DRAFT

Michigan Statewide Tolling Study: Strategic Implementation Plan

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

MDOT

HNTB

CDM Smith

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Introduction and Key Findings

The elements of the Michigan Statewide Tolling Study are summarized in Figure ES-1. The *Feasibility Analysis* studied tolling on all 1,922 miles of limited-access highways in Michigan and included a screening process to determine appropriate corridors for a more detailed study in this *Strategic Implementation Plan*. The corridors studied in this *Strategic Implementation Plan* include nearly 550 miles and are made up of parts or all of I-69, I-75, I-94, I-196, I-275, I-696, and M-14 as shown in Figure ES-2. The key study findings are summarized on the bottom of this page.

Figure ES-1: Study Overview

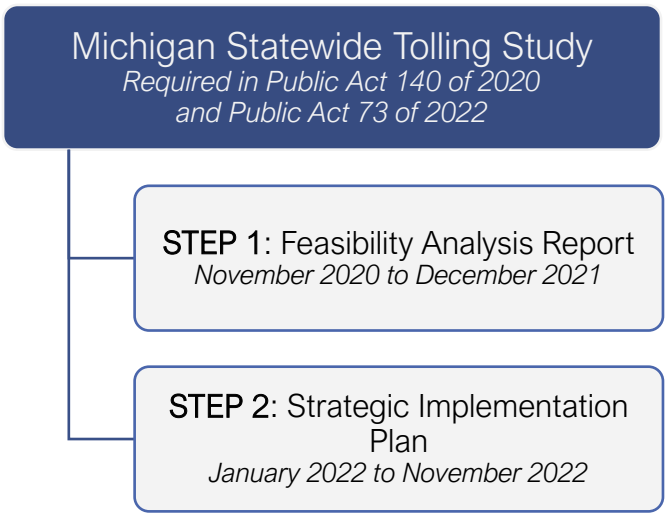


Figure ES-2: Corridors Studied in the Strategic Implementation Plan

Key Study Findings

A new statewide tolling program in Michigan could generate enough revenue to fully fund the life-cycle costs of the tolled roadways but would require a careful approach to implementation.

Tolling Implementation

Figure ES-3 includes estimated timelines of key phases to the start of tolling, which is assumed to be in 2028. The toll system in Figure ES-2 is assumed to be rolled out over five years beginning in 2028. The total system mileage by year during the rollout period is shown in Figure ES-4. Key concepts related to toll implementation are defined at the bottom of this page.

Figure ES-3: Timeline to Initial Start of Tolling

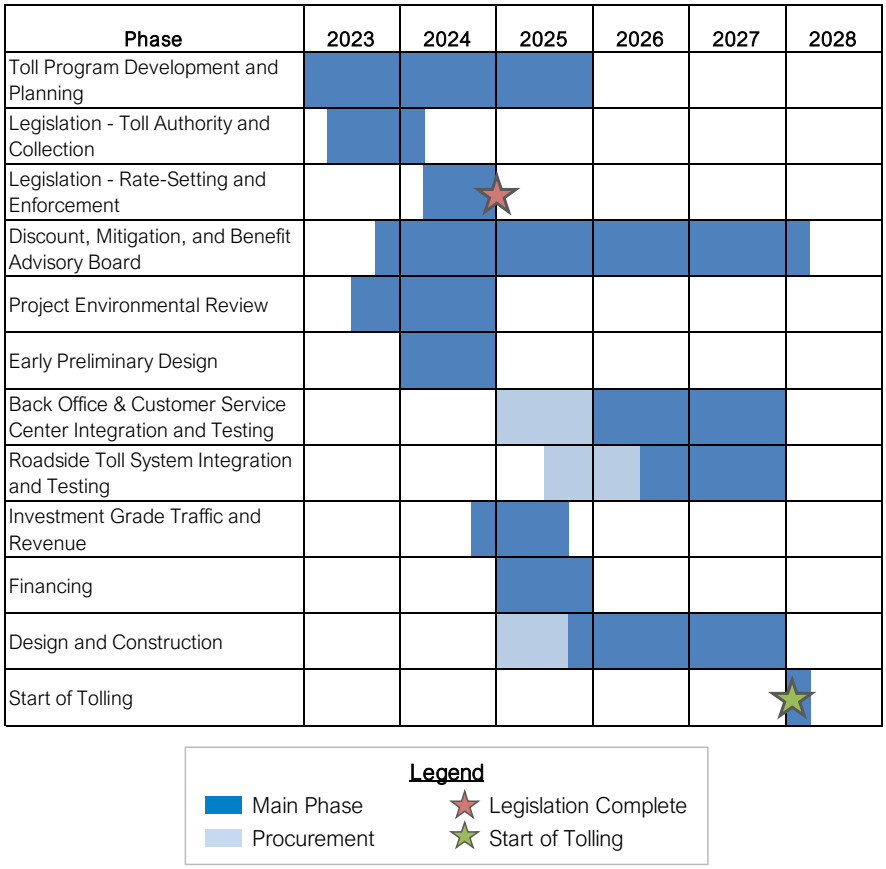
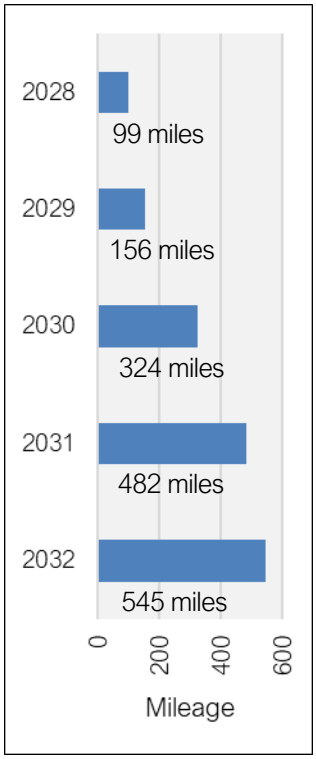


Figure ES-4: System Mileage by Year



Key Tolling Concepts

All-Electronic Tolling: Toll collection at highway speeds using modern collection technologies

Toll Location: A set of two gantries over a roadway with toll collection equipment

Roadside Toll System: All roadside and lane equipment installed at toll locations to support the toll collection process

Toll Payment Options: Using either transponders (toll devices placed on vehicle windshields) or video tolling (a bill mailed to the registered owner of a vehicle)

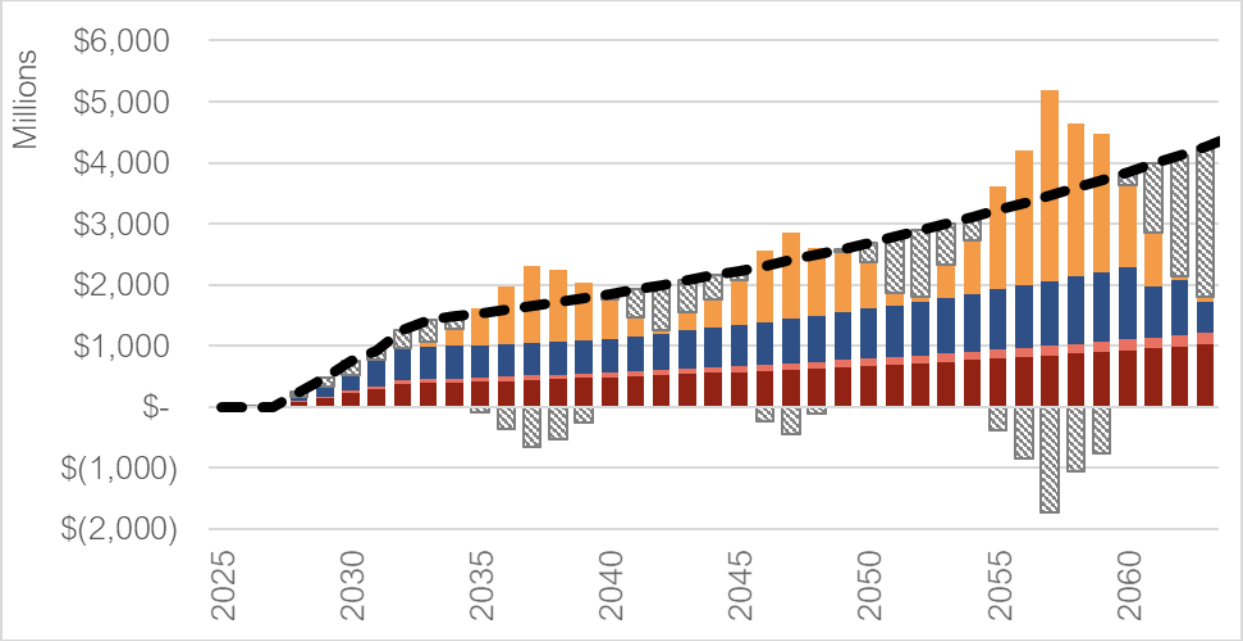
Back Office System: Software and supporting staff that process toll transactions and administer transponder-based toll accounts

Customer Service Center: Handles all customer interactions for the toll system. Includes a customer service call center

Financial Analysis

The results of the financial analysis are summarized in in Figure ES-5. This includes annual cash flows for the toll system including all program costs and revenue. Certain years are estimated to have costs above gross toll revenue resulting in a revenue shortfall in that year. However, it is estimated that shortfalls in specific years can be covered by a combination of accrued excess revenues from previous years and adjustments to the renewal and replacement program, resulting in a fully self-supported toll system.

Figure ES-5: Tolling Program Annual Cash Flows for the Nearly 550 Mile Toll System



Financial Summary

Total program cost including roadway, bridge, and toll systems from 2026 to 2031 is $8.5 billion, funded by toll revenue bonds.

After 2031, toll revenue would fund all ongoing construction, operations, and maintenance in addition to debt service on the bonds.

Governance and Policy Recommendations

Goverance Model

- A “hybrid” governance model like the Mackinac Bridge Authority.
- Independent toll rate-setting authority, the ability to sell its bonds and procure its toll-specific systems while still sharing staff and resources with MDOT.
- The ability to hire necessary tolling-specific leadership and staff as new agency staff/consultants at industry-competitive salary levels should be further evaluated.

Project Selection

- Use existing project selection processes but with considerations for revenue, financing, and tolling-related equipment and software.

Financing Structure

- Finance toll projects as a complete system.
- Support all the infrastructure, staffing, and tolling costs on the included toll roads with toll revenue.
- Provide bonding authority to the new toll agency with debt policies consistent with legacy toll systems in other states.

Toll Rate Setting

- Program indexing of toll rates to inflation or a similar metric.
- Program a specific budget (“soft cap”) for toll rate discount/mitigation/benefit programs. Costs above programmed levels would require higher base toll rates or other funding.

Environmental and Outreach

- Incorporate tolling at a programmatic level into existing planning processes.
- Perform project-level environmental clearance as required based on project characteristics.

Equity

- Establish a Toll Discount, Mitigation, and Beneift Program Advisory Committee.
- Provide a 100 percent discount to low-income users.
- Set aside one percent of gross toll revenue for local community transportation mitigations.
- Set aside 0.5 percent of gross toll revenue for local community non-transportation benefits.

Procurement

- Allow for independence in the procurement of toll-specific systems including toll collection equipment, the back-office software, and customer service.

Collection and Enforcement

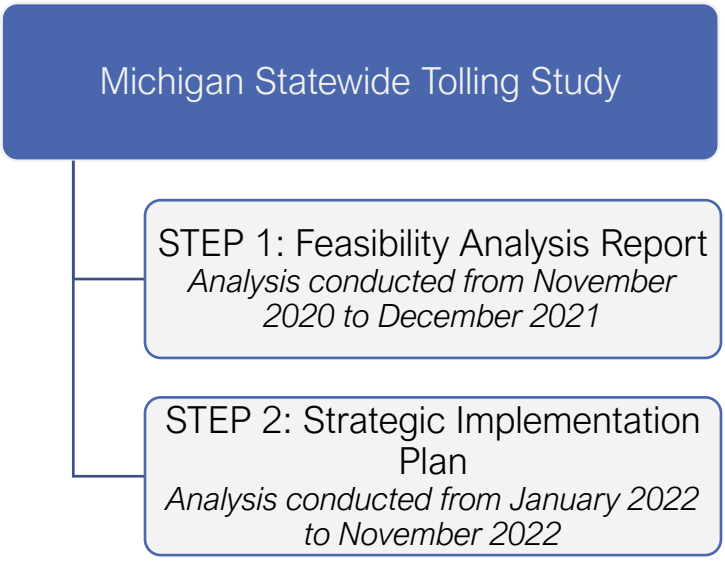
- Use current toll industry best practices with toll collection and enforcement.
- Initially consider all toll road users as customers. If they do not pay a bill, then they would be considered violators.

1. Introduction

1.1. The Michigan Statewide Tolling Study

The 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 included in Figure 1-1.

Figure 1-1: The Michigan Statewide Tolling Study



This *Strategic Implementation Plan* builds upon the results of the companion *Feasibility Analysis Report*, which is a separate document. **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.**

This *Strategic Implementation Plan* discusses the process of implementing tolling on existing highways in Michigan if a decision to move forward with tolling is made. It is important to note that the State has not decided to implement a new tolling program at the time of the issuance of this report. Such a decision would require 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 other states, including Connecticut, Indiana, Minnesota, and Wisconsin, that have completed major studies

of tolling all lanes of existing highways over the last decade. Other states, including Pennsylvania and Rhode Island[1], have completed major statewide bridge tolling studies.

A new statewide tolling program in Michigan could generate significant transportation revenue – enough to fully fund the life-cycle costs of the tolled roadways – but would be complicated and require a careful approach to implementation. Consistent with findings in other statewide tolling studies, a new tolling program in Michigan would have a wide range of technical, social, environmental, financial, and regulatory steps. This *Strategic Implementation Plan* presents tolling program implementation strategies for Michigan based on decades of tolling experience across the United States (U.S.) and reflects the latest best practices in tolling technology and operations.

1.2. Michigan Transportation Funding

1.2.1. Funding challenges

As was summarized in the *Feasibility Analysis*, tolling is one option that could help the State of Michigan address transportation funding shortfalls. To help illustrate transportation funding trends, Figure 1-2 shows a historical summary and a conceptual future estimate of Michigan transportation revenue before Act 51 distributions (in year-of-collection dollars). The figure includes registration taxes, motor fuel taxes on gasoline and diesel, interest income, other sources that contribute to the Michigan Transportation Fund, including general fund transfers and marijuana taxes, federal funding, other general fund transfers, and transportation bond sales. Figure 1-3 shows the total funding amount converted to constant 2022 dollars based on historical and estimated construction price inflation. This figure is intended to approximate the relative value of construction work that can be purchased in each year. Figure 1-3 also includes the amount of the total estimated funding to be used for debt service on outstanding transportation bonds.

[1] *Rhode Island's program was implemented and began tolling in June 2018. However, tolls were removed in September 2022 after a successful lawsuit that challenged the program's policy of only tolling commercial vehicles. Because of this, it is not recommended that the Michigan Statewide Tolling Study consider only tolling commercial vehicles.*

Figure 1-2: Michigan Transportation Revenue Before Act 51 Distributions

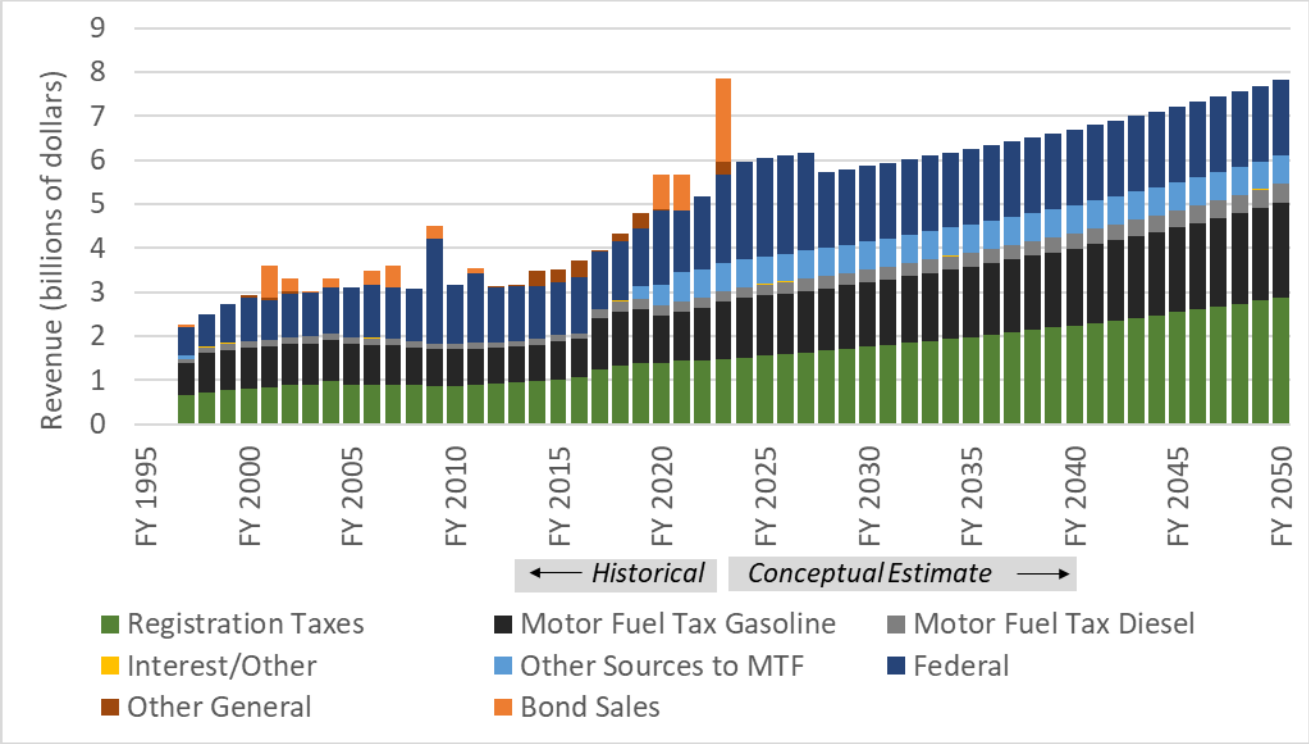


Figure 1-3: Inflation-Adjusted Michigan Transportation Revenue Before Act 51 Distributions

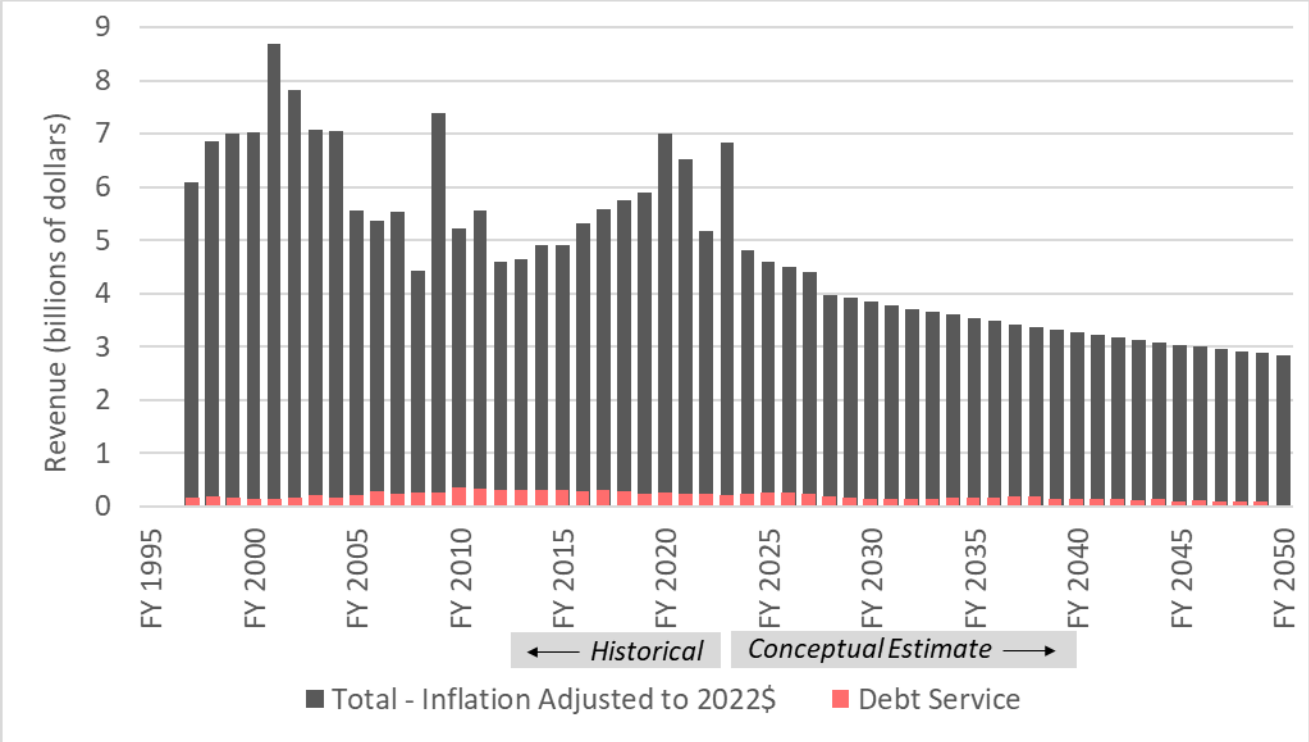


Figure 1-2 was developed based on a conceptual analysis conducted by the Michigan Tolling Study team. Future funding estimates include continuation of existing funding sources and do not consider potential future funding increases beyond those currently approved. The estimates should be considered conceptual, as uncertainty exists in future funding levels due to several factors, including the following:

- There is uncertainty in the rate of electric vehicle adoption and continued fuel economy improvements and the associated decline in fuel tax revenues. Michigan does have an electric vehicle registration surcharge and indexing of fuel taxes to inflation that are expected to offset some of these potential declines. However, the adoption of electric vehicles and overall improvements in fuel economy are still anticipated to be a challenge for transportation funding at the state level.
- There is uncertainty in federal funding for transportation beyond the current Infrastructure Investment and Jobs Act. The conceptual estimate assumes that approximate baseline federal funding from the Act would continue beyond 2026, but without the potential short-term funding increases provided by grant programs associated with the Act.

While total future funding is expected to increase over time, Figure 1-2 and Figure 1-3 illustrate that the funding increases are not anticipated to keep pace with estimated construction cost increases. When adjusting the total funding levels to construction costs, funding in recent years has been similar to levels in the early 2000s. Of particular note, recent funding has been increased by the Rebuilding Michigan bonding program. However, the estimates show funding in the late 2020s could quickly drop to levels like those experienced in the late 2000s before the American Recovery and Reinvestment Act of 2009 temporarily increased funding.

When considering construction inflation, a relative drop of two to three billion dollars per year in state transportation funding is possible by the end of the decade when compared to current levels. This is especially concerning because current pavement and bridge condition ratings in Michigan are already below goal levels. MDOT's pavement condition goal is to maintain 90 percent of pavement in good or fair condition and 2022 levels are projected to be below 80 percent[2]. MDOT's bridge condition goal is to maintain 95 percent of bridges in good or fair condition on the freeways and 85 percent off the freeways. Current 2022 levels for bridges are about 93 percent for both on and off freeways[2].

1.2.2. Transportation funding options

As described in the *Feasibility Analysis,* it is recommended that the findings of the *Feasibility Analysis* and *Strategic Implementation Plan* be considered in the context of other current and future transportation funding options available to the State of Michigan. Table 1-1 includes examples of some of these options, as well as associated opportunities and challenges.

[2] *See the MDOT Five Year Transportation Plan at https://www.michigan.gov/mdot/-/media/Project/Websites/MDOT/Programs/Planning/Five-Year-Transportation-Program/2023-2027-5YTP.pdf?rev=e10c3924b8ed40be8582c67ef0ed5dfe&hash=A78EF669EFE7C5616EE9DBC3DE6915EA*

Table 1-1: Examples of Future Transportation Funding Options for Michigan

Funding Option	Opportunities	Challenges
General Sales Tax	• Inflation-resistant because sales tax revenue increases as the prices of goods increases • Sales tax is more progressive than direct user fees	• Sales tax revenue would not necessarily increase with increases in road usage • 2015 Proposal 1, which included sales tax for transportation, did not pass
Vehicle Registration Fee Increase and Reform	• Reform can be justified due to ambiguities between different vehicle classes in current fee structure	• Registration fees were increased in 2017 funding package • Already have electric vehicle and hybrid surcharges and a proxy for inflation increases through the ad valorem tax
Fuel Tax Increase	• Low cost to collect • Significant short-term revenue potential	• Long-term funding concerns • Fuel prices are volatile. It would be difficult to increase fuel taxes during a time of high fuel prices
Tolling	• Stable user fee • Could make significant improvements up-front with toll bonding • Can be considered a mileage-based user fee system on specific roads • Communications infrastructure associated with tolling could be leveraged for connected vehicle applications	• Tolling existing capacity is not common in U.S. • Technological advancement has reduced toll collection costs, but they are still higher than other revenue options
Mileage Based User Fees / Vehicle Miles Traveled Fees/ Road User Charges	• Federal funding is available for pilot programs • Small-scale systems are in place in three states • Could be applied to commercial vehicles using existing mileage logs	• Significant technological, administrative, and cost challenges for widespread adoption beyond freeways for passenger cars • Revenues on existing small-scale systems are capped, commonly at the levels of electric and hybrid registration surcharges • Requires interoperability agreements to collect fees from vehicles registered in other states
Monetization of Assets	• Could include monetization of fiber optic cable capacity, right-of-way for solar or wind, or rest area commercialization	• Requires federal legal and/or policy changes • Small revenue potential compared to that from other options
Increased General Fund Transfers	• General fund transfers to transportation have become more common at the national and state levels over the last two decades	• Makes transportation planning and programing more difficult, as it subjects transportation funding to budgetary cycles

Several Michigan-based and national research organizations have developed analyses related to transportation funding options at the state and federal levels. Some examples of reports that have been identified during the *Feasibility Analysis* and *Strategic Implementation Plan* are listed below. The Michigan Tolling Study team does not necessarily advocate for the analysis or resulting recommendations in these reports; rather, they are intended to provide references to additional supporting information related to study outreach findings included in Section 3.

- *Michigan's Road Forward: Replacing the Fuel Tax with Mileage-Based User Fees* (2022) by the Mackinac Center, a Michigan-based public policy research organization, and Reason Foundation, a national public policy research organization.
- *A Practical Analysis of a National VMT Tax System* (2021) by the American Transportation Research Institute, a national trucking industry research organization.
- *A Financial Analysis of Toll System Revenue: Who Pays & Who Benefits* (2020) by the American Transportation Research Institute;
- *Interstate 2.0: Modernizing the Interstate Highway System Via Toll Finance* (2013) by the Reason Foundation.

1.2.3. Toll credits

One advantage of a new toll system in Michigan would be the generation of significant toll credits for the State. Toll credits are a federal transportation funding accounting mechanism that rewards states that invest toll revenue on capital projects that would otherwise require federal-aid support. States are eligible to earn credits based on the amount of toll revenue used by a toll agency for building, improving, or rehabilitating highways, bridges, or tunnels that serve interstate commerce. Toll credits do not generate additional money. Instead, they can be used as a "soft match" substitute for the non-federal share of most highway and public transportation projects with toll credits and federal money, which increases flexibility and the opportunity to optimize the federal and state share on projects. The upfront capital investment of rehabilitating Michigan's roadways with a tolling program will generate billions of toll credits as construction contracts fund the roadway improvements and generate toll credits.

These toll credits would provide the State of Michigan significant flexibility when funding future trunkline and local agency projects, potentially allowing - for example - local agencies in the vicinity of a toll road to use toll credits toward the local match on a federal-aid project as opposed to using local funds for the match.

The Infrastructure Investment and Jobs Act has established a pilot program to allow the purchase or sale of toll credits between states. If another state was short on local match to draw down their federal funding, toll credits could be sold to that state, subject to the limits of the pilot program. For example, if another state was $10 million short on their match to draw down $40 million in federal funds, Michigan could sell them $20 million in toll credits for $10 million in cash. Michigan would add $10 million in transportation funding, and the other state would be able to obtain all of their federal funding using the $20 million of toll credits as local match. This innovative process would need to be further evaluated with the U.S. Department of Transportation, including through an application process as specified for the pilot program.

1.3. An Innovative "Brownfield" Tolling Approach

Nearly all toll roads in the U.S. where all lanes are tolled were originally implemented as newly constructed "greenfield" toll road projects. Less than one percent of toll mileage has been implemented on previously un-tolled highways, which is known as "brownfield" tolling. A Greenfield project includes the construction of a new route or corridor, while the term Brownfield refers to an existing roadway asset. **Thus, the major toll program on existing highways that is being considered in this study is an innovative approach to tolling.** This is also the case in other peer states near Michigan. Considering the 1,255 miles of toll roads near Michigan shown in Table 1-2, only the ten-mile Illinois-390 toll road began tolling as a brownfield toll project. A picture of this facility is shown in Figure 1-4.

Table 1-2: Toll All Lanes Toll Road Systems Near Michigan

Agency	Facility	Interstate Routes	Opening Year(s)[1]	Miles
Illinois State Toll Highway Authority	Jane Addams Memorial Tollway	I-39/I-90	1958	76
	Tri-State Tollway	I-80/I-94/ I-294	1958	77
	Ronald Reagan Memorial Tollway	I-88	1958, 1974	96
	Veterans Memorial Tollway	I-355	1989, 2007	30
	IL-390	N/A	2016-2017	10
Indiana Toll Road Concession Company	Indiana Toll Road	I-80	1956	157
Ohio Turnpike and Infrastructure Commission	Ohio Turnpike	I-80	1954-1955	241
Pennsylvania Turnpike Commission	Pennsylvania Turnpike	I-70/I-76/ I-276	1940, 1950-1951, 1954	360
	Northeastern Extension	I-476	1955, 1957	110
	Mon-Fayette Expressway	N/A	2000-2002, 2008, 2011-2012	48
	Toll 376	I-376	1991-1992	18
	Turnpike 66	N/A	1993	13
	Turnpike 576	N/A	2006, 2021	19
Total Miles:				**1,255**
Percent of Total Miles that Opened as Brownfield Toll Roads (IL-390):				**0.8%**

[1]Years indicate the start of tolling on the original facility section and the start of tolling on any facility extensions, if applicable

It can be inferred by the "Opening Year(s)" and "Miles" columns in Table 1-2 that over 80 percent of toll road mileage in peer states near Michigan originally opened before or soon after the passage of the Federal-Aid Highway Act of 1956. This Act created the Interstate Highway

System and provided funding from federal fuel taxes and other sources. The Michigan Turnpike Authority was formed in 1951 to study a toll road system in Michigan, including parts of what are now I-94 and I-75. Unlike similar toll agencies in other states, however, this Authority did not move forward with tolling before the Federal-Aid Highway Act of 1956. The Michigan toll system being studied now in this *Strategic Implementation Plan*, as well as existing toll roads in other peer states, is illustrated in Figure 1-5.

Figure 1-4: Illinois-390 Toll Road

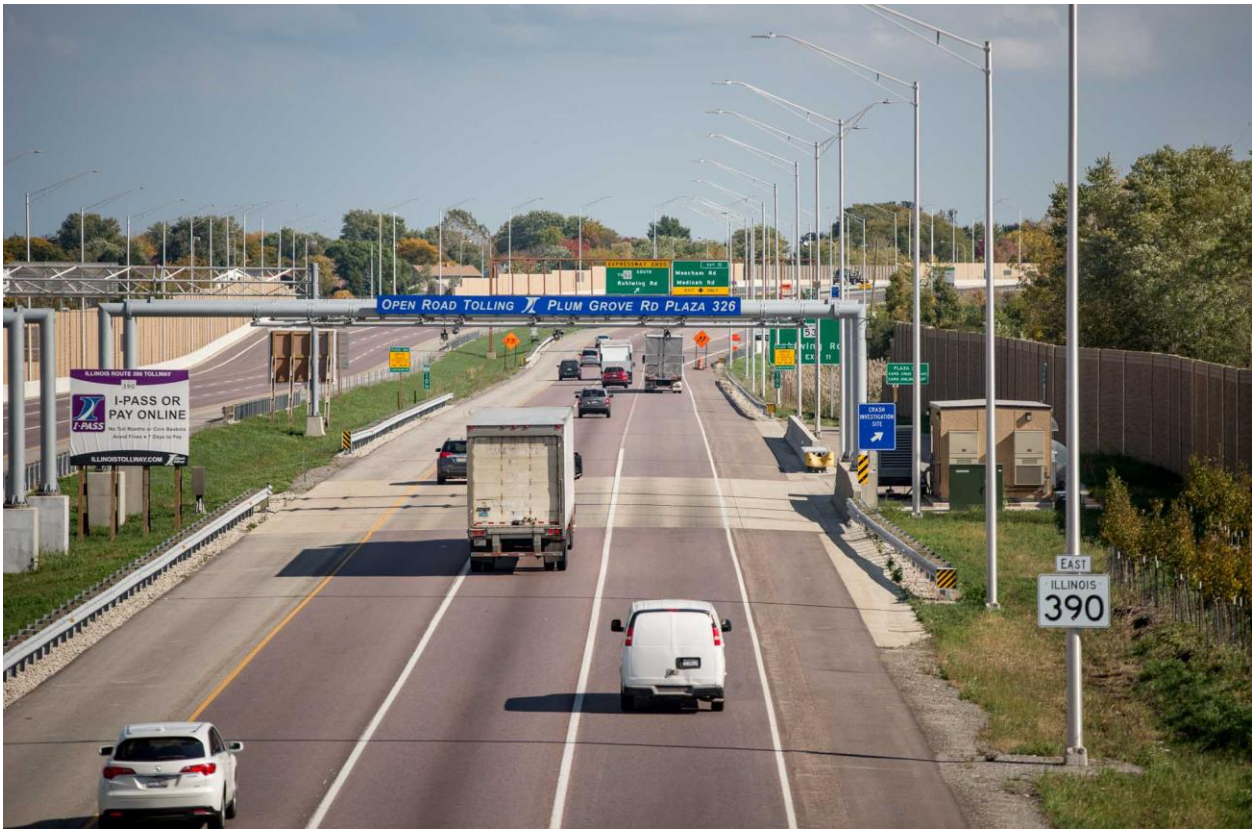


Figure 1-5: Existing Toll Roads in Nearby States and Michigan Toll Road System being Studied

1.4. Existing Tolling in Michigan

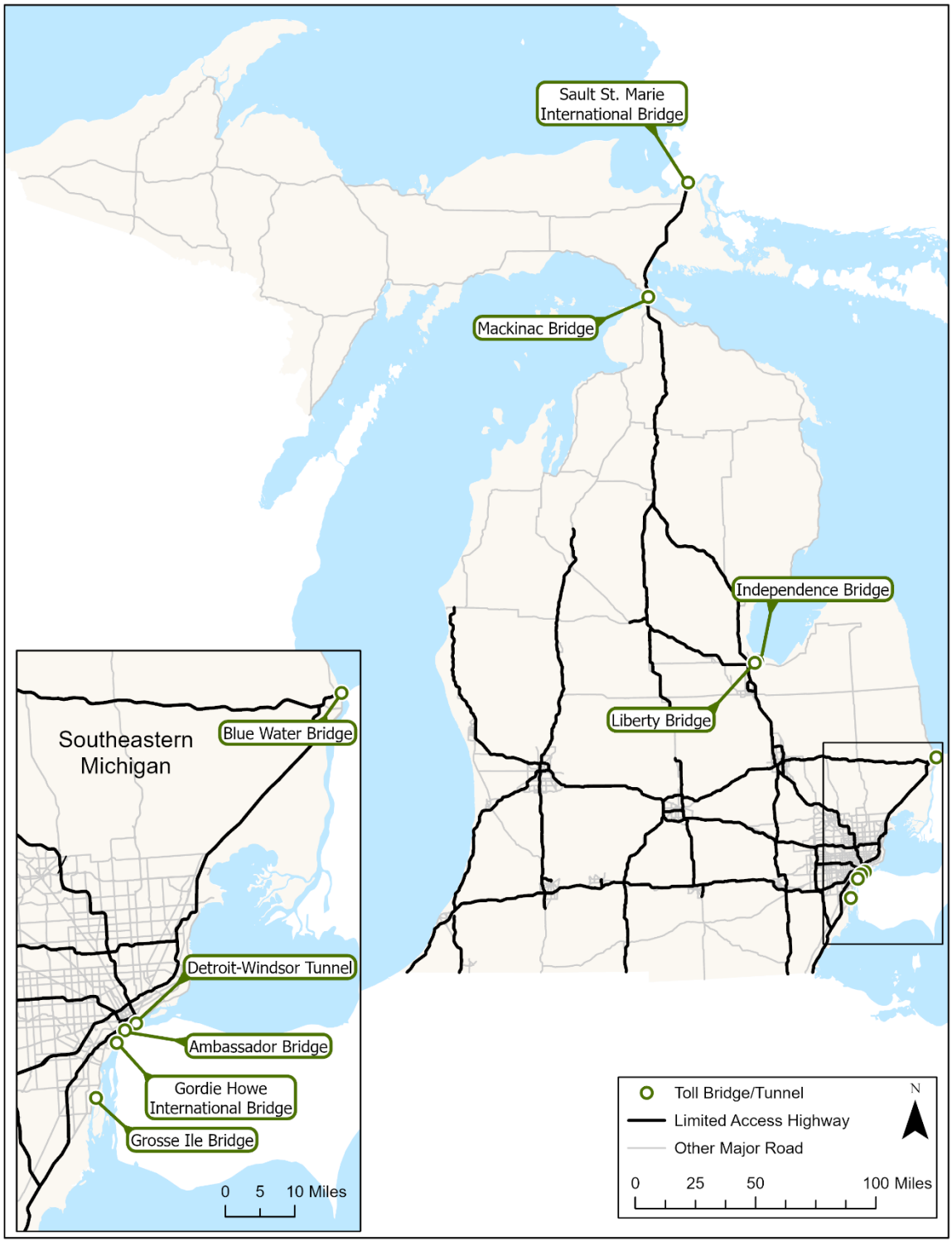
While Michigan does not currently have any toll roads, it does have eight toll bridges and one toll tunnel either already in operation or approved to start tolling in the future, as shown in Table 1-3 and mapped in Figure 1-6. Five of these facilities form international border crossings between Michigan and Ontario, Canada. One facility is the iconic Mackinac Bridge, and the other three facilities are bridges serving primarily local traffic in Bay City and Grosse Ile. **While there are differences between road and bridge/tunnel tolling, important lessons can be learned from the operation of the existing toll facilities in Michigan, especially related to the governance and policy recommendations included in this report.**

Table 1-3: Michigan Toll Facilities Already in Operation or Approved to Start Tolling

Facility	Tolling Status	Michigan Agency	Canadian Agency
Ambassador Bridge	Open	Detroit International Bridge Company	Canadian Transit Company
Blue Water Bridge	Open	Michigan Department of Transportation	Federal Bridge Corporation Limited
Detroit-Windsor Tunnel	Open	Detroit-Windsor Tunnel Company, LLC	Windsor Detroit Borderlink Limited
Gordie Howe International Bridge	In Development	The International Authority/Windsor-Detroit Bridge Authority	
Grosse Ile Toll Bridge	Open	Grosse Ile Bridge Company	N/A
Independence Bridge	In Development	Bay City Bridge Partners	N/A
Sault Ste. Marie International Bridge	Open	Sault Ste. Marie Bridge Authority (partnership between Federal Bridge Corporation Limited and Michigan Department of Transportation)	
Liberty Bridge	In Development[1]	Bay City Bridge Partners	N/A
Mackinac Bridge	Open	Mackinac Bridge Authority	N/A

[1]In development as of the writing of this report. Expected to start tolling in early 2023

Figure 1-6: Michigan Toll Facilities Already in Operation or Approved to Start Tolling in the Future



1.5. Screening Process

This *Strategic Implementation Plan* report includes analysis of nearly 550 miles of highways in Michigan that could be part of the first deployment of a statewide tolling program. These specific corridors were selected for analysis using a screening process that is discussed in detail in the *Feasibility Analysis*. A summary of the screening process is as follows:

- Phase 1 Screening: All 31 Interstate, US-Route, and M-Route highways in Michigan comprising a total of 1,922 centerline miles were analyzed and screened based on nine specific pass-or-fail criteria related to tolling viability.
- Phase 2 Screening: The 14 routes (1,538 centerline miles) that were retained for further study after the Phase 1 screening were analyzed and screened based on financial performance and eleven other quantitative and qualitative criteria. Phase 2 screening focused on developing a feasible system for tolling, considering all criteria in combination. One key element of this screening was, as much as possible, to avoid including corridors adjacent to environmental justice communities, including in Detroit and Grand Rapids.
- Tiering Process: The result of the Phase 2 screening was an assumed 1,156-centerline-mile, financially self-supported system of toll roads. The system was broken into three tiers based on readiness for tolling deployment:
    1. Tier 1 (545 centerline miles) has an assumed deployment timeframe of five-seven years
    2. Tier 2 (232 centerline miles) has an assumed deployment timeframe of seven-14 years, and
    3. Tier 3 (379 centerline miles) has an assumed deployment timeframe of 15 or more years.
- Tier 1: Tier 1 highways were included in this *Strategic Implementation Plan* analysis, with the intent of focusing on nearer-term strategies.

Two different federal tolling programs were assumed for the *Strategic Implementation Plan* analysis: the Section 129 Bridge Program and the Value Pricing Pilot Program (VPPP). These programs are described in more detail in Section 5.1.

Tier 1 corridors studied in the *Strategic Implementation Plan* are identified in Table 1-4 and shown geographically in Figure 1-7. The I-75 South and I-275 South results are combined in the analysis results included in this report since they are adjacent shorter segments, and both assumed the Section 129 Bridge Program for tolling. Results for the I-94 corridor were split into six segments to support the phasing analysis, as it was assumed that construction and tolling on I-94 would occur over time. This is further detailed in the overall phasing assumptions included in Section 9.2. Major operational and safety improvements are assumed as part of this study on I-94 Segment 2 (entire segment) and part of Segment 3 (between Sprinkle Road and I-69), with an additional general-purpose lane in each direction, and on part of I-94 Segment 6 (between M-14 and US-23), with a flex lane in each direction.

Table 1-4: Tier 1 Corridors

Corridor and Segment		From	To	Centerline Miles	Existing Lane Miles	Future Lane Miles	Toll Program[1]
I-69	-	I-94	I-75	94.2	401.7	401.7	Bridge
I-75	North	I-675	US-127	94.3	409.2	409.2	Bridge
I-75[2]	South	Ohio border	I-275	20.3	122.4	122.4	Bridge
I-94	S1	Indiana border	I-196	34.1	204.7	204.7	Bridge
	S2	I-196	US-131	39.4	157.6	236.5	Bridge
	S3	US-131	I-69	34.3	146.1	214.8	Bridge
	S4	I-69	US-127 (NE of Jackson)	33.7	134.8	134.8	Bridge
	S5	US-127 (NE of Jackson)	M-14	29.1	126.4	126.4	Bridge
	S6	M-14	US-24/ Telegraph Road	30.9	169.7	186.8	Bridge
I-196	-	I-94	M-6	64.2	256.9	256.9	Bridge
I-275	North	Eureka Road	I-96/I-275/ I-696/M-5	22.2	148.7	147.8	VPPP
I-275[2]	South	I-75	Eureka Road	14.6	83.0	83.0	Bridge
I-696	-	I-96/I-275/ I-696/M-5	I-94	28.9	211.3	211.3	VPPP
M-14	-	I-94	West US-23/ M-14 split	4.7	18.8	18.8	Bridge
Total				544.9	2,591.3	2,755.1	

[1]Section 129 Bridge Program or Value Pricing Pilot Program (VPPP)

[2]I-75 South and I-275 South were combined in the analysis since they are connecting and have the same toll program assumption.

Figure 1-7: Tier 1 Corridors

2. Governance and Policy Strategies

If Michigan decides to move forward with road tolling in the future, determining the appropriate governance model and developing policy and regulatory approaches to tolling is critical to the success of the program. Governance and policy considerations and recommendations are included in Table 2-1.

Table 2-1: Summary of Governance and Policy Recommendations

Category	Recommendations for Potential New Michigan Tolling Program	Plan Section to Refer to for More Detail
Governance Model	• A "hybrid" governance model like the Mackinac Bridge Authority, with independent toll rate-setting authority and the ability of the entity to sell its own bonds and procure its own toll-specific systems. • The ability to share staff resources and collaborate with MDOT • The ability to hire necessary tolling-specific leadership and staff and/or consultants at industry-competitive salary levels • This recommended entity is referred to as the new Michigan Toll Authority in this document	Section 2.1
Project Selection	• Mimic MDOT's existing project selection processes, with considerations for revenue, financing, and tolling-related equipment and software	Section 4.2
Financing Structure	• Finance all toll projects in Michigan as a pooled revenue system with no pledge or allocation of existing state revenues • Support all the roadway and bridge infrastructure, staffing, and tolling costs on the included highways using toll revenue • Provide bonding authority, with independent debt policies like those of legacy toll systems in other states, to the new Michigan Toll Authority	Section 9
Toll Rate-Setting	• Program indexing of toll rates to inflation or a similar metric • Program a specific budget for toll rate discount programs. Costs above the programmed levels would require higher base toll rates or other funding sources	Sections 2.2, 2.3
Environmental and Outreach	• Incorporate tolling at a programmatic level into existing planning processes, including those related to environmental considerations and outreach • Perform project-level environmental clearance, as is required based on project characteristics	Section 4

Category	Recommendations for Potential New Michigan Tolling Program	Plan Section to Refer to for More Detail
Equity	• Establish a Toll Discount, Mitigation, and Benefit Program Advisory Committee that would provide guidance on the development of equity programs • Provide a 100 percent discount to eligible and enrolled low-income users • Set aside one percent of gross toll revenue for local community transportation mitigation efforts • Set aside 0.5 percent of gross toll revenue for local community non-transportation benefits	Section 2.3
Procurement	• Allow for independence in the procurement of toll-specific systems, including toll collection equipment, the back-office software, and customer service	Section 2.5
Collection and Enforcement	• Use toll industry collection and enforcement best practices • Initially consider all toll road users to be customers. Customers become violators after invoices are unpaid	Section 7.2

2.1. Governance Models

Table 2-2 shows characteristics of three alternative governance model structures that were considered as part of this study: a toll agency as a division within a department of transportation, a toll agency independent from a department of transportation, and a hybrid of these two categories. **As shown previously in Table 2-1, the hybrid governance model is recommended so the new Michigan Toll Authority can provide independent toll rate-setting authority, sell its own bonds, and procure its own toll-specific systems while still being able to share staff resources and collaborate with MDOT.**

Table 2-2: Toll Agency Governance Model Categories with Examples and Typical Characteristics[1]

Category	Division within DOT	Hybrid	Independent of DOT
Number in U.S.[2]	7	7	31
Michigan Examples	Blue Water Bridge	Mackinac Bridge, International Bridge	All other Michigan toll agencies
National Examples	Florida Turnpike Enterprise, Minnesota DOT, Washington State DOT	Maryland Transportation Authority, North Carolina Turnpike Authority	Illinois State Toll Highway Authority, Ohio Turnpike and Infrastructure Commisssion, Pennsylvania Turnpike Commission
Leadership Structure	Toll Division Director reports to DOT Director	Toll Agency Executive Director reports to Toll Agency Board of Directors	

Category	Division within DOT	Hybrid	Independent of DOT
Board Structure	N/A	Typically five to ten members are appointed by Governor and/or Legislature, following requirements ensuring diverse political representation. DOT Director is commonly an ex-officio member	
Interactions with Elected Officials	Through existing DOT processes	Through existing DOT processes and/or Board of Directors	Through Board of Directors
Opportunities Related to a New Toll System in Michigan	• Leverage existing DOT capabilities • Less redundancy in leadership and staff between DOT and toll agency	• Staff sharing between toll agency and DOT is common • More independence in toll rate-setting and financing authority compared to being within DOT • More opportunities for specialized tolling staff	• Faster project delivery • Most like public utility model • Most independence in toll rate-setting and financing authority
Challenges Related to a New Toll System in Michigan	• May limit financing options for toll system • Specialized needs of toll project delivery can be difficult to structure within DOT • More difficult to have independence in toll rate-setting and financing authority, which is preferred by bond rating agencies	• May present challenges for paying market salaries for toll professionals if relying on MDOT staff for project delivery • May be challenging for the public to understand the difference between MDOT and the Tolling Agency	• Difficult to transfer roads currently owned by MDOT to a new independent toll agency • Regional independent authorities would not work as part of statewide system financing

[1]There are often gray areas when categorizing different agencies. Thus, typical, or most common information is shown

[2]The number of existing toll-all-lanes toll road agencies in the U.S. by governance model category is shown

Different project delivery models are possible for the implementation of the toll system within the governance models described here, for example, when project designers and builders are contracted separately by the project owner (design-bid-build), when designers and builders are under the same contract with the project owner (design-build), or when a public agency shares some or all management responsibilities for a project for a specific period of time with a private entity (public-private partnerships).

A public-private partnership for a toll road typically includes operations and maintenance and can be structured so the private entity collects tolls and revenue. A public-private partnership can also be structured so the private entity takes on the risk that toll revenue may be lower than anticipated. The Michigan Tolling Study team does not recommend the transfer of revenue risk to a private entity if a public-private partnership for a new toll system in Michigan was explored. This is because tolling would be added to existing highways, which minimizes the risks of revenue being lower than anticipated. Rather, it is recommended that if Michigan pursues a public private partnership to support development of a potential toll road system it retains the revenue risk. Michigan would then also retain the potential toll revenue upside (revenues being higher than anticipated) associated with brownfield tolling projects. In addition to potential revenue upside, non-revenue risk public-private partnerships also have lower risk of default and a greater likelihood of operational continuity. These recommendations would likely be different if new tolled highways were being considered in Michigan (i.e., greenfield tolling project) where traffic levels would be less predictable.

2.2. Toll Rate Policy

Determining the appropriate toll rate levels and structure when considering brownfield tolling is important for balancing traffic diversion off the toll facility and meeting toll revenue objectives, among other factors. Diversions from tolled to non-tolled alternate routes are caused by drivers determining paying a toll is not worth the benefits of traveling on a tolled route. Higher toll rates generally raise additional revenue but lead to higher diversion rates.

Table 2-3 summarizes toll rate recommendations for different classes, payment types, and the peak period. Peak period rates are assumed for the Value Pricing Pilot Program Corridors. This program requires different toll rates to be charged by time of day as is described in more detail in Section 5.1.3. The transponder and video tolling payment types are defined and described in more detail in Section 7.2.1.

Table 2-3: Toll Rate Recommendations

Category	Passenger Car (Classes 4 or lower[1])	Single-Unit Trucks (Classes 5 to 7[1])	Multi-Unit Trucks (Classes 8 or higher[1])
Multipliers Applied to Base Passenger Car, Transponder Toll Rate			
Class Multipliers	1.0x	1.5x	4.0x
Video Tolling Multipliers	1.5x additional multiplier (same for all classes)		
Peak Period[2] Multipliers	1.25x additional multiplier (same for all classes)		
Example Toll Rates for $1.00 Passenger Car Transponder Toll Rate			
Base Transponder	$1.00	$1.50	$4.00
Base Video Tolling	$1.50	$2.25	$6.00
Peak Transponder[2]	$1.25	$1.88	$5.00
Peak Video Tolling[2]	$1.88	$2.81	$7.50

[1]Vehicle classes correspond to the Federal Highway Administration vehicle classification system. See https://www.fhwa.dot.gov/policyinformation/tmguide/tmg_2013/vehicle-types.cfm

[2]Peak rates only apply to Value Pricing Pilot Program Corridors, which are discussed in more detail in Section 5.1.3

The transponder per-mile toll rates assumed for the Michigan Tier 1 toll system in this analysis are shown in Table 2-4 and compared with other Midwestern toll systems. A key recommendation for toll rates that is common in the industry is the annual indexing of toll rates to some measure of inflation.

Figure 2-1. Example Toll Rate Sign for Riverlink Toll Bridges

A six-cents-per-mile passenger car (PC) transponder toll rate in 2020 dollars was determined to be sufficient to support all the tolling, roadway, and bridge infrastructure costs to roll out the initial tolling system between 2028-2032. In 2033, a one-time toll rate increase above inflation to 6.5 cents per mile was assumed (PC transponder rate in 2020 dollars) to support the program financing objectives. The assumed Michigan toll rates are like PC rates in Illinois, Indiana, and Ohio and lower than rates in Pennsylvania. Assumed multi-unit commercial vehicle (CV) toll rates are higher than those in Ohio but significantly lower than the Illinois, Indiana, and Pennsylvania rates.

Table 2-4: Comparison of Transponder Toll Rates in Cents Per Mile for Michigan and Peer States

Toll Road System	Miles	Rate as of	Passenger Car Rate	Multi-Unit Commercial Vehicle Rate	Annual Toll Rate Indexing?
Illinois Tollway	289	2021	6.7	56.3	Commercial Vehicles only
Indiana Toll Road	157	2021	7.7	41.4	Yes
Ohio Turnpike	241	2021	5.8	17.9	No[1]
Pennsylvania Turnpike	567	2021	13.0	62.2	Yes[2]
Michigan Tier 1 System	**545**	**2020**	**6 to 6.5 [3]**	**24 to 26**	**Yes**

[1]Annual increases from 2015-2023 to support bonding program; no increases are currently scheduled beyond 2023
[2]Some type of increase every year since 2009, but the increase is not necessarily applied to all classes or payment types. Increases are expected to continue in the future
[3]Six cents per mile (in 2020 dollars) was assumed for 2028 to 2032 and 6.5 cents per mile (in 2020 dollars) was assumed beginning in 2033

The assumed per-mile toll rates were translated to assumed toll rates at specific toll locations using a mileage corresponding to each location. The approach for setting toll locations is explained in more detail in Section 5.2.

The setting of toll rates on a toll road can be like rate-setting for public utility companies, for example, in the electric and water industries. Base rates and rate changes are tied to operations, maintenance, and capital program needs.

2.3. Recommended Toll Discount, Mitigation, and Benefit Programs

A Toll Discount, Mitigation, and Benefit Program is recommended to help mitigate the impacts of diversion and impacts on environmental justice communities with tolling. It is also recommended that a specific budget be set for toll rate discount programs. Costs above budgeted levels would require increases to base toll rates or supplemental funding from other sources. Having a "soft cap" on these programs as opposed to open-ended programs would be viewed favorably by bond rating agencies and financial market participants because the financial risk from discounts would be capped.

Estimates of the costs of these programs are included in this section in 2022 dollars and year-of-expenditure dollars. More information on the conversion of costs to year-of-expenditure dollars is provided in Section 9.3.

2.3.1. Advisory Committee

The formation of a Toll Discount, Mitigation, and Benefit Program Advisory Committee is recommended to help guide state planning for the toll system, project-level environmental reviews, and the development of tolling legislation and policy. The Advisory Committee could provide recommendations and/or develop policies related to the use of Toll Discount, Mitigation, and Benefit Program funding.

An example of this type of committee is the Virginia Toll Relief Steering Committee. This volunteer advisory group formed by the Virginia Deportment of Transportation provides technical guidance and assistance with overall Toll Relief Program development. The committee includes representatives from state and local agencies and not-for-profit organizations. The committee has assisted with the program's implementation and rollout.

2.3.2. Income-based Toll Discount Program

An income-based discount on tolls of 100 percent is recommended for the tolling program to help impacted people and communities and to address environmental justice concerns for low-income individuals. It is recommended to explore basing eligibility for the Toll Discount Program on an existing program such as the MI Bridges program. The MI Bridges program is administered by the Michigan Department of Health and Human

Figure 2-2. Virginia Toll Relief Equity Discount Program

Services and helps low-income people apply for assistance, including healthcare coverage, food and cash assistance, child development and care, and emergency relief. Eligibility for the MI Bridges program is based on a variety of factors, including income and assets.

To allow potential impacts of the Toll Discount Program to be quantified in this study, 1.5 times the federal poverty level was used as a proxy for eligibility in the analysis, and the 100 percent toll discount was assumed. It was also assumed that half of the individuals eligible for the program would enroll. These assumptions were included in the traffic and revenue analysis model used in the *Strategic Implementation Plan*. The traffic and revenue analysis results are described in more detail in Section 6.

Based on these assumptions, it was estimated that about five percent of overall transactions would receive the 100 percent (free toll) equity-based discount through the Toll Discount Program. The estimated annual cost of the Toll Discount Program is listed below for 2032, the first year of operation of the full Tier 1 system, and 2067, 40 years after the initial start of tolling for Tier 1:

- 2032 cost: Approximately $30 million in 2022 dollars or $40 million in year-of-expenditure dollars
- 2067 cost: Approximately $40 million in 2022 dollars or $150 million in year-of-expenditure dollars

This entire discount program would be funded by toll revenue and is included in the financial analysis included in this *Strategic Implementation Plan.* Lower levels of discounts would have a lower estimated program cost.

2.3.3. Local Community Transportation Mitigation Program

It is recommended that one percent of gross toll revenue be set aside for a Local Community Transportation Mitigation Program. The purpose of local transportation mitigation would be to help address the local impacts of tolling highways due to diversions off highways onto local roads. Eligibility for this program would be determined based on identifying local roads expected to receive diverted traffic, and toll revenue would be transferred to the agencies administering those roads for investment.

The revenue could be used for a wide variety of transportation improvements, including traffic signal timing, intersection or interchange improvements, and multimodal initiatives, such as park-and-rides and commuter buses. It is recommended that transit providers be included in the development of the Local Community Transportation Mitigation Program. Based on the location of the Tier 1 corridors included in the *Strategic Implementation Plan*, this could include TheRide in Ann Arbor, SMART in Detroit and the metro area, the Michigan Flyer motorcoach service, and the Regional Transit Authority of Southeast Michigan, as well as the D2A2 Detroit to Ann Arbor pilot express bus service.

The estimated annual cost of the Local Community Transportation Mitigation Program is listed below for 2032 and 2067:

- 2032 annual cost: Approximately $9 million in 2022 dollars or $12 million in year-of-expenditure dollars

- 2067 annual cost: Approximately $11 million in 2022 dollars or $43 million in year-of-expenditure dollars

This entire mitigation program would be funded by toll revenue and is included in the financial analysis included in this *Strategic Implementation Plan.*

2.3.4. Local Community Non-Transportation Benefit Program

It is recommended that one-half-of-one percent (0.5 percent) of gross toll revenue be set aside for a Local Community Non-Transportation Benefit Program. The purpose of this program would be to help address local, indirect impacts of tolling highways. Eligibility for this program would be based on the proximity of communities relative to tolling corridors and outreach to the potential communities.

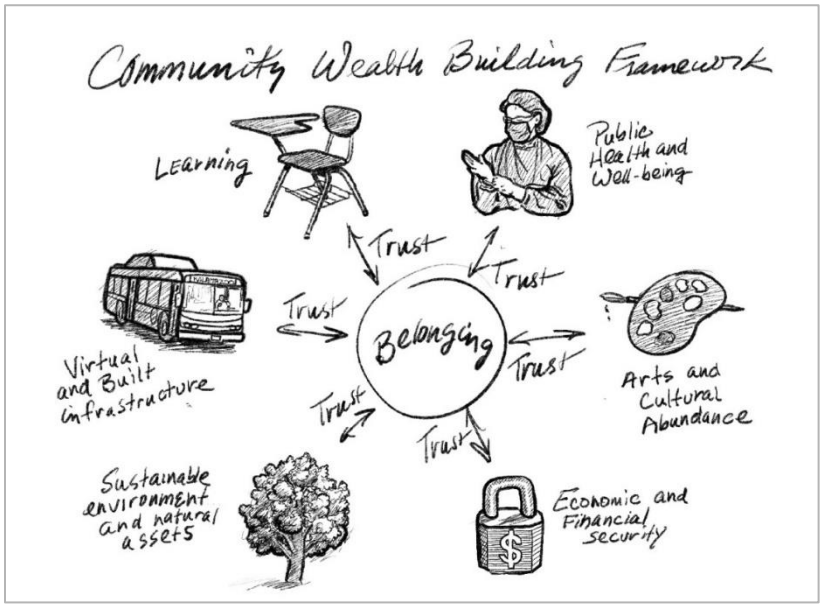
The revenue could be used for a wide variety of non-transportation benefits. A helpful summary of different potential examples of these types of programs was provided by the Michigan Municipal League related to its Community Wealth-Building Framework. Elements of this framework are provided in Figure 2-3. For example, using the program for parks and trails would support sustainable environmental and natural assets, public health, and wellbeing.

The estimated annual cost of the Local Community Non-Transportation Benefit Program is listed below for 2032 and 2067, which are two important years in the financial analysis:

- 2032 cost: About $5 million in 2022 dollars or $6 million in year-of-expenditure dollars
- 2067 cost: About $6 million in 2022 dollars or $22 million in year-of-expenditure dollars

This entire benefit program would be funded by toll revenue and is included in the financial analysis included in this *Strategic Implementation Plan.*

Figure 2-3: Michigan Municipal League Community Wealth-Building Framework



Source: Michigan Municipal League, "The Road to Community Wealth", see https://www.mml.org/the-road-to-community-wealth/

2.4. Other Potential Toll Discount, Mitigation, and Benefit Programs

Other toll discount, mitigation, and benefit programs are possible beyond those recommended in the previous sub-sections. The *Feasibility Analysis* included an overview of different types of programs based on:

- Frequency
- Equity
- Geography
- Rebates
- High-occupancy vehicles
- A combination of various programs

Discount, Mitigation, and Benefit programs are not common among the peer toll roads in Illinois, Indiana, Ohio, and Pennsylvania. Considering other toll-all-lanes toll roads, frequency- and geographic-based discount programs are more common among toll agencies in the northeastern U.S. However, most of these programs were established many years after initial tolling on their systems once the user base and revenue potential had become well-established.

It is recommended that the impacts of other potential toll discount, mitigation, and benefit programs be considered in more detail in future project-level tolling analysis. The most significant consideration with any potential program is to balance total program costs with financial objectives of the toll system. **Additional discount, mitigation, and benefit programs, widening program eligibility, or increasing the level of discounts for the toll system analyzed in this *Strategic Implementation Plan* would require higher base toll rates or funding from other sources in order to achieve the same roadway and bridge investment objectives.**

2.5. Procurement

As indicated previously, it is recommended that policies allow for independence in the procurement of toll-specific systems, including toll collection equipment, back-office software, and customer service center operations. A lesson learned from existing toll agencies is that the toll-specific software, collection systems, and unique security requirements with modern toll collection processes benefit from having the toll agency itself lead the procurement process. This has also been the case in Michigan in procurements of new toll systems for the Blue Water, International, and Mackinac Bridges. **Based on these lessons learned, it is recommended that the new Michigan Toll Authority lead the procurement for toll systems, with the Michigan Department of Technology, Management, and Budget supporting the procurement as a key stakeholder and information technology resource.**

Specifically related to the toll collection systems, the best approach is to have one procurement for the toll equipment and system on the roadway and another procurement for the combined back-office system and customer service center. These different systems are discussed in more detail in Section 7.2.

2.6. Addressing Local Transportation Revenue Needs

The funding challenges discussed previously in Section 1.2 impact both state-level and local transportation funding. The tolling program described in this *Strategic Implementation Plan* would generally help address state-level funding challenges. Addressing some of the local funding challenges could be considered through the following options:

- The recommended Local Community Transportation Mitigation Program described in Section 2.3.3 could help local agencies with their transportation needs on roadways that receive diverted traffic from tolled highways.
- Changes to Michigan's Act 51 funding distributions could be considered in combination with a new highway tolling system. The changes could redirect a higher share of overall existing funding to local governments since state funding would be supported by toll revenue.
- More options for local counties and municipalities to raise transportation revenue could be provided as part of broad transportation funding legislation that also includes tolling. Currently, the main mechanism available to local governments to fund transportation is through property taxes. Options used in other states include local fuel taxes and local sales taxes for transportation. Michigan currently redirects more state transportation revenue to local governments than other Midwestern states, partially because local governments have fewer options to raise their own revenue.
- Toll credits, as summarized previously in Section 1.2.3, could be used by the State as a "soft match" to support local transportation projects receiving federal funding. This could reduce the local burden related to federal match requirements.

2.7. Future Vehicle Technology

Creating tolling policies that are flexible to accommodate future advances in connected and autonomous vehicle (CAV) technology, as well as electric vehicle technology is recommended. Related to CAVs, toll roads have communications systems in place to support toll collection and commonly have more funding available for intelligent transportation systems to improve operations than other highways. This creates synergies with connected vehicle technologies that are being studied by existing toll road agencies and toll road developers. Related to electric vehicles, vehicle charging infrastructure is an important consideration for all transportation agencies in the near future, including for toll agencies.

For example, among existing toll roads in peer states, the Pennsylvania DOT and Pennsylvania Turnpike Commission are exploring CAV technology. The PennSTART facility that is under construction and expected to open in 2024 will allow for the testing of toll equipment and CAV technology, among other uses. This builds on previous Pennsylvania DOT and Pennsylvania Turnpike Commission efforts, including the 2017 *Connected and Automated Vehicles (CAV) Program Roadmap*. In the document, the relationship between tolling and CAV technology is discussed, and the Pennsylvania Turnpike Commission supports "the transmission of tolling information to CVs, such as suggested lanes for expedited servicing or specific tolling methods and in the future for toll payment services."

In Michigan, Public Act 179 of 2022 was signed into law on July 2022 to allow MDOT to designate automated vehicle roadway lanes. Per the legislation, "'Automated vehicle roadway system' means a hardware and software system that is capable of facilitating the deployment and operation of an automated motor vehicle…" that is "traveling through a segment of roadway that has been designated for such a system by the state transportation department." The law also authorizes user fees for automated lane use and enforcement.

Cavnue, LLC is exploring connecting Detroit and Ann Arbor with experimental vehicle-to-infrastructure services that allow for a mix of connected and autonomous vehicles, traditional transit vehicles, shared mobility, and freight and personal vehicles. It is recommended that potential synergies between this project and the Michigan Tolling Study on I-94 between Detroit and Ann Arbor continue to be explored, especially if the decision to move forward with tolling is made by the Legislature.

3. Communications Strategies

3.1. Communications Plan

The results of the *Feasibility Analysis* and *Strategic Implementation Plan* were transmitted to the Michigan Legislature by January 31, 2023, as required in Public Act 73 of 2022. MDOT will continue education and outreach to the Governor, Legislators, and statewide outreach groups that have been involved in the *Michigan Statewide Tolling Study*. Further communication with additional groups and the public across the state will be evaluated in concert with the Legislature and Governor based on feedback from the study's findings. The following sections summarize the legislative and outreach communication that has occurred throughout the development of the study.

3.2. Legislative and Stakeholder Outreach Findings

Throughout the *Feasibility Analysis* and *Strategic Implementation Plan* development, the Michigan Tolling Study team met with identified groups to provide input on both reports. These meetings have occurred and will continue in four phases:

- Education – Winter/Spring 2021,
- Qualitative economic interviews – Summer/Fall 2021,
- Feedback on preliminary results – Winter/Spring 2022, and
- Sharing *Strategic Implementation Plan* results – Fall/Winter 2022-2023.

Highlights from these meetings are summarized in the following sections. More detailed findings from the qualitative economic interviews can be found in the *Feasibility Analysis.*

3.2.1. Legislative findings

The Michigan Tolling Study team met with members of the Michigan Legislature, House Policy staff, and Senate Policy staff to share findings and receive input. The key areas of discussion and feedback surrounded funding and revenue, toll technology, traffic effects, and operations. The feedback is categorized below:

Funding and Revenue

- Funding questions were focused primarily on considering vehicle miles traveled and road user charge mechanisms as alternatives to tolling. Tolling is a road user charging system for all vehicles on highways using the technology available today.
- There was discussion about what tolling revenue could fund in regard to non-transportation purposes and about displacing existing funds.
- Feedback on geographic equity and how tolls could impact the Detroit and Grand Rapids metropolitan areas was shared. Section 2.3 addresses the proposed Toll Discount, Mitigation, and Benefit Program.

Toll Technology

- In regard to the setup of tolling technology, there was discussion about how new infrastructure options could be interoperable between states. Refer to page 6 of the *Feasibility Analysis* for more information on the tolling technology setup.
- The user technology discussion focused on existing devices such as the global positioning system, cars, and phones, the option to use a transponder, and affordable and portable ways to do so. Section 7.2 includes more information on the tolling technology that is recommended.

Changes in Traffic Patterns

- The potential for diversion was discussed in terms of how it could impact local business and tourism. Section 6.4 contains the diversion estimates.

Discount and Equity

- An emphasis on the need for fair and equitable programs to reduce or minimize impacts to low-income populations was discussed. Section 2.3 addresses the proposed Toll Discount, Mitigation, and Benefit Program.

Operations

- There was discussion about violation of tolls and toll enforcement concerns. Many questions centered on how to handle enforcement. Section 7.3 contains more information on the plan for violations and enforcement.

3.2.2. Outreach group findings

The Michigan Tolling Study team met with various outreach groups, as shown in Table 3-1, including business and economic development organizations, national and municipal associations, unions, logistics suppliers, and state agencies and commissions. Four existing toll agencies were also met with to discuss feedback related to governance and policy as well as toll collection.

Table 3-1: Outreach Groups

Organization	Organization Type
Logistics Company	Logistics Supplier with Fleet
Business Leaders for Michigan	Business and Economic Development
Carpenters Union	Union
CAVNUE, Inc.	Automated Vehicle Technology
Chicago Skyway	Toll Agency
Detroit Regional Chamber	Business and Economic Development
Grand Rapids Chamber	Business and Economic Development
Illinois Tollway	Toll Agency
Logistics and Supply Chain Collaboration Committee	Statewide Commission
Michigan Economic Development Council/Pure Michigan	Economic Development and Tourism
Michigan Chamber of Commerce	Business and Economic Development
Michigan Municipal League	Municipal Association
Michigan Restaurant and Lodging Association	Economic Development and Tourism
Michigan Secretary of State office	State Agency
Michigan State Police	State Agency
Motor Carriers Advisory Board	Statewide Board
National Association for the Advancement of Colored People	National Association, Local Chapter
North Carolina Tollway Authority	Toll Agency
Pennsylvania Turnpike Commisssion	Toll Agency
Regional Retail Supplier	Logistics Supplier with Fleet
Small Business Association of Michigan	Business and Economic Development
The Right Place	Business and Economic Development
United Auto Workers	Union
University of Michigan Economic Department	Research and Economic Development

Feedback from Michigan-based organizations addressed funding, discount programs and equity, and traffic, as shown below:

Funding

- Like the legislators, outreach groups also discussed vehicle miles traveled, road user charges, and toll revenue.
- There was a clear interest among outreach groups in Michigan related to having stable transportation revenue. A one-time funding influx (peak/valley funding approach) was seen as a distraction from stable solutions.

Discount Programs and Equity

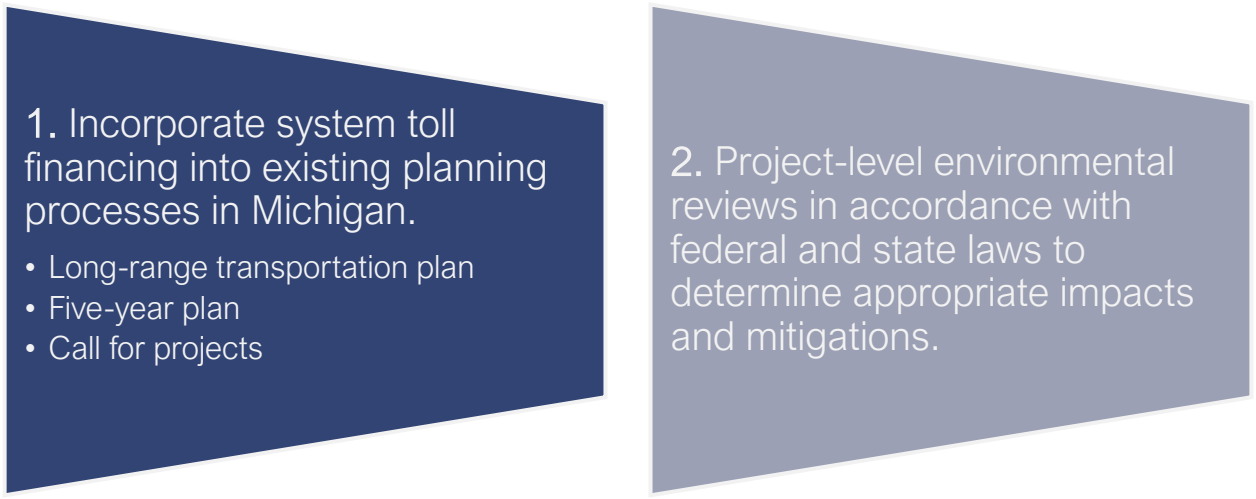
- Generally, outreach groups were supportive of discount programs. There was discussion about how best to integrate it into existing systems. Strategic approaches were recommended to avoid making discount programs overly complex. Section 2.3 addresses the proposed Toll Discount, Mitigation, and Benefit Program.
- Outreach groups were interested to learn how the tolling burden could be alleviated for low-income populations.
- Geographic equity was recommended by outreach groups, given the differences between the urban and rural areas across the State.

Changes in Traffic Patterns

- The potential for diversion was discussed in terms of positive and negative impacts to local business and tourism. Local communities could potentially experience increased economic development due to the traffic on local roads, but too much diversion could cause congestion and require local communities to bear mitigation costs. Section 6.4 contains the diversion estimates and Section 2.3.3 contains transportation mitigations.
- Outreach groups discussed how tolling could impact industries that are supported under the current transportation funding revenue model.

4. Environmental Review Strategies

As described previously, tolling in Michigan is one option to help address the state's transportation funding shortfalls. The funding and financing aspects of tolling are considered at a systemwide (statewide) level in this study. However, certain impacts and mitigation strategies for tolling, such as those related to traffic diversion and environmental justice, would vary between different toll regions and projects across the state. **As this would make a statewide environmental review strategy challenging, the recommendation is for a two-level approach to environmental review**:



The remainder of this section summarizes how different user groups could be impacted by tolling and provides more detail on the two-level environmental approach. As the potential future tolling program evolves, the approaches described would need to be updated. See Section 10 for next steps. A helpful reference document detailing the approaches described in this section is the *AASHTO Practitioner's Handbook: Managing the NEPA Process for Toll Lanes and Toll Roads*.

A supporting corridor-level environmental screening effort for the environmental review was undertaken as part of the *Strategic Implementation Plan* and is included in Appendix C. The results of this screening will inform both the Statewide Approach and the Project Approach to environmental review.

4.1. Impacted User Groups

Tolling can impact different highway user groups in varied ways. This has been identified in research and actual experience with existing toll facilities around the country. Michigan-specific feedback related to different highway user groups was obtained during discussions with outreach groups and legislators, as documented in Section 3 of this report, and during qualitative economic analysis interviews conducted as part of the *Feasibility Analysis*. The following sub-sections summarize potential impacts on different user groups if the State were to proceed with a new tolling program.

4.1.1. Tolling and commuters

Figure 4-1. Tolling and commuters

Frequent users of a toll system pay more in tolls than infrequent users. This is especially apparent with regular commuters. Before the COVID-19 pandemic, business trips tended to constitute up about 19 percent of all person-miles of travel in a vehicle[3]. This has fluctuated in the last few years as working from home has become more prevalent. However, service, manufacturing, and construction industries do not allow for working from home. Many professional and technology jobs have encouraged employees to return to office work for at least a few days per week.

Consider that a regular Monday-Friday commuter would make ten trips per week on a toll facility. If the commuter paid a $1.00 toll per trip, it would add up to about $500 per year. While regular commuters would realize the most benefits of tolling, including improved roadway conditions and incident responses, financial burdens would need to be considered. As described in more detail in Section 2.4, frequency discounts are possible with tolling but require higher base toll rates to achieve equivalent financial objectives.

4.1.2. Tolling and tourists

Figure 4-2. Tolling and tourists

Two categories of tourists are important when studying tolling: in-state and out-of-state tourists. **Considering overall transportation funding, an out-of-state tourist may not currently pay any transportation fees to use roads in Michigan if the tourist purchases gasoline outside of Michigan or drives an electric vehicle.** Thus, a tolling program would create payment equity.

With both in-state and out-of-state tourists, there are concerns among business organizations about tourists choosing not to travel to certain destinations if they must pay tolls. However, tourist-oriented toll facilities are already in operation around the country. Anecdotal information from the users and operators of these facilities has shown that, while there can be concerns about toll costs, tourists commonly appreciate the better operations and road conditions associated with toll facilities over the long term. It has also been observed anecdotally that tolling costs typically make up a small proportion of overall vacation expenses.

[3] *See 2017 National Household Travel Survey, Table 12, Private Vehicle "To or From Work" (16.9%) plus "Work-Related Business" (1.95%) categories. At https://nhts.ornl.gov/assets/2017_nhts_summary_travel_trends.pdf*

4.1.3. Tolling and freight movement

The commercial trucking industry is typically one of the most organized and vocal opponents of tolling. Outreach to Michigan commercial trucking organizations as part of this study has confirmed broad trucking industry opposition to tolling in Michigan. There were two main points of concern with tolling. First, the cost to collect tolls is higher than the cost to collect a motor fuel tax or other funding sources. Second, there was substantial concern that the proportion of revenue from commercial vehicles (CVs) relative to passenger vehicles (PCs) is typically higher on a toll road compared to other existing transportation funding mechanisms.

Figure 4-3. Tolling and freight movement

A balanced and thorough assessment of tolling must acknowledge commercial trucking industry concerns with tolling. While technological advancements in toll collection related to all-electronic tolling have reduced the cost of collecting tolls from customers, the cost-to-collect is still typically two times to three times what it costs the state to collect motor fuel taxes. This is primarily driven by the number of transactions processed for tolls compared to motor fuel sales. The converse point of view is that tolling charges for a specific corridor or set of corridors, while a motor fuel tax is a proxy for the use of the entire roadway network. In a motor-fuel-tax-based system, a motorist effectively pays the same cost-per-mile to drive on a Michigan dirt road as they pay to drive on I-75 or I-94.

When discussing the proportionality of tolls, an oft-cited example is the George Washington Bridge between New Jersey and New York City. Tolls for this facility are charged one-way (into New York City) and in 2022 were $11.75 for a PC and $90.00 for a 5-axle CV (with a transponder during off peak hours). Advocates of tolling often argue that the higher toll rates charged to CVs relative to PCs are justified based of the relative damage to roadways caused by CVs compared to PCs and that higher prices can be passed on to trucking and shipping consumers. Trucking advocates, in turn, often argue that damage caused by CVs is overestimated or misrepresented. From either point of view, a more-than seven times higher CV toll rate compared to the PC toll rate, such as on the George Washington Bridge, would have large impacts on the trucking industry if it were implemented system-wide in Michigan. As noted in Section 2.2, this *Strategic Implementation Plan* assumes a four times higher toll rate for large CVs compared to PCs.

Based on the outreach conducted for this study, the most concerned group within the trucking industry is small business truckers. It is more difficult for small business truckers to negotiate higher prices in order to pass along toll costs than it is for operators of large trucking fleets, which would make the transition to tolling more challenging for small business truckers.

Frequency and/or rebate-type discounts would be possible for certain sectors of the trucking industry or the industry as a whole. However, these types of discounts would require higher base toll rates to achieve the same financial objectives, as described in Section 2.4.

4.1.4. Tolling and environmental justice populations

A focus on the impacts of tolling on environmental justice populations has been growing in recent years across the tolling industry. Environmental justice populations include minorities, low-income individuals, and other underserved communities such as religious minorities, LGBTQ+ persons, persons with disabilities, and persons living in rural areas. Two common ways environmental justice communities may be impacted by tolling are through the toll itself or impacts related to traffic diversions off the highway after tolling. Any operational improvement projects included in the toll capital program can also cause impacts and should also be evaluated as necessary.

The burden of user fees - including tolling - relative to overall income is higher for low-income groups than it is for higher-income groups. As described in more detail in **Section 2.3**, this *Strategic Implementation Plan* recommends toll discounts for low-income users. A Local Community Transportation Mitigation Program and a Local Community Non-Transportation Benefit Program are both recommended to help address the impacts of traffic diversions.

4.2. State-Level Planning Process

A state-level, programmatic approach to tolling would involve incorporating the key conclusions of the *Feasibility Analysis* and this *Strategic Implementation Plan* into existing planning processes in Michigan. This may include the:

- *Michigan's State Long-Range Transportation Plan, Michigan Mobility 2045*,
- *Michigan Five-Year Transportation Program*, and
- MDOT call for projects processes.

From a funding perspective, the incorporation of tolling into these plans and processes would build on existing transportation funding discussions. For example, the *Michigan Mobility 2045: A transportation plan for a connected future* plan adopted in November 2021 includes discussion and analysis related to transportation funding in Michigan and the gap between existing and projected future funding and system needs. Related to addressing the identified revenue gap, the plan suggests further exploring three innovative funding strategies: road user charging, toll lanes/roads, and value capture. The toll lanes/road discussion does not quantify toll revenue potential but specifically references the *Feasibility Analysis* and this *Statewide Implementation Plan*.

Tolling topics that can be incorporated into existing planning processes include those identified below. These topics should be initially incorporated and then continue to be reviewed for applicability in any periodic future updates of the planning processes. If tolling were to move forward, this would initially apply to the Tier 1 corridors being studied in this *Strategic Implementation Plan* but then could also apply to Tier 2 and Tier 3 corridors defined in the *Feasibility Analysis*.

- Assessing tolling feasibility, including potential rates, revenue generation, diversion, costs, and project phasing;
- Incorporating recommendations for a statewide toll policy related to elements described in Section 2 and elsewhere in this report;
- Preparing a draft purpose and need statement;
- Evaluating environmental-related impacts of tolling; and
- Determining potential mitigation strategies to address the impacts of tolling.

Existing environmental laws and guidelines should be followed to ensure that tolling decisions are incorporated into any subsequent required project-level National Environmental Policy Act (NEPA) processes. For example, 23 USC 168 provides legal authority to adopt planning-level decisions regarding "whether tolling, private financial assistance, or other special financial measures are necessary to implement the project." In addition, in guidance on NEPA compliance for toll roads, FHWA has identified circumstances in which a study can focus solely on tolled alternatives, including when tolling is assumed in the transportation planning process as the basis for meeting fiscal constraints.

4.3. Project-Level Environmental Processes

Project-level environmental reviews of a new toll program in Michigan may be required in accordance with NEPA and the Michigan Environmental Protection Act. Different federal tolling programs have different environmental requirements. As described in more detail in Section 5.1, two federal tolling programs are assumed in this *Strategic Implementation Plan*: the Section 129 Bridge Program and the Value Pricing Pilot Program. Environmental-related information is included below:

- Section 129 Bridge Program: This program does not by itself trigger the need for a NEPA review of a tolling project. However, other project-level characteristics could trigger a NEPA review, for example, when using federal funds, including through Transportation Infrastructure Finance and Innovation Act (TIFIA) credit assistance or Federal Highway Administration approvals such as Interstate access change approvals or design exception approvals.
- Value Pricing Pilot Program: A NEPA review would likely be required for a Value Pricing Pilot Program project.

There are potential impacts to users that come from toll implementation, including those related to the cost of tolls and those related to roadway and bridge improvements funded by toll revenues. Introducing tolls may lead to the following impacts:

- Change in travel patterns, like diverting to a different route or mode of transportation;
- Change in mobility;
- Change in accessibility;
- Change in travel reliability;
- Change in trip-making behavior and trip purposes, including frequency and timing;
- Change in household disposable income and

- Change in disposable time.

4.3.1. National Environmental Policy Act approach

The following are typically included in the environmental review process:

- Define the need(s) of the project,
- Develop different alternatives to address the said need(s),
- Analyze the benefits and impacts of each alternative,
- Identify the preferred alternative,
- Engage the public through meetings and outreach,
- Coordinate with other government agencies, and
- Incorporate feedback received.

Based on project factors, the environmental review approaches listed below may be appropriate. The chosen environmental approach would be based on project characteristics, the federal tolling program being used, timing, agency coordination, and public involvement.

- Planning and Environmental Linkages Study: Used as a collaborative approach that considers environmental, community, and economic goals early in the planning process to inform the subsequent environmental review process.
- Categorical Exclusion: Used when an action does not normally have significant impacts on the environment.
- Environmental Assessment: Determines if an action has the potential to cause significant environmental impacts.
- Finding of No Significant Impact: Used if the Environmental Assessment determines an action will not have significant environmental impacts.
- Environmental Impact Statement: Used if the Environmental Assessment determines the environmental impacts of an action will be significant.

4.3.2. Purpose and Need

A draft purpose and need statement can be developed as part of the statewide planning process for tolling. The draft purpose and need statement could then be refined and finalized as part of the environmental process for a specific project. The concept of tolling can be incorporated directly into the project-level purpose and need if there is a solid underlying foundation to do so in the planning process. The purpose and need would include the following based on the tolling system that is currently being studied in this *Strategic Implementation Plan*:

- A summary of the intent of the tolling program to establish a self-supported toll system in Michigan that would cover all roadway-, bridge-, and tolling-related costs, including operations and maintenance of the project;
- A description of current roadway and bridge conditions and how conditions compare to federal- and state-level performance measure targets;

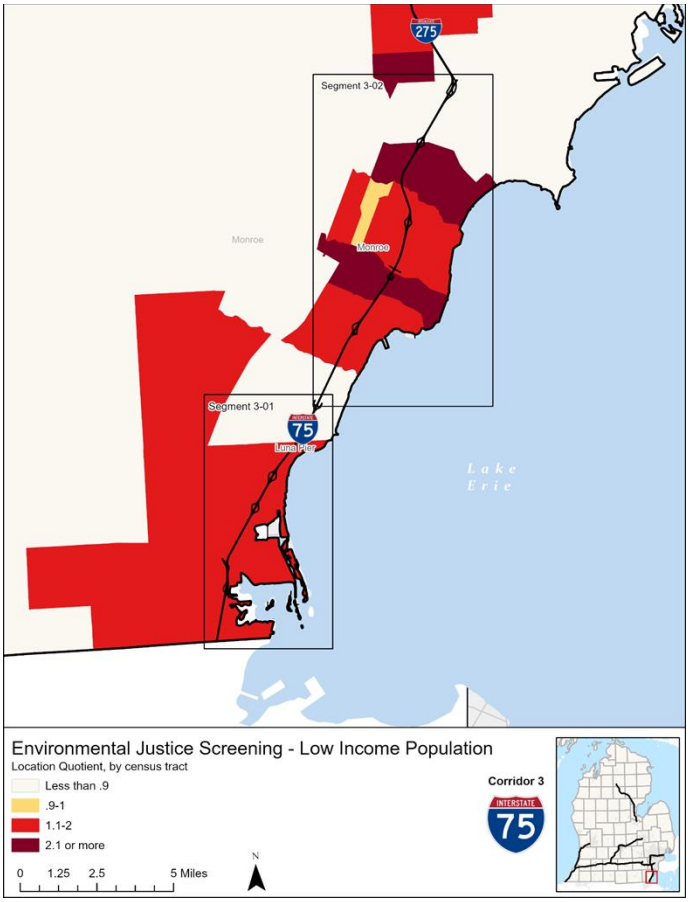
- A summary of safety and operational issues that could be improved with toll-funded operational enhancements; and
- A description of how existing state and federal funding sources are insufficient to fund the necessary improvements.

Many of these factors required for a purpose and need statement are considered as part of this *Strategic Implementation Plan*.

4.3.3. Environmental justice

Environmental justice will be a primary consideration during the environmental review process. This includes analyzing the demographics of existing and potential users, predicting their travel pattern changes, and considering costs that are related to pricing transportation assets. Presidential Executive Order 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* directs agencies to identify and address disproportionately high and adverse human health or environmental effects on minority and low-income populations; develop an environmental justice strategy; promote nondiscrimination in programs that affect human health and the environment; and provide minority and low-income communities access to public information, as well as the ability to be involved actively and effectively throughout the planning process.

Figure 4-4. Example Environmental Justice Screening – Low Income Populations from Appendix C



Environmental justice consideration involves gaining a better understanding of who currently uses or may use the roadway and predicting the changes in their travel patterns and costs. These impacts are then reviewed to discover if any environmental justice populations would experience disproportionate impacts from the project compared to other populations. To establish the current users, public outreach is necessary.

The federal government has required federal agencies to develop a strategy for identifying and addressing any disproportionately high and adverse human health or environmental impacts on minority and/or low-income populations. FHWA identified three guiding environmental justice principles:

- To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations;
- To ensure the full and fair participation of all potentially affected communities in the decision-making process; and
- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

In addition to these principles, MDOT has created its own guidance, *Environmental Justice Guidance for Michigan Transportation Plans, Programs, and Activities*. This guidebook includes environmental considerations, such as public involvement, analysis methodology, and disproportionate effects tests.

5. Toll Gantry, Roadway, and Bridge Cost Strategies

The objectives of the toll program are to generate sufficient toll revenue to finance the upfront reconstruction and rehabilitation needs of the current roadway and bridge assets and provide a stable revenue source for all future lifecycle needs. This requires understanding toll revenue potential, the capital and lifecycle costs of the highway assets, and the toll collection systems. A tolling plan was developed to identify the strategy, requirements, costs, equipment, systems, and customer service center needs to collect toll revenue efficiently. Discussion related to these topics are included in Section 7. Discussion of the following topics relevant to the tolling capital program are included in this section:

- Details of the federal programs available for tolling all lanes of existing highways;
- Cost estimates for the gantries that would hold the toll collection equipment;
- Cost estimates for the communications and intelligent transportation systems infrastructure necessary for tolling;
- Roadway cost estimates, including a discussion of potential major operational improvements; and
- Bridge cost estimates.

This section includes an overview of the key assumptions and methodology for estimating the costs of each of these elements. In general, typical statewide unit costs and lifecycle cost assumptions, based on infrastructure condition, were used when developing cost estimates. Future project-level analysis would be expected to further refine the cost estimates if the decision to move forward with tolling is made. This would include more context-sensitive lifecycle costing based on geographic location and traffic levels, especially the relative percentage of commercial vehicles. Additionally, more detailed programmatic analyses would be performed to optimize the timing of work based on program needs. Potential savings from economies of scale would also be considered.

As part of the cost estimating process for each of the capital program elements, a high-level constructability review was conducted to identify any potential issues. These issues were then addressed as part of updates to the cost estimating process.

5.1. Federal Tolling Programs

Four federal tolling programs were considered when creating the *Strategic Implementation Plan*:

- Interstate System Reconstruction and Rehabilitation Pilot Program,
- Section 129 General Tolling Program,
- Value Pricing Pilot Program, and
- Congestion Relief Program.

5.1.1. Interstate System Reconstruction and Rehabilitation Pilot Program

The legislation requiring the Michigan Tolling Study included the following: "It is the intent of the legislature that this state become qualified to apply to the United States Federal Highway Administration under the Interstate System Rehabilitation and Reconstruction Pilot Program." However, after review and analysis by the Michigan Tolling Study team, it is recommended that Michigan not pursue the Interstate System Reconstruction and Rehabilitation Pilot Program (ISRRPP) at this time. If tolling advances in Michigan, the new Michigan Toll Authority will continue to evaluate federal tolling programs to identify the most beneficial strategies for achieving Michigan's tolling goals. The ISRRPP program has the following key characteristics:

- It allows existing Interstate facilities to be tolled to fund needed reconstruction or rehabilitation, provided they could not otherwise be adequately maintained or functionally improved without the collection of tolls.
- There are slots for three different states to apply to participate, all of which are currently open.
- Tolls can be collected on any existing Interstate facility in order to reconstruct or rehabilitate a corridor.
- Toll revenues can be used only for debt service, a reasonable return on investment of any private person financing a project, and any costs necessary for the improvement of and proper operation and maintenance of a toll facility. These conditions are more restrictive than those that apply to projects authorized under the Section 129 General Tolling Program.

As part of this study, I-94 was initially considered for the ISRRPP. The revenue requirements associated with this program would require separate financing for I-94 and for the rest of the toll system. This would increase financing and administrative costs and limit flexibility compared to a systemwide tolling program. Based on these reasons, it is not recommended to apply for this program.

At least four states have undertaken tolling studies assuming this program since it was first authorized in the 1998 Federal Transportation Bill. However, to date, no states have moved forward with implementing tolling using the Interstate System Rehabilitation and Reconstruction Pilot Program.

5.1.2. Section 129 General Tolling Program / Bridge Program

The Section 129 General Tolling Program is recommended for most of the toll systems included in the *Strategic Implementation Plan*, specifically all of the system except the northern part of I-275 and the entire I-696 route. This program relaxed the previous general prohibition on tolling federal-aid highways. Much of the program was enacted as part of the 2012 Federal Transportation Bill. Under the Section 129 General Tolling Program, agencies may impose new tolls upon federal-aid highways in the following situations:

- Initial construction of a new facility;
- Initial construction of new lanes, including on Interstates, as long as the number of toll-free lanes is not reduced;

- Reconstruction or replacement of a bridge or tunnel, including on Interstates; and
- Reconstruction of a highway, except an Interstate.

The allowance of tolling for the reconstruction or replacement of a bridge, also referred to as the Bridge Program, is the element of the General Tolling Program used for this study. The strategy was to identify eligible bridges on the Tier 1 toll corridors and/or segments assumed for the Bridge Program. Assumed eligibility was based on the condition of the bridge and whether it warranted reconstruction by the time tolling was assumed to start. Then it was assumed that some or all the eligible bridges on a specific corridor or segment would be tolled.

Key elements of the Bridge Program important for this *Strategic Implementation Plan* are listed below:

- Reconstruction of a bridge involves the major work required to improve the structural integrity of the structure, correct major safety defects, or improve the functional operation of the facility. This can include deck or superstructure replacement.
- An existing free facility becomes eligible for tolling when the contract has been awarded for the physical construction activities that render the facility eligible for conversion to a toll facility. However, a recommendation included in this *Strategic Implementation Plan* is that tolling is started after the initial construction program is substantially completed.
- Toll revenue collected can be used for debt service for the projects for which tolls are authorized, costs necessary for the improvement and proper operations and maintenance of the toll facility, or any other purpose for which Title 23 funds may be obligated if the facility is being adequately maintained. This allows more flexibility on funding than does the Interstate System Rehabilitation and Reconstruction Pilot Program.
- Toll rate decisions are to be made by the authority with jurisdiction over the facility and do not require review by the Federal Highway Administration.

The use of the Bridge Program for tolling passenger cars and commercial vehicles to support a statewide toll financing program has also been studied in other states. However, it has not yet been implemented. Thus, it is recommended that close coordination between the new Michigan Toll Authority and the Federal Highway Administration related to this program be a top priority if tolling were to move forward in Michigan.

5.1.3. Value Pricing Pilot Program

The purpose of the Value Pricing Pilot Program (VPPP) is to assess the potential of different value pricing approaches for reducing congestion. This program is assumed for the northern part of I-275 and all of I-696. It was initially authorized as part of the 1991 Federal Transportation Bill under a different name and has been amended in transportation bills since then. Since the VPPP authorizes tolling as a tool to manage congestion, no reconstruction of the facility is required. This is applicable to the corridors being considered for the VPPP because they both have significant reconstruction planned using funding from the Rebuilding Michigan Bonding Program.

The study of this program has been less frequent in recent years, as the study of the mainstream Section 129 General Tolling Program has become more common. The Federal

Highway Administration has indicated that requests for tolling authority under the VPPP will be limited to situations that cannot be accommodated under the mainstream tolling programs. The Michigan Tolling Study team believes that tolling the northern part of I-275 and I-696 would fall into this category. The program can provide tolling authority to state, regional, or local governments to implement congestion-pricing applications and report on their effects. Therefore, existing congestion and toll rates that vary by time of day would be required to use the VPPP. This *Strategic Implementation Plan* assumed toll rates that were 25 percent higher for the morning and afternoon peak periods in order to fulfill this requirement. If the VPPP were implemented on these corridors, motorists would experience renewed infrastructure and reduced congestion.

Based on discussions with the Federal Highway Administration, including multimodal initiatives in the program application would be important for approval of the use of this pilot program under the Biden Administration. Therefore, the Local Community Transportation Mitigation and Non-Transportation Benefit Programs described previously in this report would be especially important. Toll revenues could be used for potential multimodal initiatives on northern I-275 and I-696, such as park-and-rides and commuter buses. Express bus service on these corridors would benefit from the more reliable travel times.

5.1.4. Congestion Relief Program

The Congestion Relief Program is a competitive grant program that is part of the most recent federal transportation bill, the 2021 Infrastructure and Investment Jobs Act. This program is for projects in urbanized areas having populations of over one million. Grants of at least ten million dollars will be awarded. The goals of the program are to reduce highway congestion and other costs of congestion and optimize existing highways and transit systems that provide alternatives to highways. The program allows the use of tolls on highways, including the Interstate Highway System as part of a project under this grant.

The Congestion Relief Program may be an alternative to the Value Pricing Program for the toll system studied in this *Strategic Implementation Plan*. However, detailed guidance on the Congestion Relief Program has not yet been released. It is recommended that the State review the guidance for the Congestion Relief Program when it is released in order to determine applicability to the *Michigan Statewide Tolling Study*.

5.2. Toll Locations

5.2.1. All-Electronic Tolling

A key factor in the viability of brownfield tolling of existing highways is the emergence of all-electronic tolling over the last few decades. All-electronic tolling, such as shown in the conceptual cross section in **Figure 5-1**, allows for toll collection at highway speeds and eliminates the need for physical toll booths. Challenges associated with traditional toll booths on highways include congestion related to drivers stopping to pay tolls, increased vehicle emissions, and significant land needed for toll booth infrastructure. The technology has advanced in recent years, such that most major toll road systems around the country have

already converted to all-electronic tolling or are planning to do so in the future. Advances in all-electronic tolling constitute a major difference between this study and past toll road studies conducted in Michigan, which assumed physical toll booths.

All-electronic tolling best practices include using a pair of toll gantries at each toll zone. The toll gantries hold the toll collection equipment, including readers and cameras.

Figure 5-1: Conceptual Cross Section: Toll All Lanes All-Electronic Tolling Zone in Michigan

5.2.2. Toll location assumptions

Specific assumptions for the location of tolls were made for the *Strategic Implementation Plan* to allow more refined estimates of potential highway diversions and toll transactions. Toll locations were determined based on the requirements of the federal tolling programs assumed for the corridor and to balance other considerations, including diversion and revenue potential. The Value Pricing Pilot Program corridors had more flexibility in assuming locations compared to those in the Bridge Program.

Assumptions would be further refined in future tolling analysis. If the State of Michigan decides to move forward with a tolling program, toll locations would be evaluated in more detail during project-level analyses, including as part of the environmental and financing processes.

5.2.3. Cost estimates

The key assumptions and sources for the toll gantry cost estimates are listed in Table 5-1. Table 5-2 summarizes the number of mainline and ramp toll zones as well as the cost estimates by corridor and segment. Cost estimates shown are for the initial construction costs and do not include the costs of ongoing maintenance of the gantries. Toll gantry maintenance costs are assumed to be included as part of overall roadway maintenance costs. Costs for the roadside toll collection equipment are also included separately in Section 7.5.

Table 5-1: Toll Gantry Assumptions and Sources

Category	Source/Notes
Toll zones	Each toll zones is assumed to have two toll gantries as shown in Figure 5-1 except for single lane ramps which are assumed to have one gantry.
Gantry design	Truss-style gantries like those used for the US-23 Flex Route corridor
Construction costs	Based on unit costs from Michigan Department of Transportation Weighted Averages Item Price Report excel file
Gantry widths	Based on total width of the highway or ramp after tolling
Contingencies	15 percent general contingency for all locations plus an additional 10 percent contingency for urban depressed freeways
Other costs calculated from construction costs	• 5 percent for early preliminary engineering • 10 percent for preliminary engineering • 10 percent for mobilization • 10 percent for construction inspection
Guardrail	• Guardrail assumed only on the outside of the highway if there is an inside concrete barrier at the toll location • No guardrail is assumed for urban depressed freeways at the toll location • For all other locations guardrail is assumed on the inside and outside of the highway at the toll location
Other costs	Costs of roadside equipment cabinet and cabinet foundation are included. Costs of toll collection equipment and communications infrastructure are included in other categories.

Table 5-2: Toll Gantry Initial Cost Estimates

Corridor and Segment		From	To	Mainline Toll Zones[1]	Ramp Toll Zones	Capital Cost Estimate (millions of 2022$)
I-69	-	I-94	I-75	14	-	$8.9
I-94	1	Indiana border	I-196	4	-	$3.2
	2	I-196	US-131	8	-	$5.9
	3	US-131	I-69	4	-	$2.9
	4	I-69	US-127 (NE of Jackson)	4	-	$2.5
	5	US-127 (NE of Jackson)	M-14	2	-	$1.3
	6	M-14	US-24/ Telegraph Road	6	-	$4.4
I-75	North	I-675	US-127	14	-	$8.9
I-75/ I-275	South	Ohio border	Eureka Road	6	-	$4.4
I-196	-	I-94	M-6	10	-	$6.3
I-275	North	Eureka Road	I-96/I-275/ I-696/M-5	4	22	$10.2
I-696	-	I-96/I-275/ I-696/M-5	I-94	6	29	$20.6
M-14	-	I-94	West US-23/ M-14 split	2	-	$1.2
Total[2]				84	51	$80.8

[1]Toll zones in each direction are counted separately in this column.

[2]Totals may not match due to rounding.

5.3. Communications and Intelligent Transportation Systems

Traditional intelligent transportation system devices, which include closed circuit video monitoring, traffic detection systems, and dynamic message signs, would be added to the corridors with tolling to help monitor traffic from the traffic management centers. The intelligent transportation sites would be located with enough frequency to create effective visualization and messaging for drivers.

Fiber optic cable allows for a fast, consistent, and reliable communications medium for the toll system. Increased bandwidth from the use of fiber optic communications will allow the data-intensive tolling systems and intelligent transportation systems to work to their full capabilities. Potential fiber-sharing between the new Michigan Toll Authority, MDOT, other State of Michigan departments, local agencies, and other groups could offset construction and maintenance cost and provide better communications for operational and other mutual benefits to the State and to the public. Communications infrastructure associated with tolling could also be leveraged for connected vehicle applications.

The key assumptions and sources for the communications and intelligent transportation system cost estimates are listed in Table 5-3.

Table 5-4 summarizes the length of new fiber assumed as well as the cost estimates by corridor and segment. Cost estimates shown are for the initial construction costs and do not include the costs of ongoing annual maintenance and periodic intelligent transportation system equipment modernization. These other costs are included in Section 8.1 which summarizes the total life cycle costs for all cost elements. The communication system costs are based on unit costs from MDOT. Given the scale of the communications system assumed, economies of scale may be achieved to bring down costs. If the decision is made to move forward with tolling, a more detailed analysis should be considered in the future.

Table 5-3: Communications and Intelligent Transportation Systems Assumptions and Sources

Category	Source/Notes
Fiber optic cables	Tolling corridors would use existing MDOT intelligent transportation system fiber optic cables if they are available in the corridor. If not, installation of new fiber optic cables was assumed
Fiber optic cable strand count	• Estimated construction costs for fiber strand count for corridors with existing MDOT fiber optic cable are three cables of 60/24/24 strands to match the current MDOT standard • Estimated construction costs for fiber strand count for corridors with no existing MDOT ITS fiber optic cable is a single cable of 144 strands
Construction costs	Based on unit costs from Michigan Department of Transportation Weighted Averages Spec Book Spreadsheet
Equipment refresh frequency	Every 10 years
Contingencies	10 percent general contingency
Other costs calculated from construction costs	• 5 percent for early preliminary engineering • 10 percent for preliminary engineering • 25 percent for miscellaneous construction costs including mobilization, maintenance of traffic during construction, system integration and testing, and guardrail • 10 percent for construction inspection
Intelligent transportation system device density	• Video monitoring and vehicle detection systems would be co-located with spacing every 0.8 miles in urban corridors and every five miles in rural corridors • Dynamic message signs in Grand and Metro MDOT regions were assumed to be spaced every five miles in each travel direction and in other regions every ten miles in each travel direction
Fiber optic regeneration sites	Fiber optic regeneration sites were assumed every 50 miles per Federal Highway Administration recommendations.

Table 5-4: Communications and Intelligent Transportation Systems Initial Cost Estimates

Corridor and Segment		From	To	New Fiber Assumed (Miles)	Capital Cost Estimate (millions of 2022$)
I-69	-	I-94	I-75	94.2	$53.6
I-94	1	Indiana border	I-196	34.1	$16.5
	2	I-196	US-131	39.4	$19.7
	3	US-131	I-69	34.3	$16.6
	4	I-69	US-127 (NE of Jackson)	33.7	$18.6
	5	US-127 (NE of Jackson)	M-14	29.1	$16.8
	6	M-14	US-24/ Telegraph Road	16.1	$11.0
I-75	North	I-675	US-127	94.3	$51.9
I-75/ I-275	South	Ohio border	Eureka Road	13.3	$10.6
I-196	-	I-94	M-6	64.2	$33.9
I-275	North	Eureka Road	I-96/I-275/ I-696/M-5	-	$5.9
I-696	-	I-96/I-275/ I-696/M-5	I-94	10.6	$12.3
M-14	-	I-94	West US-23/ M-14 split	4.7	$2.7
Total[1]				468.1	$270.0

[1]Totals may not match due to rounding.

5.4. Roadway Program

This section includes a summary of the major operational improvements assumed to be included in the tolling program, the roadway capital cost estimates, and roadway operations and maintenance cost estimates. All costs associated with improving and maintaining the nearly 550 miles of roadways being studied above performance standards are included in this analysis.

5.4.1. Operational and safety improvements

Major operational and safety improvements are assumed as part of this study. These are listed below:

- Add a third general purpose lane on each direction of I-94 between I-196 and US-131 and between Sprinkle Road in Kalamazoo and I-69. These improvements were suggested

through outreach meetings to improve operations and safety, especially with high commercial vehicle traffic levels on these sections of I-94.

- Add a flex lane on each direction of I-94 between M-14 and US-23 in Ann Arbor. This improvement would help operations on this segment of I-94 which experiences recurring traffic congestion.

In addition to the assumed major improvements, other more targeted and context specific operational and safety improvements could be implemented as part of toll funded reconstruction projects in specific segments of the toll system corridors. Additionally, having the required toll collection systems in place for the toll system studied in this *Strategic Implementation Plan* would make it easier for other tolling projects to advance in Michigan. This could include priced managed lanes which are toll lanes that are separated from general purpose lanes and that offer faster and more reliable travel. Priced managed lanes in Michigan would likely generate far less revenue compared to tolling all lanes but could provide operational improvements and traffic management options.

5.4.2. Roadway cost estimates

Major roadway cost estimates are based on average life cycle assumptions developed by the study team in collaboration with MDOT and using MDOT's *Pavement Selection Manual*. A 50-year average life cycle that includes capital preventative maintenance, rehabilitation, and reconstruction was assumed for the roadways included in the analysis. Roadway costs for operations and maintenance related to minor infrastructure repairs are included in the next sub-section. The life cycle assumptions are listed below by milestone year:

- Year 0 – Newly reconstructed road
- Year 10 – Capital preventative maintenance cycle 1
- Year 20 – Capital preventative maintenance cycle 2
- Year 30 – Rehabilitation
- Year 40 – Capital preventative maintenance cycle 3
- Year 50 – Reconstruction

Other assumptions and sources for the roadway cost estimates, including where in the life cycle a roadway section would be at the start of the tolling program, are listed in Table 5-5. Table 5-6 summarizes the cost by corridor and segment.

Table 5-5: Roadway Cost Assumptions and Sources

Category	Source/Notes
Point in life cycle at start of tolling program	This was based on each section of a roadway's current remaining service life (RSL) in number of years and projected RSL at the start of the tolling program. Additional years on the RSL were also estimated and added if an associated improvement project was included in the most recent MDOT five year transportation plan. The RSL data used in the analysis was provided by MDOT in February 2022.
Construction costs	Used "Freeway Average Cost Per Lane Mile" costs from MDOT's *Average Cost Per Lane Mile by Major Work Type for Various Networks, 2020-2027* file. The per lane mile unit costs included in this file are assumed to include all roadway appurtances including shoulders, signing, and pavement markings, in addition to costs for the main roadway itself. They are also assumed to include mobilization, preliminary enginering, and construction inspection
Contingencies	10 percent general contingency for all locations plus an additional 20 percent contingency for urban depressed freeways
Other costs calculated from construction costs	2 percent for early preliminary engineering for rehabilitation and reconstruction project only
Land costs	Any additional land needed for major operational improvement projects is assumed to cost $2.5M per mile in urban areas and $500,000 per mile in rural areas. Based on a constructability review, about 8 miles of I-94 would need additional land.

Table 5-6: Total Roadway Capital Cost Estimates for 2026 to 2067

Corridor and Segment		From	To	Cost Estimate (millions of 2022 $)
I-69	-	I-94	I-75	$1,471.1
I-94	1	Indiana border	I-196	$605.5
	2	I-196	US-131	$1,331.3
	3	US-131	I-69	$1,126.4
	4	I-69	US-127 (NE of Jackson)	$480.7
	5	US-127 (NE of Jackson)	M-14	$587.0
	6	M-14	US-24/ Telegraph Road	$848.5
I-75	North	I-675	US-127	$2,082.3
I-75/ I-275	South	Ohio border	Eureka Road	$501.7
I-196	-	I-94	M-6	$1,135.8

Corridor and Segment		From	To	Cost Estimate (millions of 2022 $)
I-275	North	Eureka Road	I-96/I-275/ I-696/M-5	$462.8
I-696	-	I-96/I-275/ I-696/M-5	I-94	$1,020.2
M-14	-	I-94	West US-23/ M-14 split	$69.0
Total[1]				$11,772.3

[1]Totals may not match due to rounding.

5.4.3. Roadway operations and maintenance

Toll-paying customers expect a higher level of service for roadway operations and maintenance on a toll road compared to a non-tolled road. Toll agencies also have a direct financial incentive to prioritize mobility through efficient operations and excellent maintenance. For example, more frequent snow removal and faster incident response would lead to more drivers choosing to take a tolled route over time, resulting in more toll revenue.

It is recommended that the new Michigan Toll Authority carefully evaluate different options for the delivery of operations and maintenance activities. With any delivery model, specific performance criteria would be approved for operations and maintenance activities.

Operational and maintenance for a toll system include the following activities:

Inclement weather strategies

Dynamic Message Signs can be used to provide weather information to motorists in a specific geographic area. MDOT routinely does this on freeways statewide.

Snow removal

More resources would be devoted to frequent snow removal on the toll system to minimize the impact of weather events on operations and toll collection.

Mowing cycles and litter pickup

More frequent mowing cycles and litter pickup would be used to improve overall customer experience on the toll system.

Minor infrastructure repairs

This includes cold patching and other minor pavement or bridge patching and guardrail repairs. It would be expected that less minor pavement and bridge patching would be required on a toll road due to more frequent preventative maintenance.

Police services

Police services would be included in operations and maintenance costs for the toll system. The police would respond to emergencies and enforce traffic rules.

Courtesy patrol services

Courtesy patrol would be dispatched to provide motorist assistance in areas with traffic camera coverage. Coverage areas would be expanded along the tolled corridors. Courtesy patrol would help stranded motorists, provide protection at incident scenes, and assist during disasters, regional emergencies, and evacuations. Fast response times would be important to minimize the impact of incidents on operations and toll collection.

Traffic Management Center operations

Traffic Management Centers have the software, hardware, staffing, and processes necessary to manage traffic and weather incidents on portions of major roadways. They rely on infrastructure that transmits video images and road sensor data needed for incident detection, analysis, response, and management. It is assumed that existing MDOT Traffic Management Center buildings would be used for toll operations and the tolling program would pay for staffing and equipment to manage the toll roads.

A total of $35,000 per lane-mile (in 2022 dollars) was assumed for roadway operations and maintenance costs. This is a comprehensive cost assumed to include all the elements previously listed above and is based on costs observed from existing toll agencies.

5.5. Bridge Program

5.5.1. Cost estimates

All costs associated with improving and maintaining the bridges on the Tier 1 corridors being studied using the above performance standards are included in this analysis. Major bridge cost estimates are based on average life cycle assumptions developed by the study team in collaboration with MDOT. An 80-year average life cycle that includes two types of capital preventative maintenance, rehabilitation, and reconstruction was assumed for the bridges included in the *Strategic Implementation Plan* analysis. Bridge costs for operations and maintenance related to minor infrastructure repairs are assumed to be included in the operations and maintenance costs discussed in Section 5.4.3. The life cycle assumptions are listed below by milestone year:

- Year 0 – Newly reconstructed bridge
- Year 10 – Less intensive capital preventative maintenance cycle 1
- Year 20 – Less intensive capital preventative maintenance cycle 2
- Year 30 – Less intensive capital preventative maintenance cycle 3
- Year 40 – Rehabilitation
- Year 50 – More intensive capital preventative maintenance cycle 1
- Year 60 – More intensive capital preventative maintenance cycle 2
- Year 70 – More intensive capital preventative maintenance cycle 3
- Year 80 – Reconstruction

Other assumptions and sources for the bridge cost estimates, including where in the life cycle a bridge would be at the start of the tolling program, are listed in Table 5-7.

Table 5-8 summarizes the cost by corridor and segment.

Table 5-7: Bridge Cost Assumptions and Sources

Category	Source/Notes
Point in life cycle at start of tolling program	This was based on a bridge's deck, superstructure, and substructure ratings and a check for fracture critical or scour critical bridges. Rating improvements were estimated if an associated improvement project was included in the most recent MDOT five year transportation plan. The rating data used in the analysis was obtained from the National Bridge inventory database
Section 129 General Tolling Program bridges	A deck replacement, rehabilitation, or full reconstruction before the start of tolling was assumed for bridges assumed to be tolled under the Section 129 General Tolling Program
Construction costs	Used unit costs included in the 2022 MDOT Bridge Cost Estimate Worksheet. Specific assumptions were made in collaboration with MDOT related to the quantities for the different types of bridge construction projects
Contingencies	10 percent general contingency was included

Category	Source/Notes
Other costs calculated from construction costs	• 2 percent for early preliminary engineering for rehabilitation and reconstruction projections only • 5 percent for preliminary engineering for rehabilitation and reconstruction projects and 10 percent for capital preventative maintenance projects • 10 percent for mobilization • 7 percent for construction and inspection • 15 percent for traffic control
Other assumptions	• Specific assumptions for which corridor to include the costs on were made for bridges that are part of interchanges between two Tier 1 corridors included in the toll program analysis. For example, bridges in the I-69/I-94 interchange were included in the I-69 corridor estimates. Bridges at the endpoints of corridors, for example, the I-69/I-75 interchange, were generally not included in the costs • Costs for bridge approach work, including the roadway approach, were included • A check for substandard shoulders was performed on existing bridges. Widening was assumed for these bridges to meet design standards during the reconstruction • Bridges over water were assumed to be lengthened by 30 percent when reconstructed

Table 5-8: Total Bridge Cost Estimates for 2026 to 2067

Corridor and Segment		From	To	Cost Estimate (millions of 2022$)
I-69	-	I-94	I-75	$1,266.2
I-94	1	Indiana border	I-196	$486.6
	2	I-196	US-131	$285.2
	3	US-131	I-69	$317.7
	4	I-69	US-127 (NE of Jackson)	$219.4
	5	US-127 (NE of Jackson)	M-14	$186.4
	6	M-14	US-24/ Telegraph Road	$606.6
I-75	North	I-675	US-127	$515.0
I-75/ I-275	South	Ohio border	Eureka Road	$602.0

Corridor and Segment		From	To	Cost Estimate (millions of 2022 $)
I-196	-	I-94	M-6	$480.3
I-275	North	Eureka Road	I-96/I-275/ I-696/M-5	$443.3
I-696	-	I-96/I-275/ I-696/M-5	I-94	$1,180.7
M-14	-	I-94	West US-23/ M-14 split	$152.2
Total[1]				$6,741.7

[1]Totals may not match due to rounding.

6. Revenue Strategies

This section summarizes the toll traffic and revenue estimation methodology and results for the Tier 1 Corridors in the toll program. More detailed reporting of the traffic and revenue estimation methodology is provided in the supporting report in Appendix B.

6.1. Analysis Methodology

The traffic and revenue estimation process is built upon a similar process used to support the *Feasibility Analysis Report.* Refinements were included as part of the *Strategic Implementation Plan,* including the following:

- More detailed matching of the traffic in the statewide travel demand model to existing traffic counts with a focus on the Tier 1 corridors.
- Making specific toll location assumptions rather than using a broad per-mile toll rate in the analysis (as was used in the *Feasibility Analysis*).
- Using aggregate travel data from the data provider Streetlight to validate and adjust trip pattern distributions in the model, with a focus on the Tier 1 corridors.
- Additional analysis of diversion patterns predicted by the model and adjusting as necessary.
- Incorporating the low-income discount program (see Section 2.3.2) into the model analysis methodology.
- Applying adjustments based on COVID-19 traffic impacts (see Section 6.2).

The traffic and revenue analysis methodology assumed all drivers pay using electronic transponders. The impacts of other payment types on toll revenue were applied as part of the toll collection cost analysis, the results of which are included in Section 7.6. The payment types assumed in the analysis are detailed in Section 7.2.1.

The model analysis years 2030 and 2045 were analyzed in the traffic and revenue analysis. Traffic and revenue estimates for other years between and outside of these model years were interpolated and extrapolated, respectively.

6.2. COVID-19 Impact Adjustments

The COVID-19 pandemic had an immediate and significant negative impact on passenger car and commercial vehicle traffic in spring 2020. Traffic has since recovered, but the amount of recovery has varied across the U.S. for different vehicle classes, trip purposes, and geographic regions. A comparison of traffic counts between 2019 and 2022 was performed to estimate the impact of COVID-19 on the corridors being studied for tolling in the Tier 1 system. Data from 2019 was used to allow a comparison between recent traffic and pre-COVID-19 traffic levels. The comparison was based on passenger car and commercial vehicle traffic count data from MDOT permanent count recorders. For the passenger car comparison, recreational (tourism-oriented) and non-recreational corridors were considered separately. This is because

recreational roadways have been observed to show more recovery than non-recreational corridors.

The analysis was completed by corridor. A summary of the analysis results is included below:

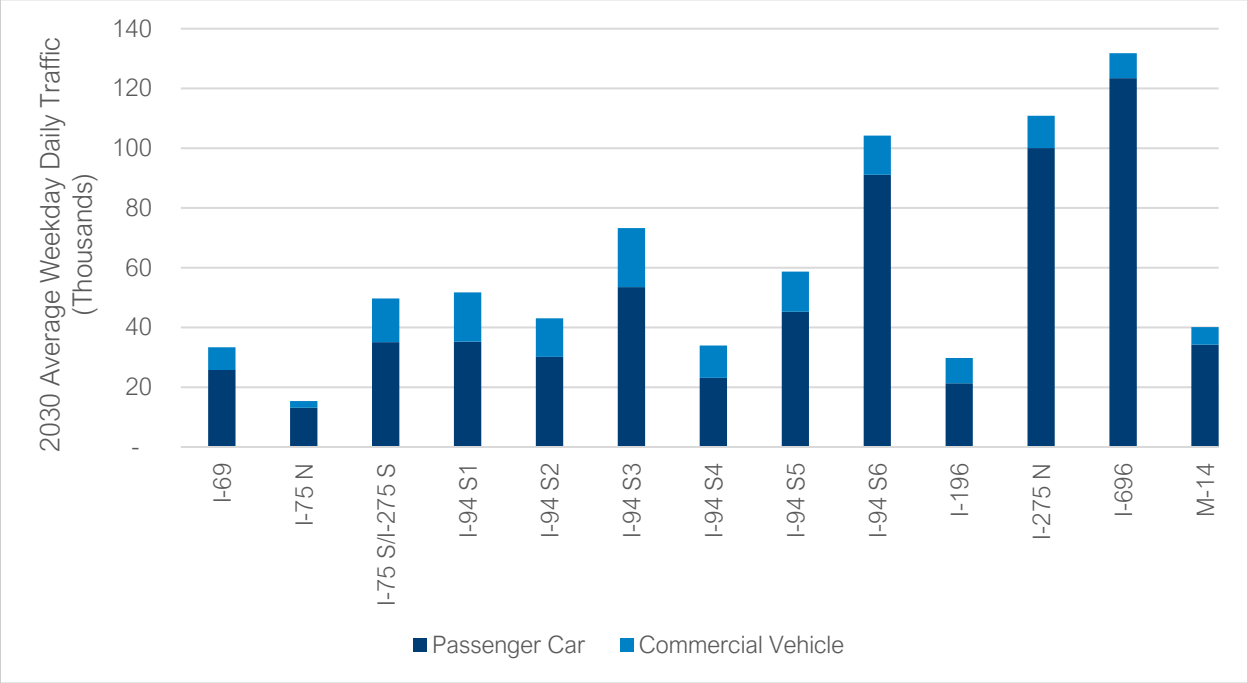
- Passenger car recreational corridors were estimated to have traffic growth of about 2.5 percent, on average, between 2019 and 2022.
- Passenger car non-recreational corridors were estimated to have traffic losses of about eight percent, on average, between 2019 and 2022
- Commercial vehicles were estimated to have traffic growth of about 11.5 percent, on average, between 2019 and 2022.

The changes between 2019 and 2022 were then compared to the growth in the statewide model to account for potential impacts of underlying traffic changes had the COVID-19 impact not occurred. The resulting impacts were applied to model results as a post-processing adjustment. When applying the post-processing adjustments, it was assumed that the COVID-19 impact would dampen over time. To account for this, 50 percent of the impact calculated for 2022 was applied to the 2030 model year results, and 25 percent of the impact was applied to the 2045 model year results.

6.3. Traffic Results

Comparative traffic results after tolling by corridor are summarized in Figure 6-1 in terms of the corridor average weekday daily traffic. Results are shown for the model analysis year of 2030. Average traffic levels are lowest on the I-75 North and I-196 corridors and highest on the I-275 North and I-696 corridors. I-94 has the highest commercial vehicle traffic levels.

Figure 6-1: Average Weekday Daily Traffic by Corridor[1]

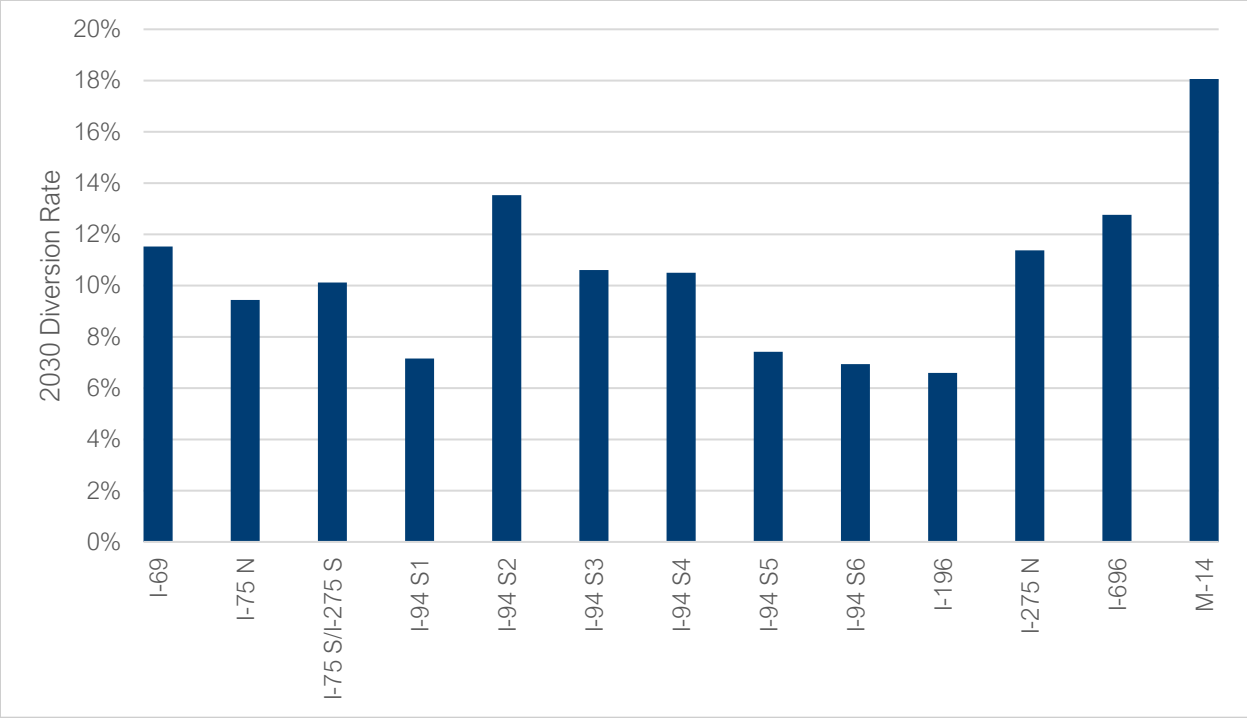


[1]Corridor limits including I-94 segment definitions (S1, S2, etc.) are included in Table 1-4 in Section 1.5

6.4. Diversion Results

Estimated diversion results by corridor are included in Figure 6-2 for the model analysis year of 2030. Diversion rates were calculated by comparing the total estimated traffic on the corridor with and without tolls. **Traffic diversion from a tolled to a non-tolled alternative route is caused by drivers who determine the toll rate is not worth the benefits of traveling on a tolled route. Diversion rates can be impacted by toll rate levels, traffic patterns, and the proximity, speed, and capacity of alternative routes.** Overall, diversion rates are estimated to range from 6 percent to 18 percent. Diversion rates are highest on the M-14 corridor partially due to a higher relative toll rate being assumed on this corridor to reflect the high cost of the Huron River Bridge.

Figure 6-2: Diversion Rates by Corridor[1]

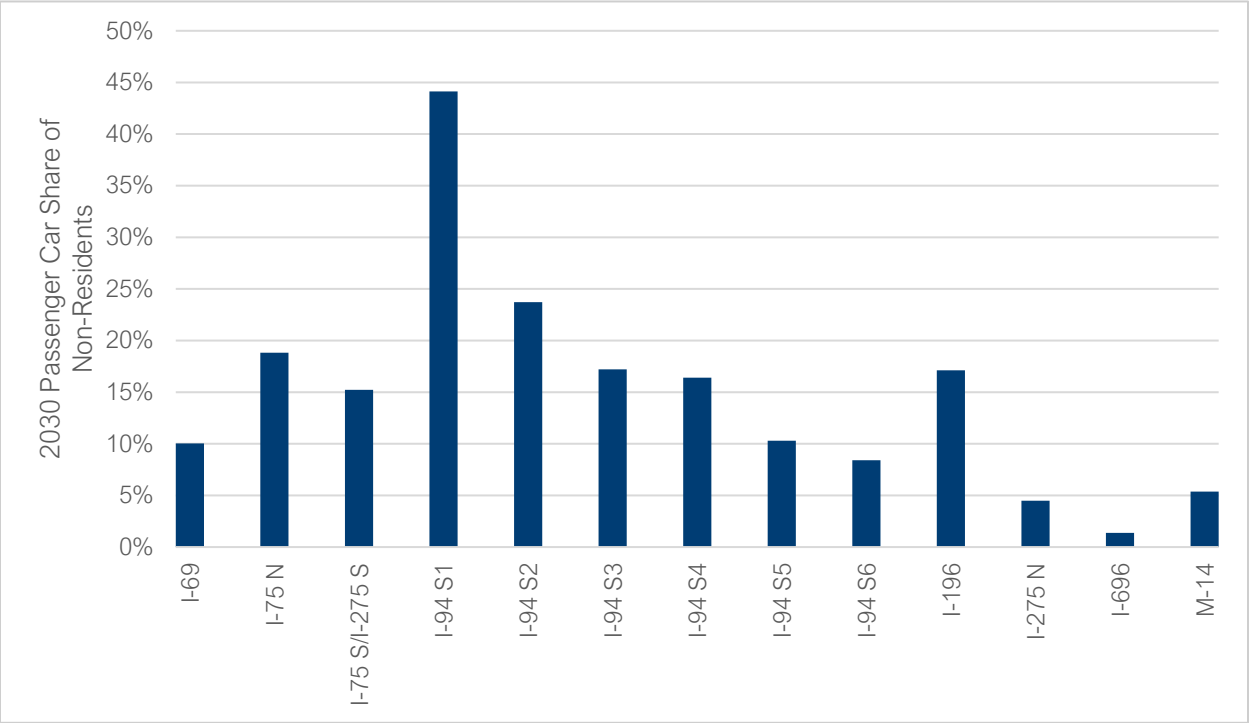


[1]Corridor limits including I-94 segment definitions (S1, S2, etc.) are included in Table 1-4 in Section 1.5

6.5. Share of In-state Results

Figure 6-3 shows the estimated share of non-resident passenger car traffic by corridor. I-94 Segment 1, which is between the Indiana border and I-196, has the highest estimated share of passenger car non-residents at just under 45 percent, which is 20 percentage points higher than any other corridor summarized.

Figure 6-3: Share of Passenger Car Non-Residents by Corridor[1]

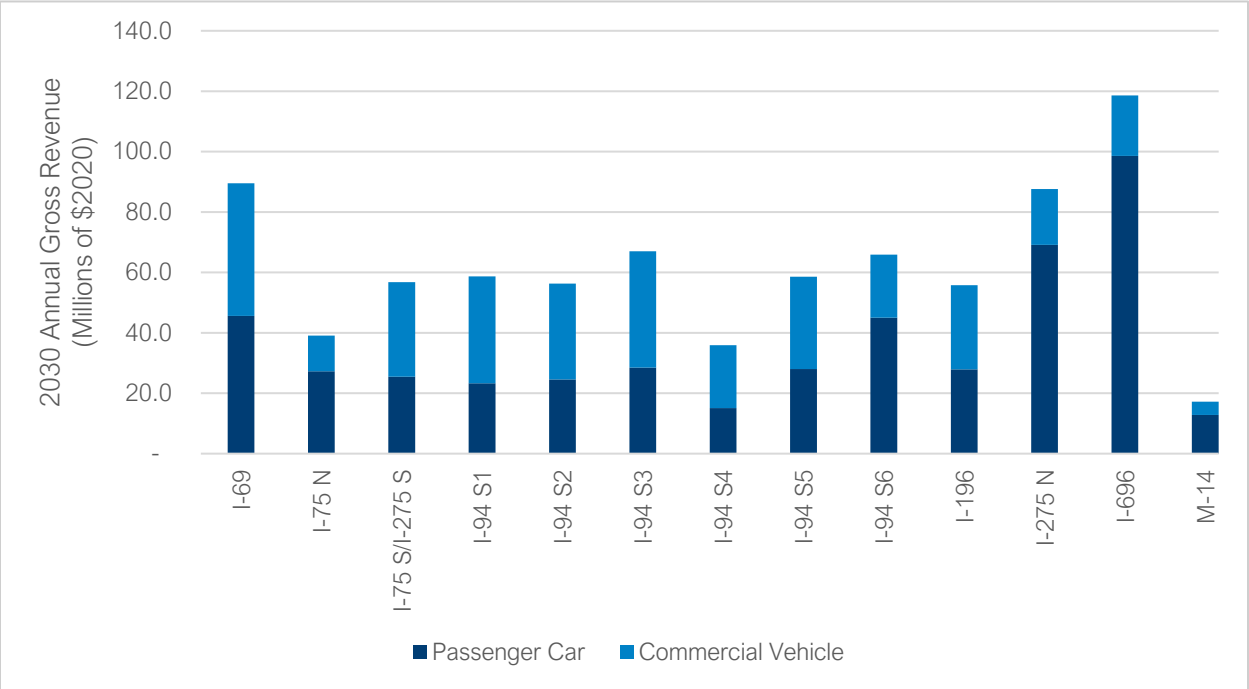


[1]Corridor limits including I-94 segment definitions (S1, S2, etc.) are included in Table 1-4 in Section 1.5

6.6. Gross Revenue Results

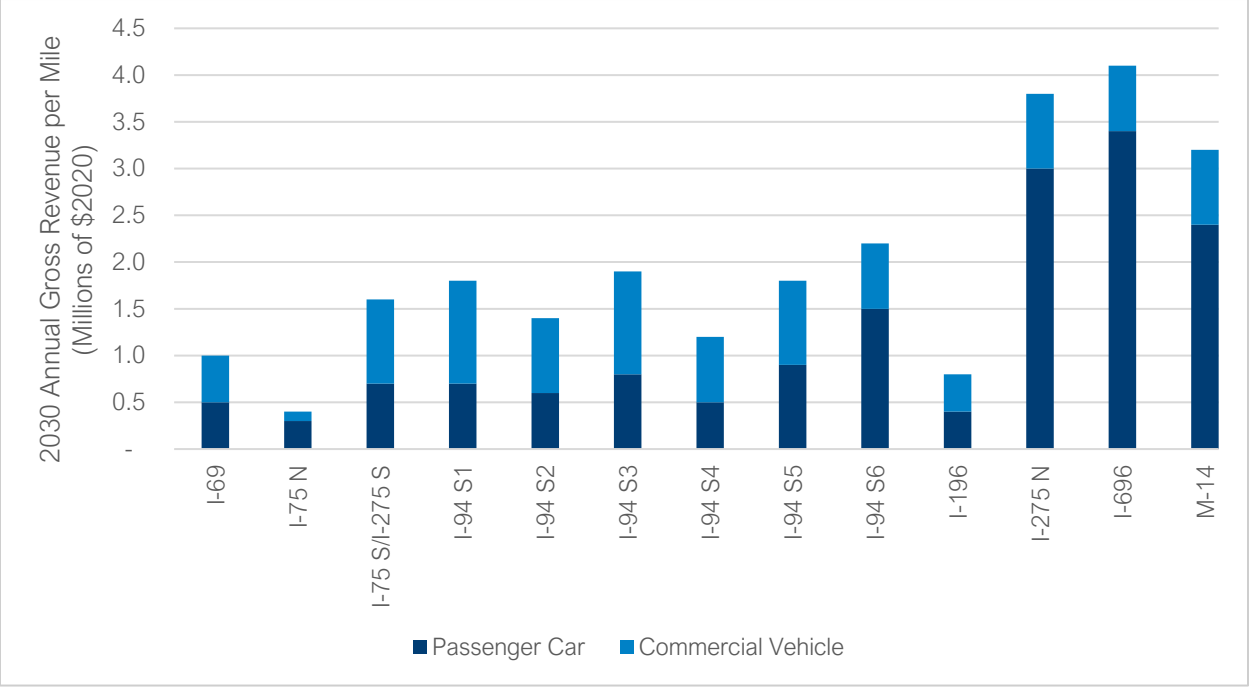
Gross toll revenue estimates in millions of 2020 dollars are shown in Figure 6-4 and Figure 6-5 for total by corridor and per mile by corridor, respectively. Revenues shown in these figures include the impacts (reduction in revenue) of the Toll Discount Program on low-income users. The Toll Discount Program, as described in Section 2.3.2, includes discounted tolls for eligible and enrolled low-income users, thus lowering the toll revenue. The highest revenue generating corridors per-mile basis are I-275 North and I-696. The lowest is I-75 North.

Figure 6-4: Annual Gross Revenue by Corridor[1]



[1]Corridor limits including I-94 segment definitions (S1, S2, etc.) are included in Table 1-4 in Section 1.5

Figure 6-5: Annual Gross Revenue per Mile by Corridor[1]



[1]Corridor limits including I-94 segment definitions (S1, S2, etc.) are included in Table 1-4 in Section 1.5

7. Toll Operation Cost Strategies

The new Michigan Toll Authority would be responsible for operating and maintaining the toll system. This *Strategic Implementation Plan* includes operating strategies for the toll system and forecasts all-inclusive, high-level cost estimates, including those related to administration and toll collection. More details are included in Appendix A. Concept of Operations Report.

7.1. Administration

A hybrid governance model for the new Michigan Toll Authority would include leadership positions and other additional staff and consultants related to finance, toll collection, and traditional roadway planning, operations, and maintenance activities. One of the benefits of the hybrid model would be sharing staff and resources with MDOT. Currently, the Mackinac Bridge Authority and Sault Ste. Marie Bridge Authority, two toll bridge agencies currently in operation in Michigan, share staff and resources with MDOT.

To estimate potential administrative costs of the new Michigan Toll Authority, six percent of gross toll revenue was assumed. This is based on MDOT's Fiscal Year 2021 administrative costs being just under seven percent. The six-percent assumption is likely conservative for the purposes of this study, given that some staff would be shared with MDOT. The six-percent assumption is in addition to costs related to planning and design and construction engineering for roadway and bridge projects. These costs are included as part of the cost estimates for these categories, as discussed in Section 5.

7.2. Toll Collection System

7.2.1. Payment types

A key factor in the viability of brownfield tolling of existing highways is the emergence of all-electronic tolling over the last few decades. All-electronic tolling, as shown in the conceptual cross-section in Figure 5-1, allows for toll collection at highway speeds and eliminates the need for physical toll booths. Challenges associated with traditional toll booths on highways include congestion related to drivers stopping to pay tolls, increased vehicle emissions, and significant land needed for toll booth infrastructure. The technology has advanced in recent years, such that most major toll road systems around the country have already converted to all-electronic tolling or are planning to do so in the future. Advances in all-electronic tolling

Figure 7-1. MacPass 6C Protocol Transponder

constitute a major difference between this study and past toll road studies conducted in Michigan, which assumed physical toll booths.

The toll system would be an all-electronic tolling system based on state-of-the-art technology which would detect, identify, and classify vehicles through integrated roadside and lane devices installed at various locations (Toll Zones) along the tolled facility. These devices would work in combination with a Back-Office System and Customer Service Center. The all-electronic tolling system's method of vehicle identification would be based on two technologies: radio frequency identification transponders and images of vehicle license plates from digital cameras.

Figure 7-2. Example Video Toll Invoice

It is recommended that the new Michigan Toll Authority issue 6C protocol transponders. These are stickers that are placed on a customer's windshield, as is the case with the MacPass 6C protocol sticker transponders used on the Mackinac Bridge since 2020 (see Figure 7-1) and the Edge Pass 6C protocol sticker transponders that began being used on the Blue Water Bridge in 2022.

The toll collection equipment would include devices that capture and store front and rear images of vehicles traveling in the Toll Zone. These devices would include high-resolution digital cameras, supplemental lighting, triggers, and sensors. They would capture readable images of vehicle license plates in a variety of typical lighting conditions as a means of vehicle identification for the purposes of toll payment and enforcement.

Registered vehicle owners that do not have transponders would receive monthly invoices in the mail with new tolls they had accumulated over the previous month, as well as fees for any past-due tolls from previous invoices (see Figure 7-2). This would be like monthly billing commonly used by utility and cellphone companies. An account's monthly invoice cycle date would be based on the date of the account's first transaction.

7.2.2. Lane system

The roadside and lane devices installed and integrated at the various Toll Zones are collectively referred to as the Electronic Toll Collection System**. At the Toll Zone level, the Electronic Toll**

Collection System consists of devices mounted on overhead gantry structures and installed in the pavement and enclosures along the roadside.

Figure 7-3. Tolling Location

Radio frequency identification readers and associated antennae would be installed at the Toll Zones and integrated into the Electronic Toll Collection System. This equipment is required so that the all-electronic tolling system can use radio frequency identification transponders as a means of toll payment.

The Toll Zones interface with a central server-based Electronic Toll Collection System facility host that aggregates data and images from the Toll Zone devices and forwards them to the Back-Office System for processing. For each vehicle that travels through the Toll Zone, the Electronic Toll Collection System generates a toll transaction data record, captures vehicle images, and transmits this information to the Back-Office System.

Roadside toll equipment enclosures/cabinets housing Electronic Toll Collection System equipment would be secured to allow access by only authorized maintenance personnel. Recorded digital cameras would be used to supplement facility and equipment security measures in order to provide the ability to monitor and review access activity.

7.2.3. Back-Office System

The Back-Office System would process toll transactions and images from the Toll Zones, administer customer accounts and manage customer payments. This includes interfacing with Michigan's Secretary of State in order to obtain ownership information about vehicles with registered Michigan license plates for video tolling. The Back-Office System would also interface with commercially available entities to obtain ownership information about out-of-state vehicles based on license plates that include state-specific Department of Motor Vehicles information or third parties providing such services.

All credit/debit card processing activities and related technologies would comply with the Payment Card Industry Data Security Standard. This standard includes activity and technology requirements regarding credit/debit card data capture, storage, and transmission to protect cardholder data. Annual compliance audits would be performed to ensure that required data protection practices and controls are followed.

It is recommended that the new Michigan Toll Authority, which would operate a large network of toll roads, as described in this *Strategic Implementation Plan*, develop its own Back-Office System. The Back-Office Systems in use on existing MDOT toll bridges in Michigan would not be scalable to process transactions for over 500 miles of toll roads. Additionally, MDOT toll

bridges do not currently offer video tolling, which would be important for a new toll road or system in Michigan. If a smaller-scale new toll road, bridge, or lane with video tolling were to move forward in Michigan, collaborating with another existing toll agency, such as the Pennsylvania Turnpike or Illinois Tollway, for Back-Office System functions may be possible.

7.2.4. Customer Service Center operations

The Customer Service Center would handle all customer interactions for the toll system. This includes the Call Center, which interfaces directly with toll customers via telephone calls about activities such as opening new transponder accounts, assisting with existing account management and maintenance, ordering new or replacement transponders, accepting payments, and responding to information requests. It is recommended that customer service representatives provide person-to-person customer service phone support during morning, afternoon, and early evening business hours. An interactive voice response tool would also provide customer service support 24/7. If a customer telephones the Call Center outside of business hours, the interactive voice response tool would indicate the business hours and allow the customer to perform various self-service functions.

Walk-up locations are another subsection of the Customer Service Center. It is recommended that the new Michigan Toll Authority rent or lease storefront space to establish customer service walk-up locations close to toll project corridors in areas that are underserved by third-party retailers. The new Michigan Toll Authority could use local third-party retailers, for example, a grocery or convenience store chain, to supplement both transponder distribution and bill payment processing efforts. These retailers would provide customers with convenient in-person access to transponders and bill payment options. A transponder sold through any third-party retail store would be able to be registered and activated by the customer contacting the Call Center, visiting a walk-up location, or using the website or mobile application.

Printing and mailing are also Customer Service Center support functions. Due to the anticipated high volume of ongoing printings and mailings, the new Michigan Toll Authority would use an outsourced third-party printing and mailing service provider. This provider would use high-capacity, high-speed printers and mail processing equipment to print and mail customer letters, statements, invoices, and notices.

7.3. Recommended Business Rules

Best practices for business rules related to all-electronic tolling have evolved over the last few decades to be more customer-friendly and less punitive. Recommendations that would apply to a new toll road system in Michigan include:

- Monthly billing for video tolling invoices, including any new and previously outstanding tolls.
- Treating the registered vehicle owners that initially receive video tolling invoices as customers, not violators. Vehicle owners would not be considered violators until after they do not pay an initial invoice. Related to this, an initial invoice should include the cost of the video toll only, not any additional mailing or other fees.

- There would be three total video invoices prior to the use of other enforcement efforts:
  - The first invoice would include the original transactions with no additional fees.
  - The second invoice would include a late fee for the original invoice in addition to the unpaid transactions.
  - The third invoice would include an administration fee in addition to the late fee and unpaid transactions.
- If a registered vehicle owner does not pay a threshold of transactions after the invoicing process, it is recommended that the vehicle be placed on a vehicle registration hold. This process is common in other states with modern tolling systems. A vehicle registration hold would be administered in collaboration with the Secretary of State and would not allow a vehicle registration to be renewed until unpaid transactions associated with that vehicle are resolved. A collections process may also be initiated as part of overall enforcement efforts.
- Business rules should be flexible to allow adjustments over time to Michigan-specific lessons learned and to allow incorporation of any new toll collection technologies in the future.

7.4. Collaboration with Existing Michigan Toll Facilities

It is recommended that dialogue continues with existing toll facilities in Michigan if planning for a toll road program were to move forward. When possible, policies and decisions should be made that would promote long-term collaboration between the different toll agencies in Michigan to achieve the most consistent possible customer experience across Michigan. For example, the recommended use of 6C protocol transponders would be consistent with the transponder protocols introduced for the International Bridge, Mackinac Bridge, and Blue Water Bridge over the last few years.

The existing public international toll bridges and tunnels in Michigan have complicated financial agreements with Canada and unique Michigan-based financial and/or operational structures. These agreements would limit the ability of existing toll bridges and tunnels to merge their operations and/or finances with a new toll system in Michigan. However, it is recommended that the potential for collaboration in planning, operations, and finances continue to be reviewed on a case-by-case basis.

7.5. Toll Collection Cost Estimates

Table 7-1 summarizes toll collection cost assumptions and sources for five key analysis categories. The toll collection cost estimate results are provided in Section 7.6 as a relative share of gross toll revenue and in Section 8 as total costs.

Table 7-1: Toll Collection Cost Assumptions and Sources

Category	Source/Notes
New Michigan Toll Authority administration	Assumed that six percent of gross toll revenue would fund administration
Toll system unit costs (in 2020 dollars)	Unit costs are based on industry standards and recent toll system procurements, implementations, and operations. The most important unit cost assumptions include: • $0.03 per transaction for all transactions • $0.06 additional for video transactions that required manual image reviews • Related to video tolling, In-state license plate lookups were assumed at no cost. Some up-front costs were assumed to allow development of the Michigan Secretary of State software process for providing these lookups. Out-of-state or out-of-country license plate lookups were assumed to be $1.00 per lookup • Mailing costs related to video tolling invoices and other customer correspondence are assumed to be $1.25 per mailing
All-electronic tolling by payment type	• An opening year share of customers paying with a transponder of 65 percent was assumed. This was assumed to increase to 80 percent after five years and remain at 80 percent for the remainder of the program • An assumed 15 percent of transactions initially considered to be video-based were assumed to be associated with transponder accounts (“V-Tolls”). Reasons for this occurring include if a transponder account had an insufficient balance to pay the toll • Five percent of transactions initially considered to be video tolls were assumed to have no license plate or an unusable license plate image • Of the remaining transactions initially considered to be video tolls, 65 percent were assumed to have in-state license plates, 11 percent to be a different state, and four percent to be from Canada
Lane-based roadside toll collection system	• All necessary lane-based and roadside equipment associated with all-electronic tolling was assumed • Annual operations and maintenance costs related to the roadside toll equipment are included • The lane system would be modernized every seven years after initial implementation • An axle-based toll collection system was assumed • Utility relocations and additional right-of-way were not assumed to be needed for the tolling equipment • Toll equipment was assumed to be installed above all mainline lanes and shoulders at least four feet in width

Category	Source/Notes
Back-office system and customer service center	• Annual operations and maintenance costs related to the back-office system are included • Related to operations, staffing costs, facility costs, and costs of an annual third-party audit are included • Back-office and customer service center software would be modernized every ten years after initial implementation • Transactions would be processed by toll zone rather than by trip • An assumed 25 percent of transactions associated with transponder accounts were assumed to be associated with accounts from a different toll agency. Additional collection costs were assumed for these transponder transactions based on standard industry rates • The success rates of license plate lookup of the registered vehicle owner for video tolling were based on typical toll industry averages • Sixteen transactions per video invoice were assumed on average

7.6. Gross Revenue Estimates

The gross revenue estimates previously summarized in Section 6 do not include the impact of video tolling. These impacts were included in the toll collection cost estimation process. The results of this analysis are illustrated in Figure 7-4. As shown, annual gross toll revenue is estimated to increase from about $1.3 billion in 2032 to about $4.5 billion in 2067 (year of collection dollars). Table 7-2 shows how the 2032 revenue compares with toll revenue in other peer states. In terms of revenue per mile, 2032 revenue is most comparable with recent revenue collected on the Pennsylvania Turnpike system. The year 2032 is the year that tolling is assumed on the full Tier 1 system after being gradually implemented beginning in 2028. The Tier 1 sequencing plan is discussed in more detail in Section 9.2.

Based on the toll collection cost estimates resulting from the assumptions and methodology shown in Table 7-1 and the revenue shown in Figure 7-4, it can be estimated that toll collection costs account for about 13 percent on average of gross annual toll revenue.

Figure 7-4: Gross Revenue Including Video Tolling Impacts

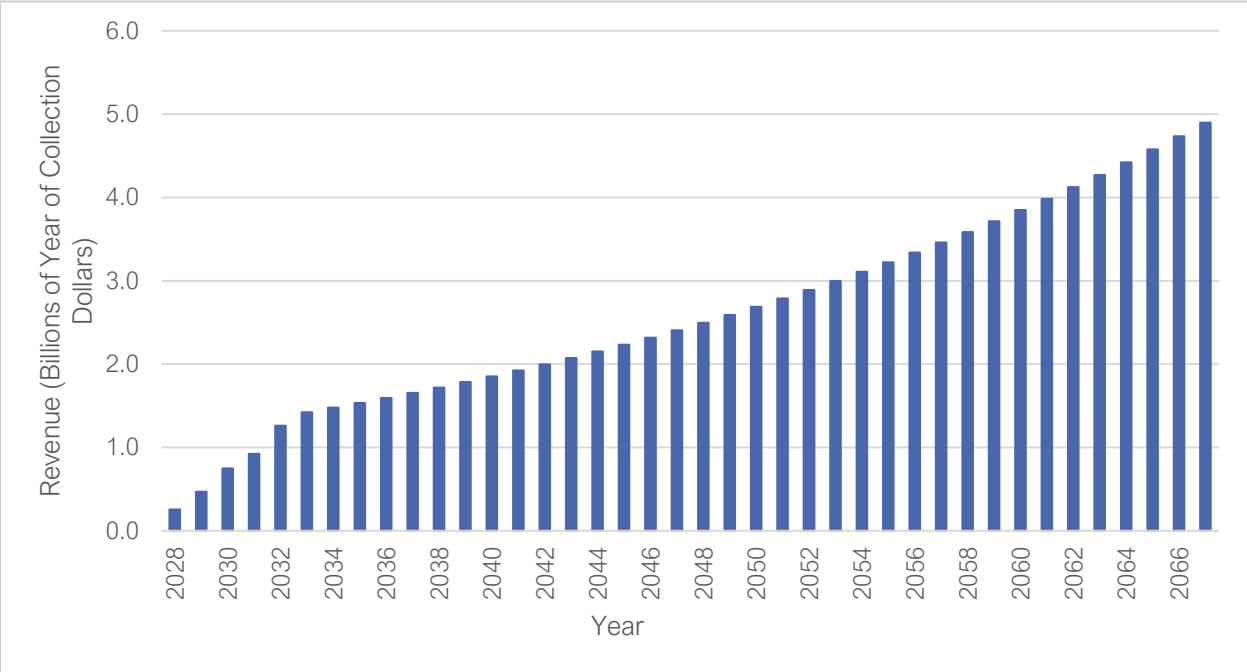


Table 7-2: Annual Gross Toll Revenue for Michigan and Peer States

Toll Road System	Miles	Revenue as of	Toll Revenue (billions)[1]	Toll Revenue per Mile (millions)[1]
Illinois Tollway	289	Year ended Dec. 31, 2021	$1.3	$4.5
Ohio Turnpike	241	Year ended Dec. 31, 2021	$0.3	$1.4
Pennsylvania Turnpike	567	Year ended May 31, 2022	$1.6	$2.8
Michigan Tier 1 System	**545**	**Year ended Dec. 31, 2032**	**$1.3**	**$2.3**

[1]In year-of-collection dollars

8. Total Cost and Revenue Estimates

8.1. Total Cost Estimates by Category

This section includes the total cost estimates from the Discount, Mitigation, and Benefit Programs, toll gantries, roadway, bridge, administration, and toll collection. The costs are summarized in 2022 dollars in Figure 8-1 and in year-of-expenditure dollars in Figure 8-2. Total costs are for 2026 (the first year of construction assumed) through 2067 (40 years after the initial start of tolling in 2028). The relative amount of different cost categories can change between the two charts based on relatively how much costs are in the early years of the program versus later years. As shown, the largest cost of the program is roadway costs, followed by bridge, toll collection, administration, the Discount Program, the Mitigation and Benefit Program, and communications and intelligent transportation systems.

Figure 8-1: Breakdown of Toll Cost Estimates in 2022 Dollars for 2026 through 2067

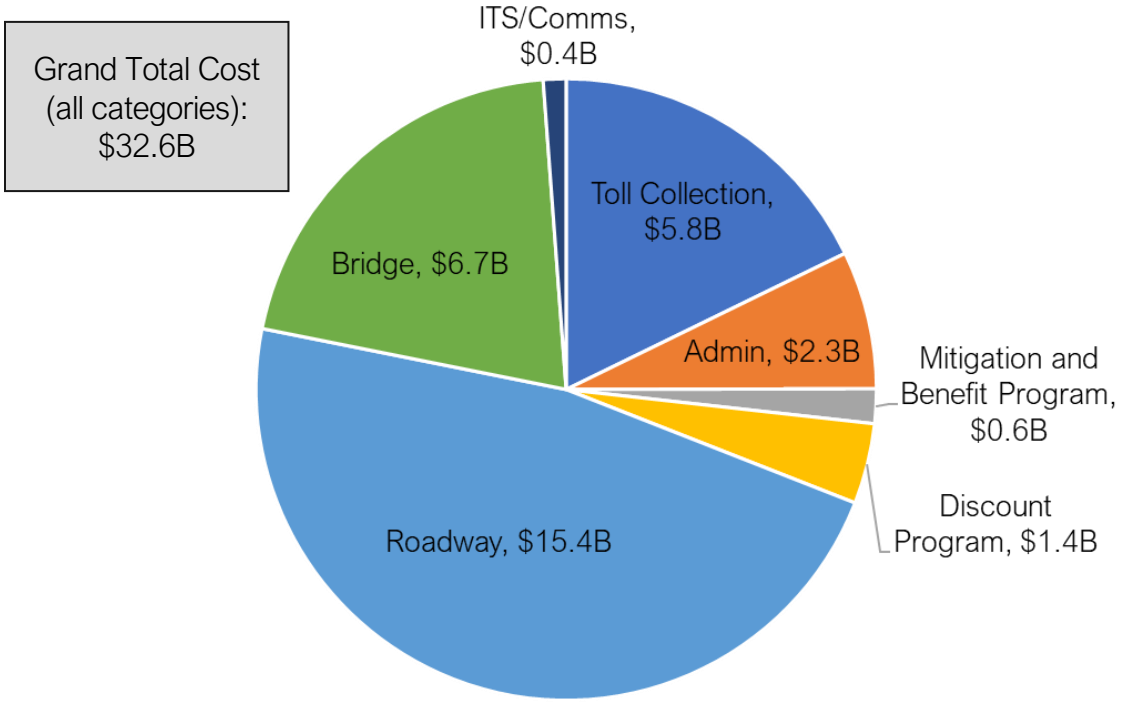
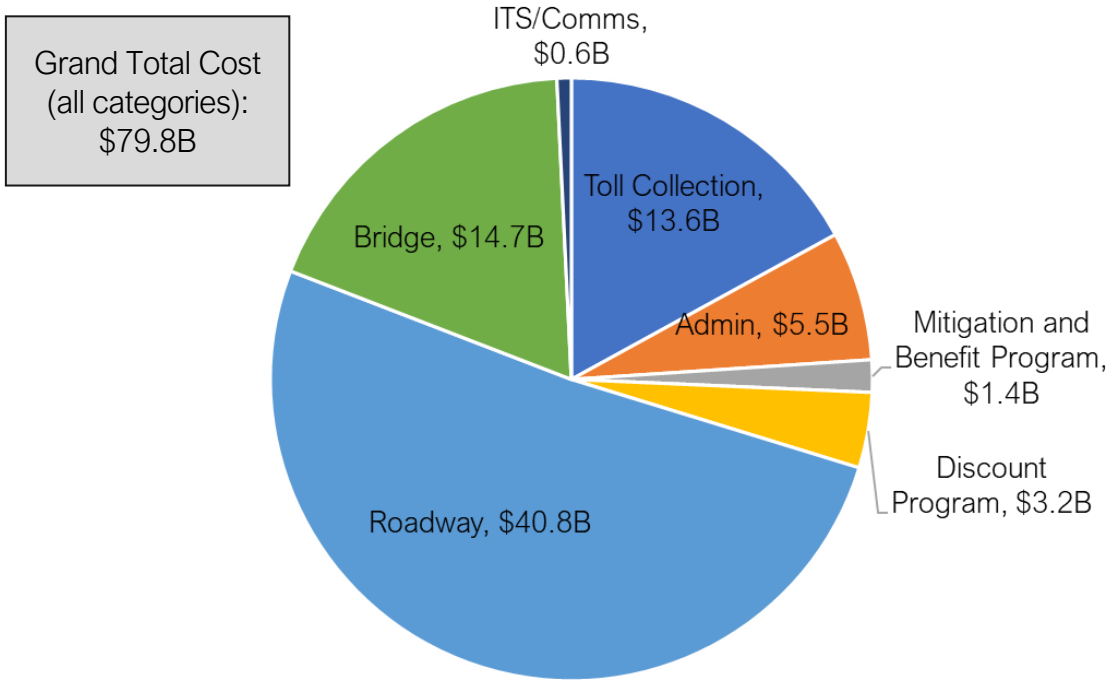


Figure 8-2: Breakdown of Toll Cost Estimates in Year-of-Expenditure Dollars for 2026 through 2067



8.2. Total Gross Revenue Estimates

The total gross revenue estimates comparable to the cost estimates in the previous sub-section are included below. These are reflective of revenue between 2028 (the first year of tolling) and 2067 (40 years after the first year of tolling):

- $43.7 billion in 2022 dollars.
- $103.5 billion in year-of-collection dollars.

The differences between the revenue and costs are available to cover the costs of financing for a toll bond program. Financing strategies for the toll program are discussed in Section 9.

9. Delivery and Financial Strategies

This section includes delivery and financial strategies for the Tier 1 tolling program, including all program costs and revenues. As explained in more detail in this section, construction is assumed to begin in 2026. Tolling is assumed to begin on the first segments of Tier 1 in 2028.

9.1. Program Delivery

Tolling provides a new revenue source for the State of Michigan to preserve, rehabilitate, and expand its system of limited-access roadway and bridge assets. Tolling programs are often designed to be completely self-supporting, where toll revenues can support debt issuance for all upfront capital costs, as well as fund ongoing operations, maintenance, and lifecycle needs, without any other public revenue contributions. Most U.S. toll facilities and systems are managed and operated by public entities with authority to establish toll projects, contract with the private sector, issue debt, and enforce revenue collection.

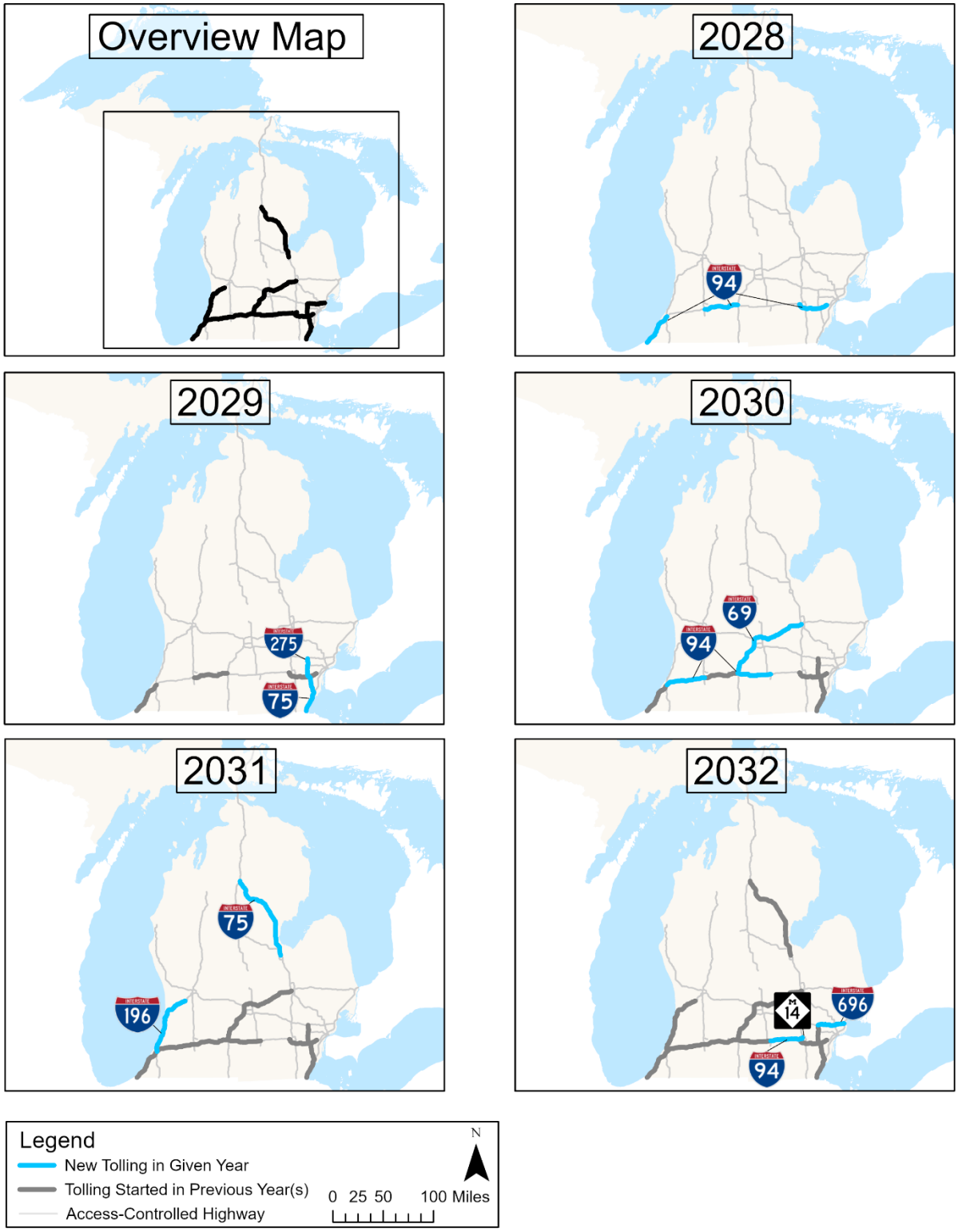
The *Strategic Implementation Plan* outlines policy options and requirements for governance, legislation, project selection, and operations that would enable an effective tolling enterprise. The financial analysis evaluated the cost, revenue, and financial potential of projects to inform the phasing and implementation of a viable tolling system. The iterative feasibility process used a credit market-accepted financial model to estimate debt capacity for Michigan's multi-year implementation of proposed toll projects. The model also evaluated the State's potential to generate upfront debt proceeds for all capital costs and satisfy all operations, maintenance, and lifecycle needs.

The financial analysis demonstrates that the net toll revenue forecast can support financing all $8.6 billion of capital costs associated with roadway and bridge construction and the initial rollout of tolling on the Tier 1 system. The financing is assumed to be structured conservatively to meet financial market expectations and ensure toll revenue is sufficient to support lifecycle costs. The financial analysis confirms for policymakers that tolling can be self-sufficient and offer stable funding for a system of highways in Michigan and that current spending on these highways could be reallocated to other transportation purposes. This analysis concludes that Michigan's Tier 1 highways could support a feasible and financially viable toll system.

9.2. Corridor Sequencing Plan

A plan was developed to implement tolling on the nearly 550 miles of Tier 1 corridors over five years, from 2028 to 2032. The plan considers high-level impacts on project financing, construction phasing, and geographic equity when developing the timing of the rollout of tolling. Figure 9-1 shows the assumed opening toll year for each construction grouping on the Tier 1 system. Corridors or segments assumed to start tolling are shown in blue. It is assumed that initial construction activities (the initial capital program) on those segments would occur in the two years before the start of tolling.

Figure 9-1: Sequencing Plan



9.3. Inflation Assumptions

The financial analysis is based on year-of-expenditure dollars for costs and year-of-collection dollars for revenue. Inflation assumptions were made to convert base year cost and revenue estimates to future year dollars. Inflation has been particularly volatile since late 2021 and is expected to continue to be volatile in the near future. Ongoing uncertainty in cost inflation can be mitigated by flexibility in toll rates.

9.4. Toll Financing Analysis

The financial analysis of Michigan's tolling system is based on creating a new, non-recourse toll revenue financing credit to support the debt of the tolling system. This new financing program would only pledge toll revenues to debt repayment and not impact any existing MDOT or other State of Michigan borrowing program or credit ratings. The planning-level analysis used a toll finance model to structure a series of public, tax-exempt toll revenue bond issuances to deliver the corridor sequencing plan. The results of the toll program financial plan were evaluated to determine if:

- All capital costs can be funded with debt proceeds,
- All lifecycle costs can be funded from toll revenue cash flows, and
- The financial structure and metrics meet rating agency and credit market expectations.

The financial structure of the toll bond transactions was assumed to be based on recent market precedents and standard market requirements for an investment-grade toll revenue credit. While start-up toll programs often feature multiple debt products and liens, the Michigan analysis uses a more conservative and standard financing structure to generate the required bond proceeds. Table 9-1 illustrates the high-level assumptions used to run the financial model and simulate the net revenue stream's debt capacity.

Table 9-1: Financial Assumptions

Item	Description
Credit / Security	• BBB ratings category (medium-grade quality bonds with adequate protection), non-recourse toll revenue debt • Net revenue pledge (gross revenue minus operations and maintenance costs)
Interest Rates	• 30-year average of AAA Municipal Market Data Curve • Plus BBB credit spread of 100 basis points
Debt Term and Structure	• 35-year bonds • Ascending annual debt service
Debt Products	Current Interest Bonds
Reserve Accounts	• Debt Service Fund fully funded • Capitalized interest funded through construction completion plus six months

Planning-level financial analysis for a complete program is often an iterative process in order to evaluate the timing of financing and sequencing of projects. To deliver bond proceeds for Michigan's current corridor sequencing plan, the financing analysis assumes three bond issues at the beginning of the relevant construction terms. Figure 9-2 illustrates how the financing tranches align with the annual construction packages. The first financing tranche would be issued by the start of the 2026 construction period for the projects that would open in 2028 and 2029. Table 9-2 presents a total of $8.6 billion in capital costs.

Figure 9-2: Financing Tranches

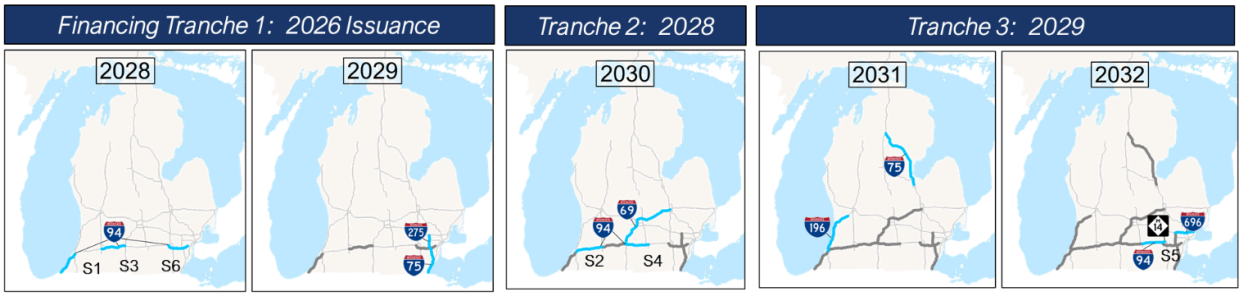


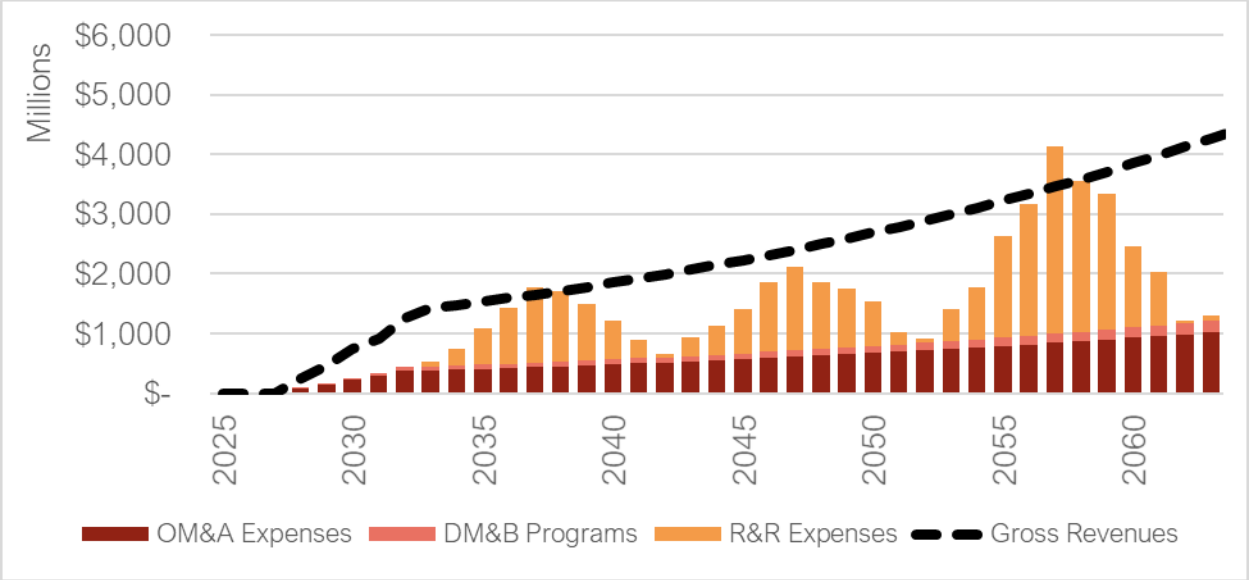
Table 9-2: Financing Tranches

Capital Costs	Tranche 1		Tranche 2	Tranche 3	
Financing Year	2026	2026	2028	2029	2029
Construction Start	2026	2027	2028	2029	2030
Toll Opening Year	2028	2029	2030	2031	2032
Amount (in billions of year-of-expenditure dollars)					
2026	1.183	-	-	-	-
2027	1.219	0.256	-	-	-
2028	-	0.263	1.380	-	-
2029	-	-	1.421	0.867	-
2030	-	-	-	0.893	0.541
2031	-	-	-	-	0.567
Total[1]	2.402	0.519	2.801	1.760	1.098
Total Financing Tranche[1]	2.921		2.801	2.857	

[1]Totals may not match due to rounding.

The first financing would generate $2.92 billion in net construction proceeds by structuring a bond transaction against the net revenue of Tranche 1 projects. Two years later, in 2028, another financing would be structured against all Tranche 1 and 2 net revenue and previous debt service. To accommodate the large initial capital program, as well as the lifecycle needs, the six-cent-per-mile (in 2020 dollars) revenue forecast was adjusted upwards by nine percent in the years 2033 and beyond to provide additional revenue and mimic a toll rate increase from six to seven cents per mile (in 2020 dollars). Figure 9-3 presents the complete net revenue stream for all three financing tranches.

Figure 9-3: System Revenues and Expenses[1]



[1]Operations, maintenance, and administrative (OM&A) expenses include administrative costs and operations and maintenance costs for roadway, bridge, and tolling systems. Discount, Benefit, and Mitigation (DM&B) Program costs are shown in a separate category. Renewal and replacement (R&R) expenses include renewal and replacement costs for roadway, bridge, and tolling systems.

9.4.1. Financing capacity

The financing capacity of the proposed tolling projects can support all $8.6 billion of initial program costs and reserve funds, and the resulting debt service coverage ratios are adequate to achieve financial market expectations. Figure 9-4, Figure 9-5, Figure 9-6, and Table 9-3 summarize the results of the financings. Annual debt service is illustrated in Figure 9-4 by Tranche and is also shown in Figure 9-5 on a total basis in a dark blue color. Table 9-3, which includes financial capacity metrics, shows that debt service levels are strong and would meet market expectations.

Figure 9-4: Annual Net Debt Service

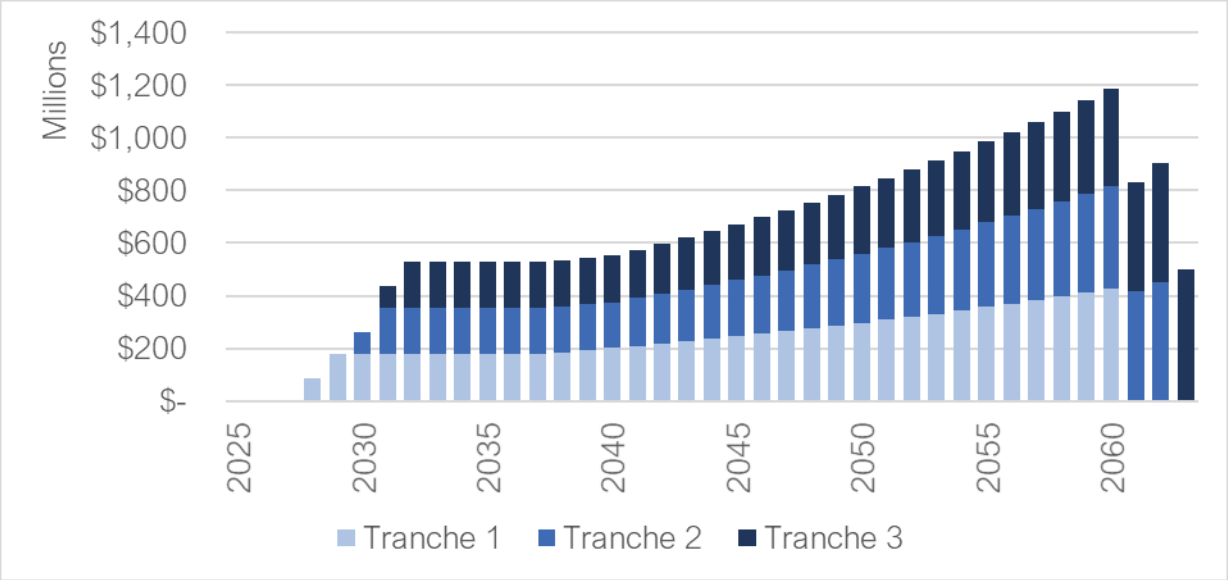
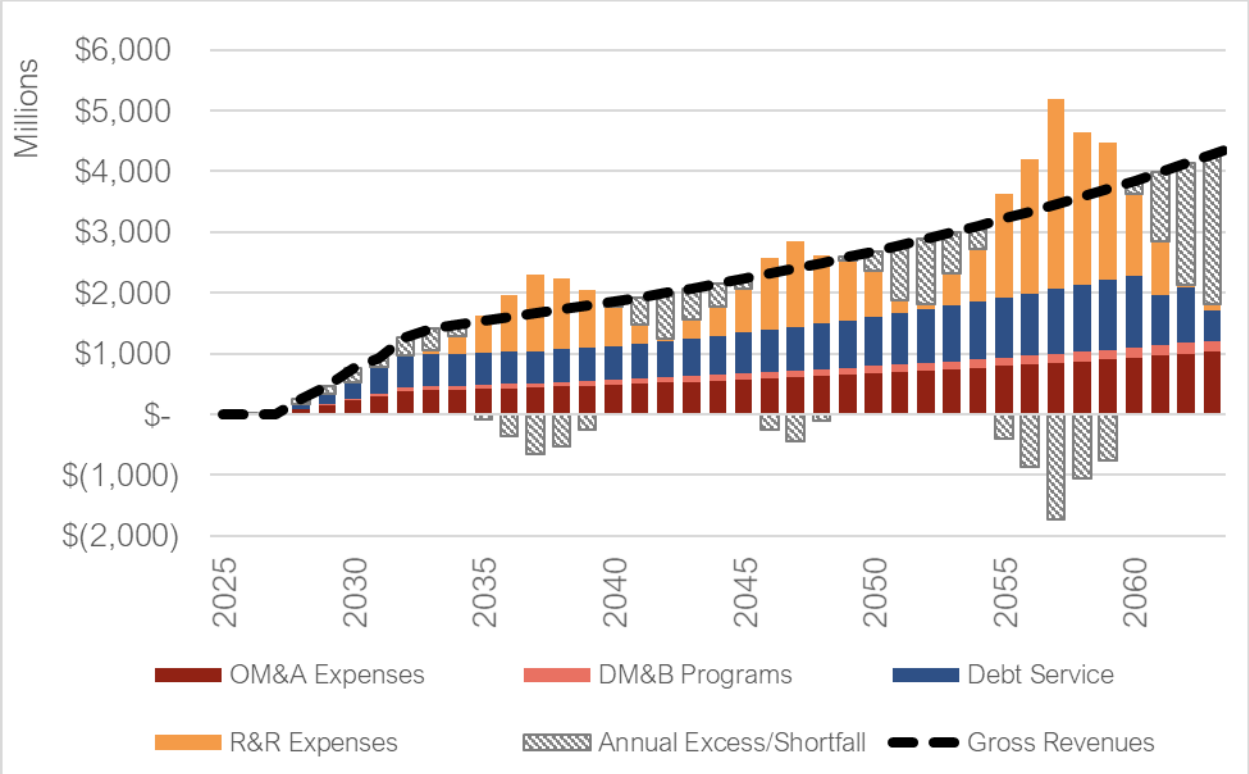


Table 9-3: Financing Capacity

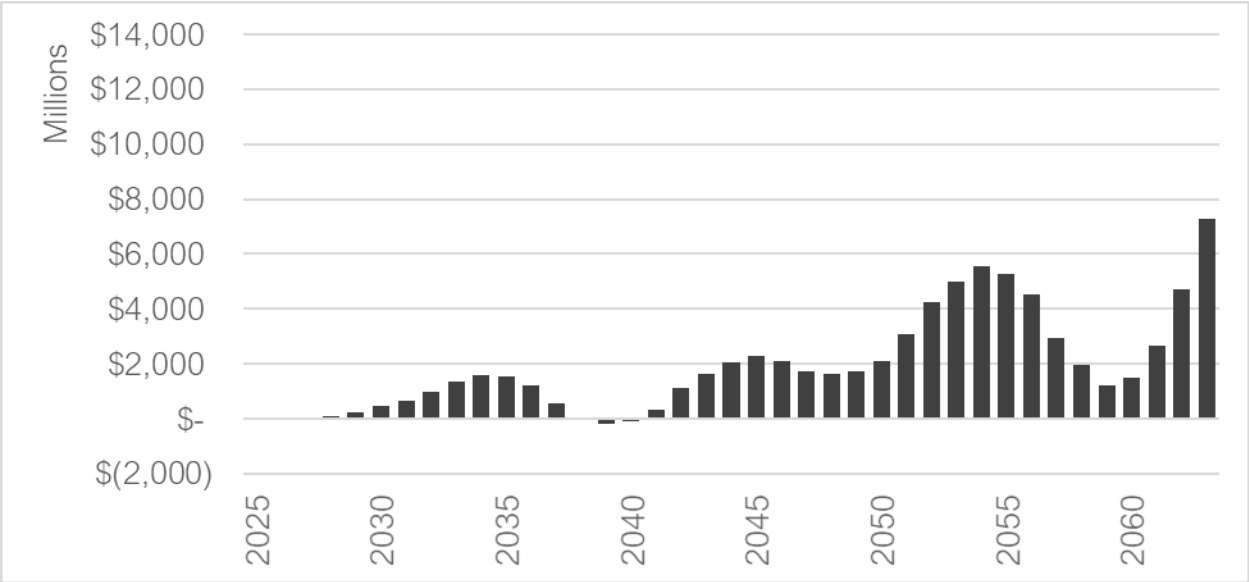
Financing Tranche	1	2	3
Net Proceeds (Billions of $)	$2.921	$2.801	$2.857
All-In True Interest Cost	5.11%	5.12%	5.12%
Average Coverage	2.47x	2.25x	2.40x

Figure 9-5: Annual Cash Flows[1]



[1]Operations, maintenance, and administrative (OM&A) expenses include administrative costs and operations and maintenance costs for roadway, bridge, and tolling systems. Discount, Benefit, and Mitigation (DM&B) Program costs are shown in a separate category. Renewal and replacement (R&R) expenses include renewal and replacement costs for roadway, bridge, and tolling systems. Toll revenue in the years with lower renewal and replacement expenses was assumed to be reserved in the toll system enterprise in order to fund the years with higher expenses. Figure 9-5 Indicates excess revenue is available in some years while in other years there would be a shortfall. Accruing excess revenue would nearly fully cover all the years with revenue shortfalls. The estimated amount of excess revenue accrued is shown in Figure 9-6. Only in 2039-2040 would the reserve fund be insufficient for renewal and replacement. This would require a future financing or modification of the original plan. This could include a renewal and replacement change or financing innovation, such as the use of other debt products.

Figure 9-6: Cumulative General Reserve Balance Over Time



The planning-level financial analysis demonstrates a feasible tolling system. While there is a funding shortfall in two years of under $200 million, the financial structure could support additional debt during the renewal and replacement peaks, and innovative options, including the Federal TIFIA loan program, exist to reduce overall debt service. Additionally, lifecycle costs and sequencing of the renewal and replacement program could be adjusted. **Thus, the financial analysis confirms for policymakers that tolling can be self-sufficient and offer stable funding for critical limited-access facilities in Michigan and that current spending on these facilities could be reallocated to other transportation purposes.**

9.4.2. Debt repayment schedules

Table 9-4 and Table 9-5 present the bond issuance details to generate the required construction fund proceeds. Table 9-6 presents the debt amortization from the financing tranches.

Table 9-4: Debt Sources (Billions of Year-of-Collection dollars)

Sources	Tranche 1	Tranche 2	Tranche 3	Total
Senior Lien Bonds				
Total Revenue Debt – Current Interest Bonds	$3.765	$3.626	$3.691	$11.072
+ Premium/-Discount	(51)	(52)	(54)	(157)
Total Bond Proceeds	$3.714	$3.564	$3.637	$10.915
Total Sources	$3.714	$3.564	$3.637	$10.915

Table 9-5: Debt Uses (Billions of Year-of-Collection dollars)

Uses	Tranche 1	Tranche 2	Tranche 3	Total
Initial Construction Cost	$2.921	$2.801	$2.857	$8.578
Initial Total Project Costs	$2.921	$2.801	$2.857	$8.578
Capital Interest Fund	$453	$436	$445	$1.334
Debt Service Reserve Fund	$329	$317	$324	$970
Underwriters Discount and Costs of Insurance	$11	$11	$11	$33
Total Uses	$3.714	$3.564	$3.637	$10.915

Table 9-6: Debt Amortization from the Financing Tranches (Millions of year-of-Collection dollars)

Bond Year	Tranche 1			Tranche 2			Tranche 3		
Ending 1-Jan	Principal	Interest	Debt Service	Principal	Interest	Debt Service	Principal	Interest	Debt Service
2026									
2027		188	188						
2028		188	188						
2029		188	188		181	181			
2030		188	188		181	181		185	185
2031		188	188		181	181		185	185
2032		188	188		181	181		185	185
2033		188	188		181	181		185	185
2034		188	188		181	181		185	185
2035		188	188		181	181		185	185
2036		188	188		181	181		185	185
2037		188	188		181	181		185	185
2038		188	188		181	181		185	185
2039	6	188	194		181	181		185	185
2040	14	188	202		181	181		185	185
2041	22	187	210	2	181	182		185	185
2042	32	186	218	9	181	190	5	185	190

Bond Year Ending 1-Jan	Tranche 1			Tranche 2			Tranche 3		
	Principal	Interest	Debt Service	Principal	Interest	Debt Service	Principal	Interest	Debt Service
2043	42	185	226	17	180	198	12	185	197
2044	52	182	235	26	179	206	20	184	204
2045	64	180	244	36	178	214	29	183	212
2046	77	177	253	46	177	223	38	181	220
2047	90	173	263	57	174	231	48	179	228
2048	105	168	273	70	171	241	59	177	236
2049	120	163	283	83	168	250	71	174	245
2050	137	157	294	97	164	261	83	170	254
2051	155	150	305	112	159	271	97	166	263
2052	174	142	316	129	153	282	112	161	273
2053	194	134	328	146	147	293	127	156	283
2054	216	124	340	165	139	305	144	149	293
2055	240	113	353	185	131	316	162	142	304
2056	265	101	366	207	122	328	182	134	315
2057	291	88	379	229	111	341	201	125	327
2058	320	73	393	254	100	354	223	115	338
2059	350	57	408	280	87	367	246	104	350
2060	382	40	422	308	73	381	271	92	363
2061	417	21	438	338	58	396	298	78	376
2062				385	41	426	356	63	419
2063				435	22	457	419	45	464
2064							486	24	511
Total	**3,765**	**5,438**	**9,203**	**3,616**	**5,265**	**8,881**	**3,691**	**5,386**	**9,077**

The financing analysis, including the debt repayment schedules discussed in this section, assume beginning tolling on the Tier 1 corridors between 2028 and 2032. If the Tier 1

implementation is successful, continuing to expand the toll system to other highways in Michigan, including those included in Tier 2 and Tier 3 would be possible.

9.5. Sensitivity Discussion

Planning-level analyses of this nature contain a multitude of assumptions, and the long-term nature of the forecasts makes outcomes unpredictable. Multiple technical and financial sensitivities could be run to test revenue, cost, and financial assumption impacts. For instance, the nine percent net revenue increase embedded into the financial analysis began as a sensitivity to test revenue and cost impacts on the financing results. A range of possibilities could be modeled or performed in future analyses in order to address program financial challenges. These include:

- Optimization of balance between initial capital and lifecycle (renewal and replacement) costs.
- Refinement of renewal and replacement costs to reflect sequencing and roadway wear (based on traffic levels and actual asset performance over time).
- Use of TIFIA loans and subordinate liens to lower borrowing costs.
- Analysis of debt products to tailor debt-service shaping (capital appreciation bonds, convertible bonds, and accreted interest of TIFIA funds) around renewal and replacement cycles.
- Optimization of reserve account funding.
- Testing of additional interest rate scenarios.
- New traffic and revenue sensitivities (diversion, economy, fuel price, COVID-19 pandemic, etc.).
- Additional sequencing analysis and timing/sizing of debt (including market capacity).

10. Implementation

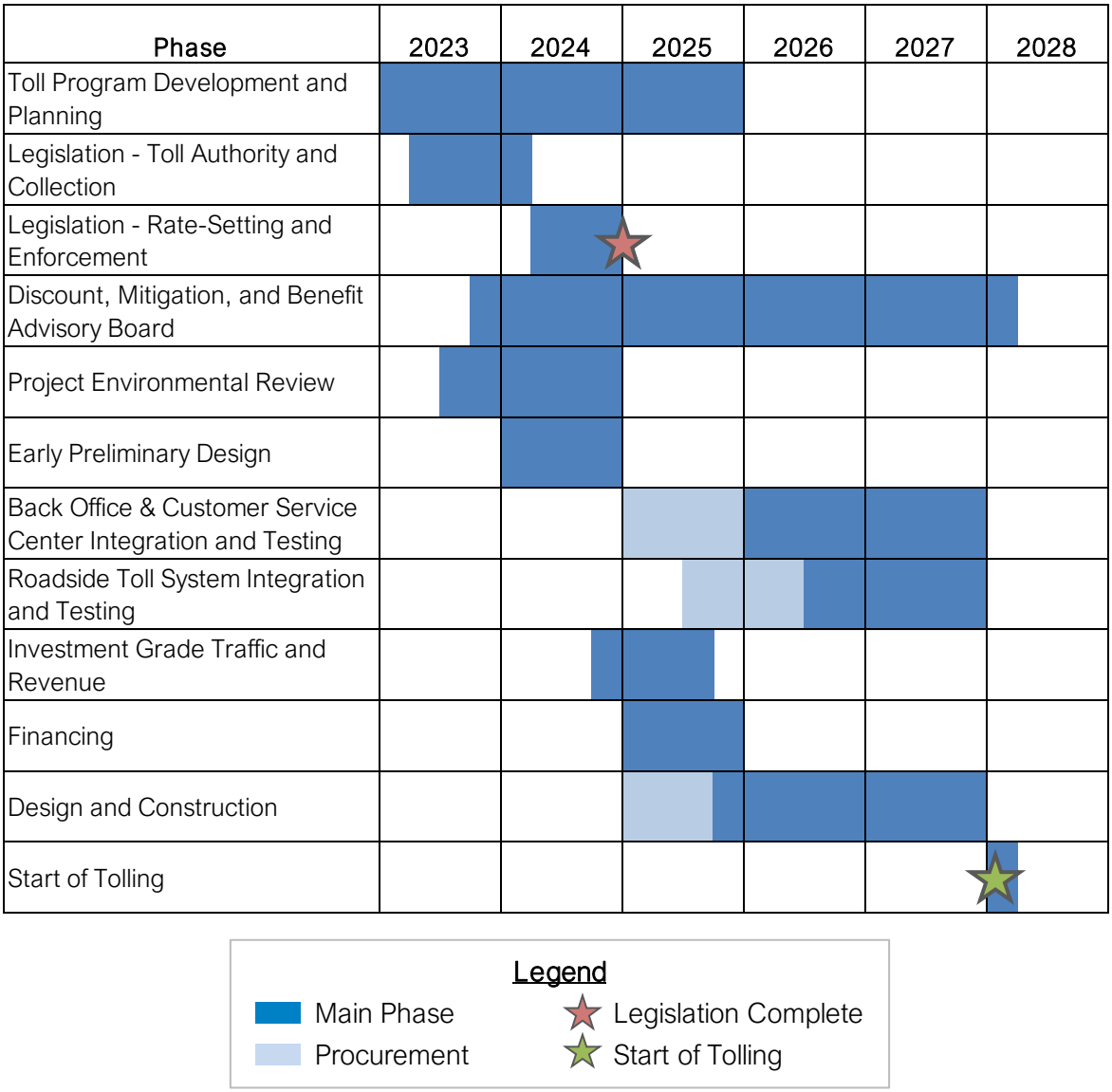
10.1. Timeline and Activities

Figure 10-1 shows an estimated timeline and necessary activities that would be required if a major toll program moves forward in Michigan. The timeline is shown to start tolling of the first segments of I-94 in 2028, as shown previously in the sequencing plan in Figure 9-1. Some key assumptions included are:

- Two separate legislative efforts are assumed. The first will establish the toll authority and provide the ability to collect tolls. The second would provide any refinements and specify rate-setting, toll collection and enforcement provisions. Breaking legislation into two separate efforts allows the establishment of the new Michigan Toll Authority earlier (by early 2024) so Authority leadership can be in place before financing and procurement activities begin. The second legislative effort should be finished by the end of 2024 before any necessary environmental approvals are made.
- The Discount, Mitigation, and Benefit Advisory Board would be set up early in the process and would be in place through the beginning of tolling.
- Toll program development activities would continue in 2023 and 2024 to refine cost estimates, revenue forecasts, and perform pre-construction activities.
- Project environmental review and preliminary design are assumed to be completed by the end of 2024.
- The key activities for 2025 would be procuring the back-office system and customer service center, project financing, and procuring the design and construction for the project.
- Design and construction and toll systems testing would occur in 2026 and 2027.

Activities shown in Figure 10-1 occurring before the toll financing in late 2025 would need to be initially funded using other non-toll revenue sources. However, an agreement could be made to pay back initial funding using toll revenue in the future, similar to the agreement in place for the development of the Mackinac Bridge.

Figure 10-1: Implementation Activities for the First Segments of Tier 1[1]



[1]The first segments of Tier 1 are shown in the 2028 box of Figure 9-1. These include I-94 between the Indiana Border and I-196, I-94 between US-131 and I-69, and I-94 between M-14 and US-24.

10.2. Plan Updates

The assumptions and analysis approaches used for this *Strategic Implementation Plan* were developed to produce transparent and data-driven results. As is the case with forward-looking estimates of traffic, construction costs, and other key parts of analysis, actual revenue and costs will be different than forecasted. However, as discussed in Section 9.5, there are financial mechanisms available if, for example, traffic and thereby toll revenue is lower than expected or construction costs increase more than expected. The *Strategic Implementation Plan* analysis is designed to be conservative and allow for responses to future changes in

assumptions. If this Plan is ultimately approved for implementation, it is designed to be updated in the future with a minimum update of every five years.

Additionally, if a major tolling program does move forward in Michigan in the future, more detailed planning work, analysis, and outreach would be warranted. This would be tied to any necessary project-level environmental clearance, engineering, design, and investment-grade revenue studies as expected by rating agencies to support financing

Report updates

This page summarizes any report updates made to the original draft report.

Updates on February 1, 2023

- Page ES-4: The third bullet under the "Equity" heading was corrected to say "…local community transportation mitigations" instead of "…local community transportation photos".
- Section 5: The table showing the "Toll Gantry Initial Cost Estimates" was incorrectly shown twice in the original draft report on page 43 and page 45. The duplicated table on page 43 was removed and the table numbering in Section 5 was corrected accordingly.