) arrangements, procurement, and staffing.
- Use of Revenue: This covers options to restrict how and where toll revenue can be used.
- Privacy / Data Retention: This includes options to direct the tolling entity to develop a policy or adhere to specific statute language related to privacy and data.

21. Toll-funded projects could drive the use of Michigan workers and products

One of the potential benefits of a statewide tolling program would be an increase in transportation design, construction, and operations projects throughout Michigan. Public Act 140 of 2022 directed MDOT to consider "ways to maximize the use of Michigan workers and products made in this state".

A statewide tolling program in Michigan would provide a stable funding source for transportation. This would provide transportation design, construction, and operations companies with more long-term confidence that they can continue to invest in their Michigan based employees and businesses. Natural market forces would tend to drive the use of Michigan labor, materials, and products for projects supporting a statewide Michigan tolling program, as is the case currently with MDOT and other local transportation projects.

Title 49, Part 26 of the US Code of Federal Regulations requires recipients of federal transportation funding to develop a Disadvantaged Business Enterprise (DBE) program. MDOT has established a DBE program that meets these requirements. It is the policy of MDOT to ensure that DBEs have an equal opportunity to receive and participate in contracts that use federal funds, without regard to race, color, national origin, or sex. Whichever governance structure is used for a potential tolling program in Michigan, similar policies could be required for a Michigan tolling agency that would operate a tolling program.