

MICHIGAN DEPARTMENT OF TRANSPORTATION



**State Long-Range Transportation Plan
2005-2030**

**Revenue Gap
and Investment
Packages Report**

*Prepared for
The Michigan Department
of Transportation
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Prepared by



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MITransportation

MICHIGAN LONG RANGE TRANSPORTATION PLAN



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Executive Summary

Purpose

The *MI Transportation Plan* primary focus is on the parts of the transportation system that the Michigan Department of Transportation (MDOT): 1) has jurisdiction over, 2) provides funding for, or 3) regulates. The purpose of this document is to:

1. Provide the description of the needs, revenues, and resource gaps facing Michigan's transportation system under MDOT.
2. Describe four possible scenarios for allocating Michigan's state transportation resources, using the concept of illustrative investment packages.
3. Conclude with insights regarding a preferred investment level based on the comparison of investment packages under the vision, goals and decision principles of *MI Transportation Plan*.

The statewide long-term transportation needs for the department were split and costed into eight categories:

1. *Aviation*. Preservation and modest expansion of aviation facilities;
2. *Freight*. Preservation and modest expansion of rail and marine facilities, as well as investment in preserving and modernizing roadway infrastructure to support safe and efficient goods movement;
3. *Highway Expansion*. New capacity on trunkline facilities;
4. *Highway Other*. Miscellaneous capital improvements to trunkline facilities such as electrical, drainage, etc.;
5. *Highway Preservation*. Maintenance, rehabilitation, resurfacing, and replacement of pavements and bridges;
6. *Highway Modernization*. Safety and operational improvements, such as ITS and signalization coordination;
7. *Multi-modal Preservation*. On-going transit facilities, carpool, and bike/pedestrian facilities; and
8. *Multi-modal Expansion*. Adding new capital to bus transit and rail passenger facilities, expanding transit and rail passenger service, carpool lots, and bike/pedestrian facilities.

The base case provides a forward looking assessment of state transportation revenues, needs and gaps under MDOT's current revenue and investment trends. It assumes revenues grow in a way consistent with both the Michigan Public Act 51 of 1951 known as "Act 51," and trends in state and federal transportation revenue growth. Other possible futures are compared against the base case to explore how policy changes in revenue or in the investment mix may address unmet needs as well as system conditions and performance to the year 2030. The investment packages are intended to be educational and distinct enough to demonstrate the implications of meaningfully different futures for Michigan's state transportation system.

Base Case

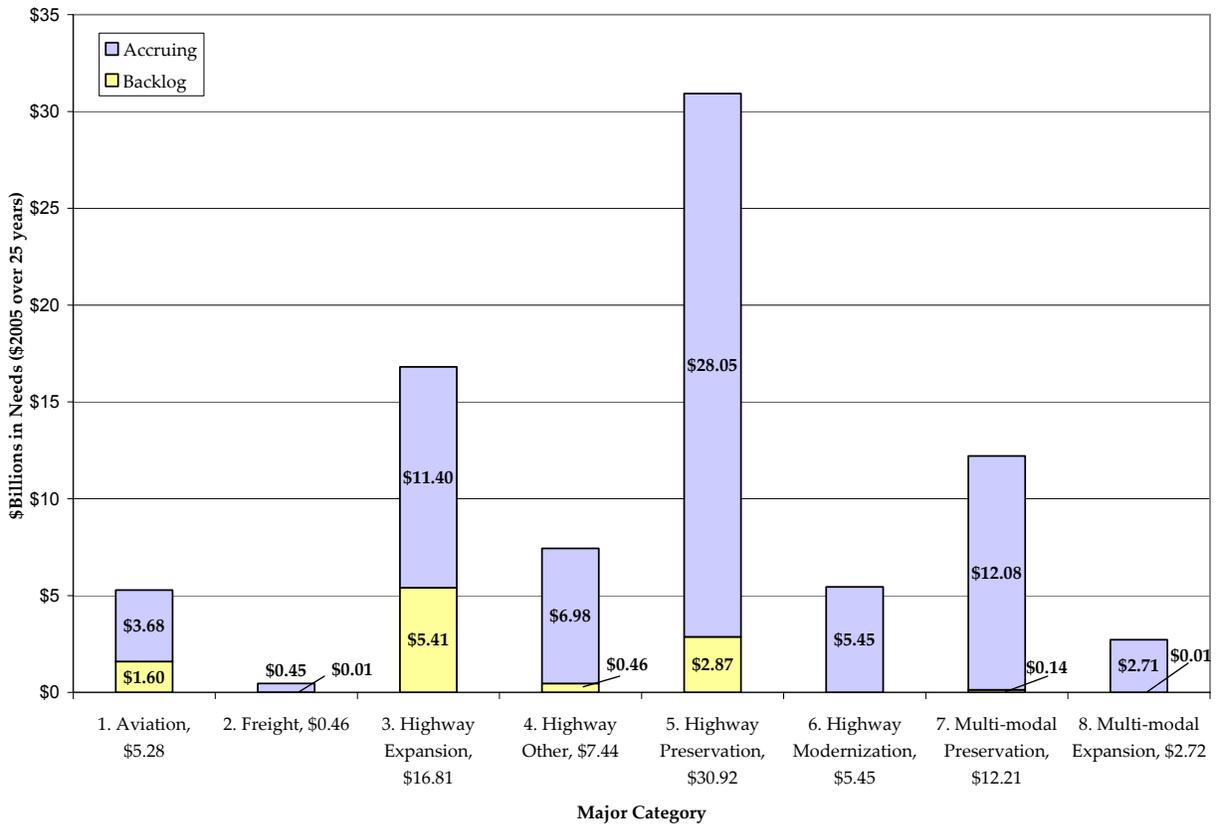
The base case delineates the state's transportation needs against the available revenues, based on trends in the growth of revenues and on how transportation programs are currently funded, over the 25-year life of *MI Transportation Plan* (2006-2030).

The state has \$81 billion (in Base Year 2005 dollars, or \$2005) in transportation needs over the life of the plan. The distribution of these needs by major categories is shown in the figure on the following page.

The categories represent groups of state transportation programs. These categories are mutually supporting as described in the *Integration Technical Report of MI Transportation Plan*. For example, programs explicitly supporting goods movement through ports and marine infrastructure comprise the Freight category. However the investments in Highway Preservation, Highway Expansion, and Highway Modernization also represent a significant investment in goods movement supported by programs with broader reach than Freight alone. In a similar way, the rail category addresses only the state-owned rail system, which is a small part of the rail system in Michigan. The privately-held rail industry is also likely to invest millions in the private system over the 25-year plan timeframe in ways beyond the scope of the public investment quantified in *MI Transportation Plan*.

Among the major investment categories, Highway Preservation has the highest need of \$30.9 billion; Highway Expansion and Multi-modal Preservation (which includes transit, intercity passenger, and carpool and bike/pedestrian facilities) have needs of \$16.8 billion and \$12.2 billion, respectively. Freight has the lowest need of less than \$0.5 billion over the life of the plan.

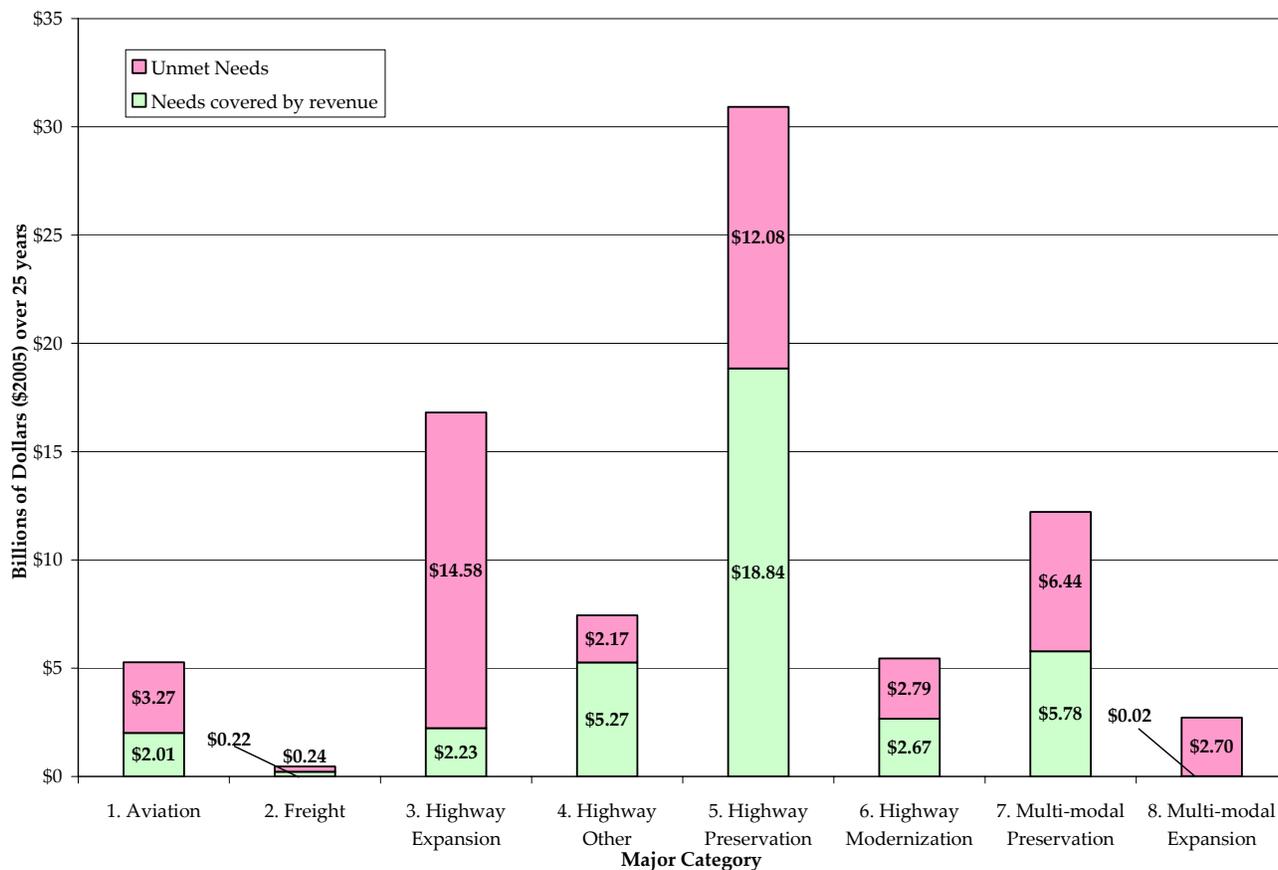
Statewide Long-Term Transportation Needs, by Major Category



Source: Wilbur Smith Associates

Over the 25-year plan (2006-2030), the state has a significant gap in transportation revenues, compared to transportation needs. The revenues available are only \$37 billion (\$2005), which leaves a revenue gap of approximately \$44 billion (\$2005). The gaps for eight major categories are shown in figure below. Highway Expansion and Highway Preservation have the largest gap, totaling almost \$27 billion together. Multi-modal Preservation has the next highest gap of well over \$6 billion.

Revenue Gap, by Major Category



Source: Wilbur Smith Associates

Investment Packages

Investment packages are simply different ways to invest transportation revenues. They consider how changes in revenue and policies, such as allocation of state transportation revenues between modes, may impact the performance and condition of Michigan’s transportation infrastructure and programs. The future investment scenarios presented in this report are intended to be illustrative only. Comparing investment packages provides insight into how the preferred investment level may affect Michigan’s transportation system performance and program goals.

Four investment packages are presented to address the \$44 billion projected revenue gap:

1. *“Business as Usual.”* The “Business as Usual” package explores the implications of living with the revenue gaps described in the base case presented. This future assumes no state transportation revenues beyond those associated with the base case revenues and an allocation of these funds among state programs in ways consistent with how revenues are allocated today.
2. *“Change the Mix.”* The “Change the Mix” package explores the implications of seeking to improve efficiency by investing projected revenues into a different mix of programs. This future also assumes no state transportation revenues beyond those associated with the base case revenues. “Change the Mix” considers reducing Highway Preservation revenues to allocate more funds to Multi-modal Preservation and Highway Modernization programs associated with the seamless and multi-modal system consistent with the Preferred Vision of *MI Transportation Plan*.
3. *“Move Ahead.”* The “Move Ahead” package explores the implications of raising additional revenue beyond those associated with the base case revenues by 16 percent and investing the additional revenue into Multi-modal Preservation and Highway Modernization programs without taking projected revenues away from existing programs. The “Move Ahead” package accounts for \$6.21 billion in new revenue over the life of the plan and still represents a \$38 billion revenue gap.
4. *“Flexible New Revenue.”* The “Flexible New Revenue” package explores the implications of raising additional revenue through the “Move Ahead” scenario as well as dedicated new revenue sources to support system preservation, both consistent with the Preferred Vision of *MI Transportation Plan*. The “Flexible New Revenue” future entails increasing overall state transportation revenues by 42 percent to preserve existing assets and to invest in Multi-modal Preservation and Highway Modernization programs. The “Flexible New Revenue” package accounts for \$15.68 billion in new revenue over the life of the plan and still represents a \$28 billion revenue gap.

The four illustrative investment packages are summarized in the following table. The “Business as Usual” and the “Change the Mix” packages have no revenue increase over the base case revenues, while “Move Ahead” and “Flexible New Revenue” packages show increase in revenues.

Summary of Four Investment Packages (in \$2005 over 25 years)

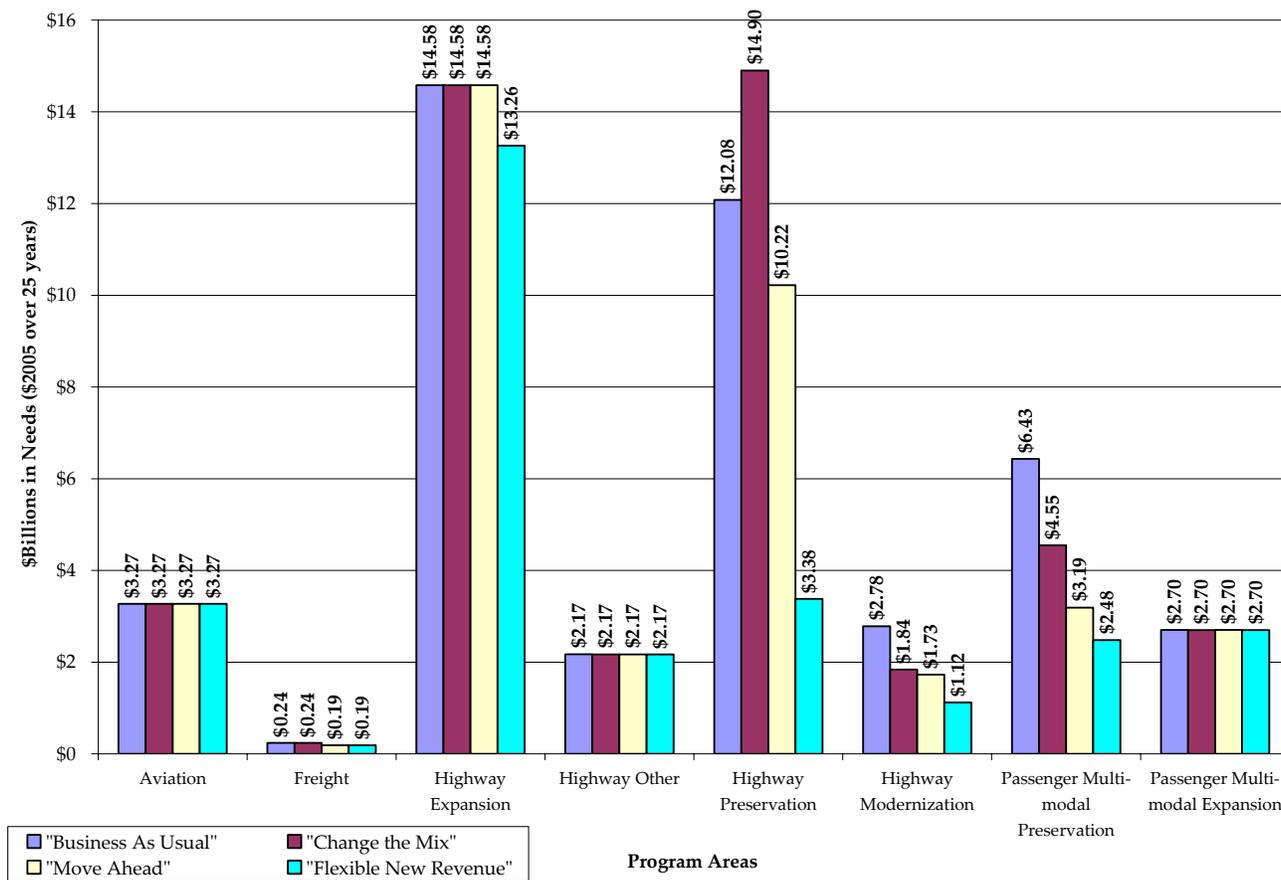
#	High-Level Category	Needs	1. Business as Usual	2. Change the Mix	3. Move Ahead	4. Flexible New Revenues
1	Aviation	\$5.28B	\$2.01B [38% of need]	\$2.01B	\$2.01B	\$2.01B
2	Freight	\$0.46B	\$0.22B [48% of need]	\$0.22B	\$0.27B (\$0.05B) [59% of need]	\$0.27B (\$0.05B) [59% of need]
3	Highway Expansion	\$16.81B	\$2.23B [13% of need]	\$2.23B	\$2.23B	\$3.55B (\$1.32B) [21% of need]
4	Highway Other	\$7.44B	\$5.27B [71% of need]	\$5.27B	\$5.27B	\$5.27B
5	Highway Preservation	\$30.92B	\$18.84B [61% of need]	\$16.02B (-\$2.83B) [52% of need]	\$20.70B (\$1.86B) [67% of need]	\$27.54B (\$8.69B) [89% of need]
6	Highway Modernization	\$5.45B	\$2.67B [49% of need]	\$3.61B (\$0.94B) [66% of need]	\$3.72B (\$1.05B) [68% of need]	\$4.33B (\$1.66B) [79% of need]
7	Multi-modal Preservation	\$12.21B	\$5.78B [47% of need]	\$7.66B (\$1.88B) [63% of need]	\$9.02B (\$3.24B) [74% of need]	\$9.73B (\$3.95B) [80% of need]
8	Multi-modal Expansion	\$2.72B	\$0.02B [1% of need]	\$0.02B	\$0.02B	\$0.02B
Total		\$81.30B	\$37.03B	\$37.03B	\$43.24B (\$6.21B)	\$52.71B (\$15.68B)
Revenue Gap			\$44.26B	\$44.26B	\$38.06B	\$28.59B

Source: Wilbur Smith Associates Note: Figures shown in parentheses “()” provide the difference between the investment package and the base case revenues.

Each possible future considered on the previous table leaves unmet needs for all of Michigan’s state transportation programs. The investment packages can be viewed as illustrations of a succession of possible ways to spend increasing streams of revenue, with “Business as Usual” and “Change the Mix” representing the baseline, and “Move Ahead” and “Flexible New Revenue” representing increases in funding levels. As possible funding levels increase, the packages seek to balance the investment of those funds against unmet needs based on the Preferred Vision, plan goals, and decision principles of *MI Transportation Plan*.

Comparing the investment packages side by side with respect to the percentage of needs met for different program areas additionally illustrates the choices for allocating projected and potential revenues. The figure below compares the unmet needs, by program area, left by each of the four possible futures. While the dollar amounts of unmet needs are shown and compared, some categories can provide different increments of services—for example, dollars spent on capital for commuter rail will provide a different level of service than investments in express bus. These decisions are not made in this report, but will be part of the implementation of *MI Transportation Plan*.

Unmet Needs under Four Investment Packages



Source: Wilbur Smith Associates

Out of all of Michigan's transportation programs, the deepest shortfalls are in Highway Preservation and Highway Expansion. This is due to both the size of Michigan's highway system and the expense of improving a lane mile of highway relative to the expense of other types of improvements.

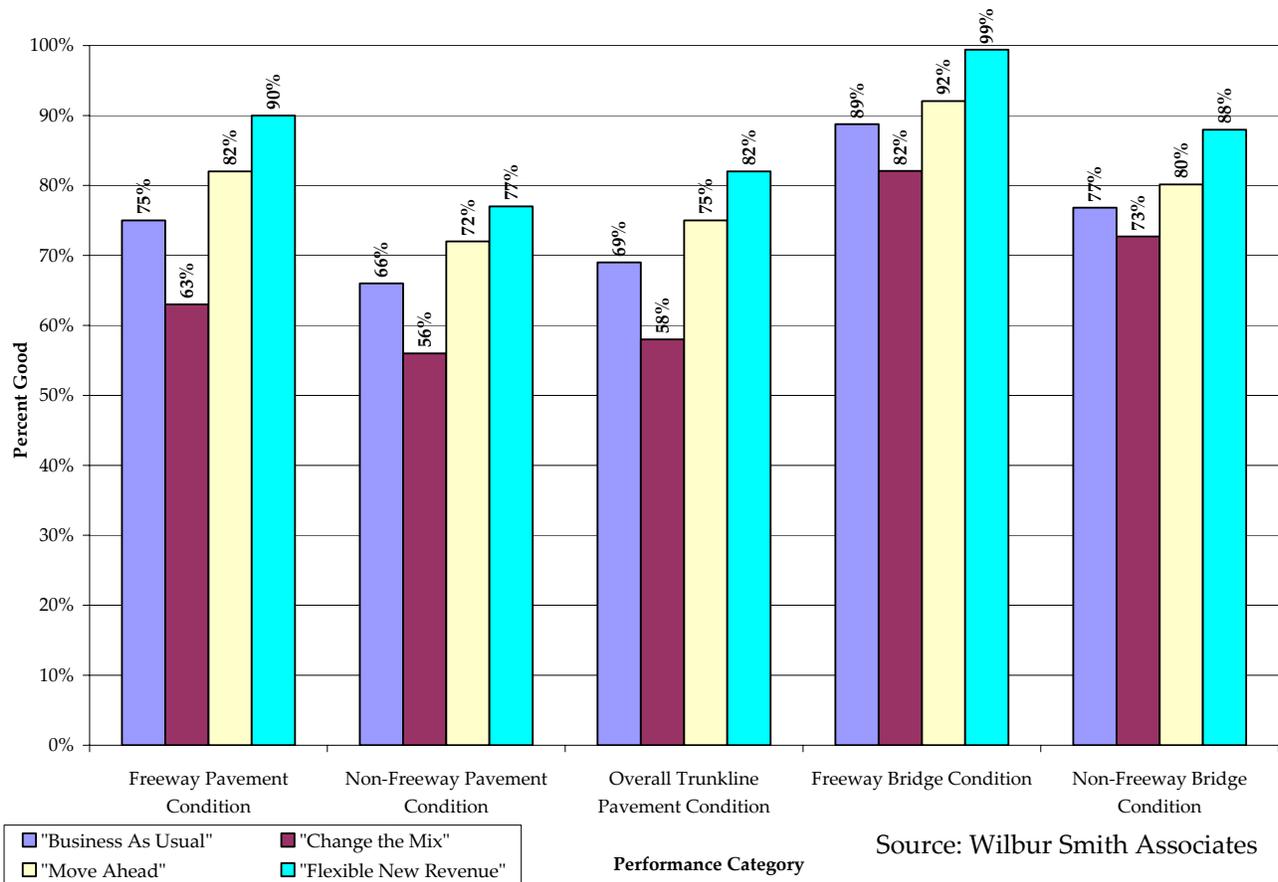
Because the Preferred Vision, goals, and decision principles of *MI Transportation Plan* seek to leverage investment in Multi-modal and Highway Modernization programs to offset Highway Expansion needs, Highway Preservation becomes the deepest need of concern among the investment packages. While the revenue gap for this category deepens in the "Change the Mix" package, as new revenues become available under "Move Ahead" and "Flexible New Revenue" packages, the shortfall in preservation revenue narrows sharply. Each of the illustrative investment packages represents successive steps in reducing the shortfalls in Multi-modal Preservation and Highway Modernization programs, both of which are expected to leverage with the widest range of other categories.

None of the four illustrative investment packages considered in this report has sought to remedy unmet needs in Michigan's Aviation or Highway Other categories. This is largely due to the relative lack of potential leverage for these categories to directly or indirectly offset needs on other modes. If additional revenue streams can be identified for these categories, they may be considered in the ultimate preferred investment level as a variation of the "Flexible New Revenue" approach.

The system performance impacts of Highway Preservation and Highway Expansion investments are more quantifiable than the impacts of investment in Multi-modal Preservation, Highway Modernization, and other program areas. However, it is understood that investment in Highway Modernization and Multi-modal Preservation programs is likely to mitigate unmet needs in Highway Preservation and Highway Expansion through the effects of direct and indirect leverage as described in the *Integration Technical Report of MI Transportation Plan*.

The direct performance impacts of different levels of investment in Highway Preservation are analyzed using MDOT's forecasting systems for road quality and bridge conditions. The comparative direct highway impacts of the four investment packages are summarized in the following figure.

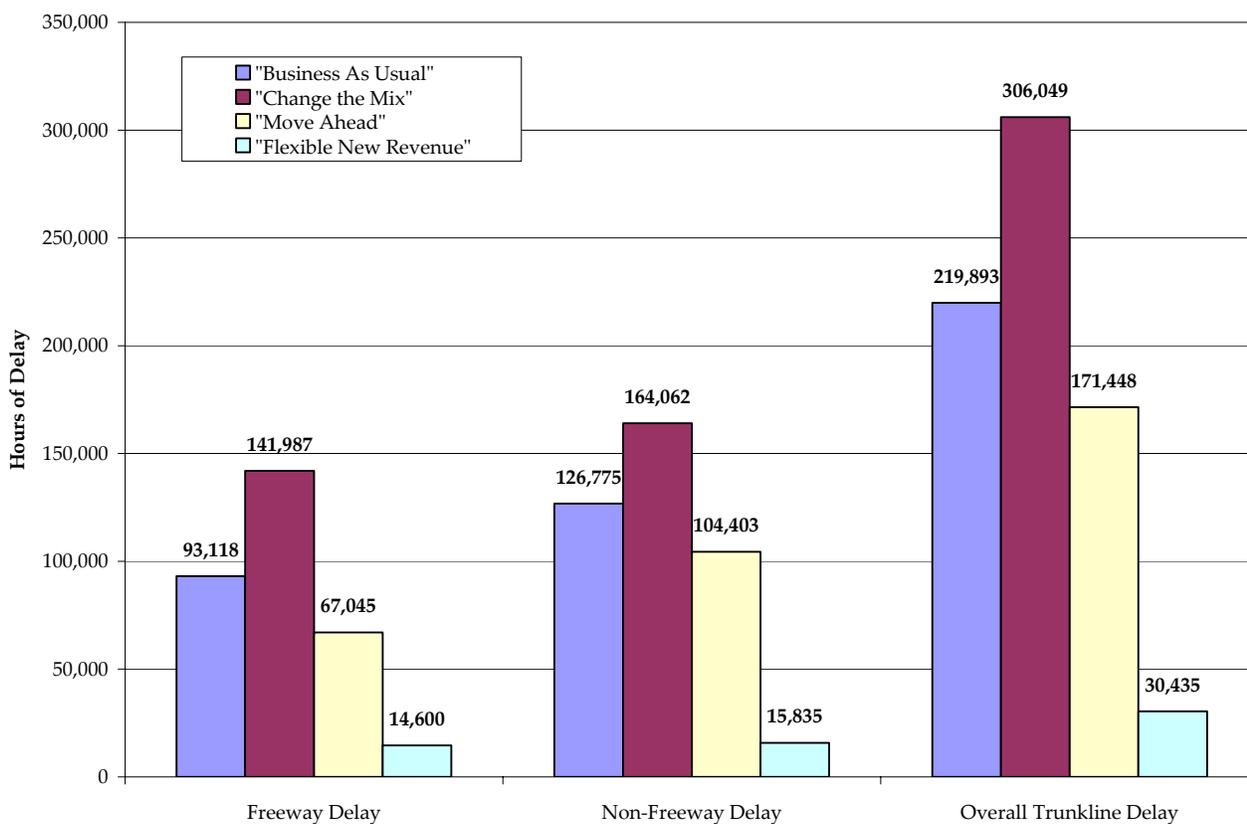
Percent of “Good” Pavement and Bridge Conditions in 2030 under Four Investment Packages



With the exception of “Change the Mix,” each successive package involving additional revenue achieves an associated improvement in both bridge and pavement condition for freeways and non-freeways. The sharpest increases are in the “Flexible New Revenue” package for trunkline pavements. When preservation revenues are scarce, bridges receive a higher priority; therefore, the variation in bridge conditions between investment packages is less marked than in pavement conditions.

Mobility on the trunkline highway system can be estimated in terms of hours of delay. Investments in improved highway pavement and bridge condition can reduce anticipated delay due to poor pavement or poor bridge condition (which reduces travel speeds, or may affect highway routing). Investment in additional lanes for congested facilities through expansion programs can also reduce delay and increase the portion of the system that is uncongested in 2030. The figure below illustrates the relative impacts of the four investment packages on daily delay expected in year 2030.

Estimated Daily Delay in 2030 under Four Investment Packages



Source: Michigan Department of Transportation Post-processing of Statewide Travel Demand Model

The results show that delay is less sensitive to the quantifiable impacts of Highway Preservation and Highway Expansion funding between the investment packages. This is largely because the relationship between preservation investment and delay is less direct than the relationship between preservation and condition. The comparison shows that the investment levels of “Move Ahead” and “Flexible New Revenue” each have the potential for significant savings in delay. The “Flexible New Revenue” package contributes even more significantly to reduction in delay through a greater focus on system modernization and the addition of more lane miles than the other packages.

Based on the comparison of these illustrative investment packages, some general conclusions can be made regarding a preferred investment level.

1. *Reducing preservation revenues can undermine other programs.* Pursuit of the vision of *MI Transportation Plan*, by reallocating scarce revenues from preservation to other programs, can adversely affect travel times and travel costs. These impacts may undermine the potential leverage gained by other investments in Multi-modal or Modernization programs. At lower levels of investment, the unit cost of Highway Preservation is higher, further draining revenues from other programs. Consequently, reallocating revenues from preservation to other areas is not recommended for the preferred investment level.
2. *Modest investments of additional revenues in Highway Preservation and Multi-modal Preservation, when balanced with other categories, can support the vision.* Even modest investments in Highway Preservation and Multi-modal Preservation, when balanced with targeted Highway Expansion and Highway Modernization, can help reduce revenue shortfalls in these areas. The analysis shows that investment levels that fall short of the 85-percent and 95-percent good pavement and bridge condition targets still offer significant improvement in travel time and delay when compared to “Business as Usual.”
3. *Additional revenue sources will be needed for Highway Expansion or Multi-modal Expansion programs.* Projected revenues cover less than 14 percent of Highway Expansion needs and less than one percent of Multi-modal Expansion needs. None of the investment packages significantly change this percentage. This is because the analysis in this report has not identified or validated any revenue source robust enough to cover a large share of expansion needs. The problem of system expansion is further exacerbated by the fact that if the system expands, the associated preservation needs will also rise.

The preferred investment level may consider a “flexible new” revenue source for Multi-modal Expansion programs, given the strong multi-modal focus of the Preferred Vision. However, the source would have to be sufficient enough, not only to progress towards the \$27.2 billion expansion need, but also to cover the additional preservation cost of an expanded multi-modal program. If expansion of highways is a consideration in the preferred investment level, market based solutions such as tolling or other types of user fees may be considered as variations of “Flexible New Revenue.”

4. *At the very least, buying power should be preserved.* The differences in what we can buy today from what we can buy tomorrow is growing over the life of the plan and will result in a \$6.33 billion loss in buying power. The “Move Ahead” future calls for an additional \$6.2 billion over the life of the plan; this is just short of preserving the buying power. The “Business As Usual” and the “Change the Mix” investment packages, however, are significantly short of preserving this buying power. The preferred investment level should, at the very least, preserve the buying power.

Chapter 1. Introduction

The preferred investment level for *MI Transportation Plan* requires understanding Michigan's state transportation needs. An effective investment strategy also requires understanding how different investment decisions can affect the long-term conditions and performance of Michigan's state transportation system to the year 2030. The *MI Transportation Plan* primary focus is on the parts of the transportation system that the Michigan Department of Transportation (MDOT): 1) has jurisdiction over, 2) provides funding for, or 3) regulates. This *Revenue Gap and Investment Packages Report* is offered to support the development of the preferred investment level by:

1. Describing the needs, revenues, and resource gaps facing Michigan's transportation system under MDOT.
2. Describing four possible scenarios for allocating Michigan's state transportation resources, using the concept of investment packages to understand the potential implications of investment decisions.
3. Concluding with insights that will support the development of a preferred investment level consistent with the vision, goals, and decision principles of *MI Transportation Plan*.

This report applies the vision, goals, and decision principles of the *MI Transportation Plan* to assessing the relative merit of options for satisfying Michigan's projected unmet needs. The insights and conclusions of this report serve as guidance for developing the preferred investment level.

The ultimate (preferred) investment level is not provided in this report. The illustrative investment packages analyzed in this report show the implications of different options for satisfying unmet needs. The conclusions of this report will provide insight on the more beneficial and less detrimental investment approaches such that the *Investing to Achieve the Vision Report* will embody promising aspects of possible scenarios with a more in-depth analysis of its comparative merits for system performance, economic, and programmatic implications.

Chapter 2. Base Case

The base case is the accounting of the needs, revenues, and gaps for 2006-2030 business-as-usual transportation operations for the state of Michigan. The needs estimate the dollars required to operate the system as we do today; the revenues are funds projected to be available for operations; the gap is simply the difference between the needs and the revenues.

2.1 Needs Analyses

A “need” is a service or infrastructure element that has been identified and could be implemented during the life of the plan, independent of whether funds or revenues are available. These needs are represented in both the actual service and element to be implemented (e.g., new lane miles, replace bridges, operate route miles, etc.) and the dollars needed to implement them. The following discussion of needs will represent needs in both transportation units and dollars. All revenues and costs are expressed in Base Year 2005 dollars (\$2005).

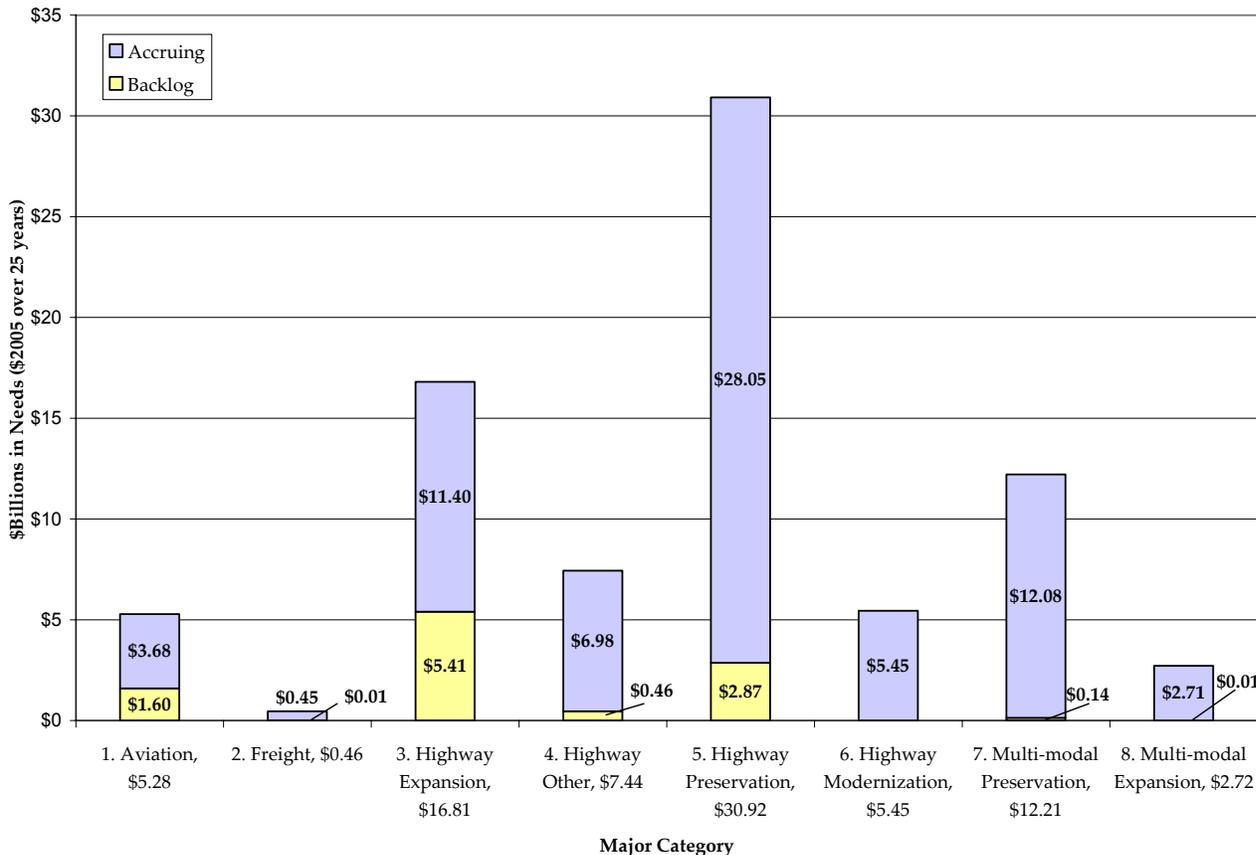
Generally, the statewide transportation needs included are for transportation infrastructure or operations that are directly operated or directly funded by the department. The following items, for example, would not be included in the needs: local roads, sidewalks, bridges, or transit services not receiving any federal or state funds to operate.

The statewide long-term transportation needs for the department were split and costed into eight categories:

1. *Aviation*. Preservation and modest expansion of aviation facilities;
2. *Freight*. Preservation and modest expansion of rail and marine freight facilities;
3. *Highway Expansion*. New capacity on trunkline facilities;
4. *Highway Other*. Miscellaneous capital improvements to trunkline facilities such as electrical, drainage, etc.;
5. *Highway Preservation*. Maintenance, rehabilitation, resurfacing, and replacement of pavements and bridges;
6. *Highway Modernization*. Safety and operational improvements, such as ITS and signalization coordination;
7. *Multi-modal Preservation*. On-going transit facilities, carpool, and bike/pedestrian facilities; and
8. *Multi-modal Expansion*. Adding new capital to bus transit and rail passenger facilities, expanding transit and rail passenger service, carpool lots, and bike/pedestrian facilities.

The total within each of the eight categories (total shown are in \$2005 and for the 25 years of the plan, 2006-2030) are shown in **Figure 1**. The figure splits out the needs into backlog and accruing. Backlog needs are transportation improvements or services that are currently deficient or currently require operations funds to bring them up to standards. Accruing needs assume the backlog needs are taken care of early in the plan period and include the needs that arise during the life of the plan.

Figure 1: Statewide Long-Term Transportation Needs, by Major Category



Source: Wilbur Smith Associates

2.1.1 Needs Assumptions

The following assumptions and terminology are used in the development of the needs:

1. As part of the identification of the needs, the needs generally were split into “backlog” and “accruing” needs. Backlog needs are transportation improvements or services that are currently deficient or currently require operations funds to bring them up to standards. Accruing needs assume the backlog needs are taken care of early in the plan period and include the needs that arise during the life of the plan. For example, some facilities are currently congested; the cost to improve these facilities would be included in the backlog needs. The highways that become congested as the population grows or shifts would be included in the accruing needs.
2. Backlog costs were calculated by taking the full backlog units or dollars and spreading them over the first six years of the plan (2006-2011) and increasing the rate to account for increasing unit cost rates.
3. Accruing costs were calculated by two methods: (1) if the year of implementation is known over the life of the plan, these units by year were multiplied by the increasing

unit cost rates, or (2) if these distributions are unknown, the units were spread evenly over the 25 years of the plan.

4. All costs were calculated in year of expenditures (\$YOE), or the actual value of the years they will be utilized in, and then these \$YOE are discounted to 2005 dollars using a discount rate of 3.1 percent.
5. Unit costs were developed for many of the categories. These unit costs were escalated at different rates, depending on the type of improvement category (rebuilding a road, providing transit services, etc.). The highway escalation rates generally used five-percent per year.
6. Some categories did not have unit costs, but 2005 base year expenditures; these expenditures were also escalated using various escalation rates.
7. All needs and revenue data and information in this report were provided by Michigan Department of Transportation (MDOT).

In addition to these assumptions, it should be noted that needs for Highway programs are stated only for state trunkline highways, which account for only about 11 percent of highways in the state of Michigan, based on current condition goals.

MDOT has jurisdictional responsibility for approximately 9,700-route miles of state trunkline highways, which consist of all the “I-,” “US-,” and “M-” designated highways. The state’s 83-county road commissions are responsible for about 89,000-route miles of county roads and the cities and villages are responsible for approximately 21,000-route miles of municipal streets. There are various ways to account for roadway mileages. **Table 1** summarizes different roadway miles by government agencies.

Table 1: Michigan Roadway Mileage by Jurisdiction

	<i>Route Miles</i>	<i>% of Total</i>	<i>Pavement Miles</i>	<i>% of Total</i>	<i>Lane Miles</i>	<i>% of Total</i>
State Trunkline	9,695.1	8.1%	12,055.3	9.9%	27,557.4	11.0%
County Roads	88,960.3	74.4%	89,113.4	72.9%	180,040.7	71.6%
City/Village Streets	20,914.1	17.5%	21,012.0	17.2%	43,745.5	17.4%
Total	119,569.5	100.0%	122,180.7	100.0%	251,343.6	100.0%

Source: 2005 Highway Performance Monitoring System

Note: “Route miles” include all undivided mileage, the forward-side mileage of divided roadways, and both directions of one-way pairs (separate streets carrying each direction of traffic).

2.1.2 Aviation Needs

The backlog of needs is based upon a compilation of airport Five-Year Plans, a federally-required planning document for all airports in the NPIAS (National Plan for Integrated Airport

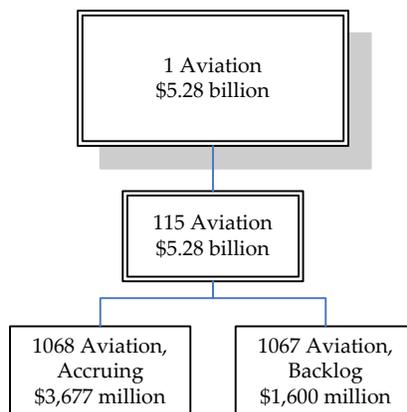
System). An assumption of \$250 million in 2006, with annual growth of five-percent annually over the subsequent five years, was used for the backlog needs costs.

Based upon the Michigan Aviation System Plan (MASP), an annual accrual starting at \$115 million (in 2005 dollars), with a five-percent annual increase, is assumed through the life of the plan. These needs estimates include anticipated capital improvements that have been historically funded through a combination of federal, state, and local sources. It also assumes the backlog costs have been satisfied. The cost of airport operations and maintenance are not included in these needs. Examples of Aviation needs include preservation and improvement of airport infrastructure including pavement, apron, taxiway, terminal, lighting, system, and other items essential to the effective delivery of aviation services. Construction and engineering costs are also included.

The three-digit needs categories shown in **Figure 2** were summed up to calculate the needs costs for Aviation needs category. The three-digit categories are all listed in **Table 2** on page 20.

The \$5.28 billion in Aviation needs (in \$2005) over the 25 years is shown in **Figure 2**. Just over 30 percent of identified Aviation needs represent the backlog that exists today.

Figure 2: Aviation Needs Structure



Source: Wilbur Smith Associates

Please note: the three-digit and four-digit numbers shown in these charts are randomly assigned to each needs category; under each category, there are one or more “three-digit” needs categories; under each three-digit categories, there are one or more “four-digit” needs categories.

2.1.3 Freight Needs

The Freight category is essentially a Rail and Marine Freight category, with Marine Freight being a very small part of this category. Because a large share of Michigan’s commodities move by truck and air, Freight needs may be covered under the Highway and Aviation programs described in other sections, but are not covered explicitly under this Freight needs category.

Freight rail service in Michigan is supplied largely by the private sector, so the needs described here do not include the needs of the entire freight system. What the private carriers may consider being their financial need to continue to operate in Michigan has not been identified.

The Freight cost assumptions cover the following programs/activities:

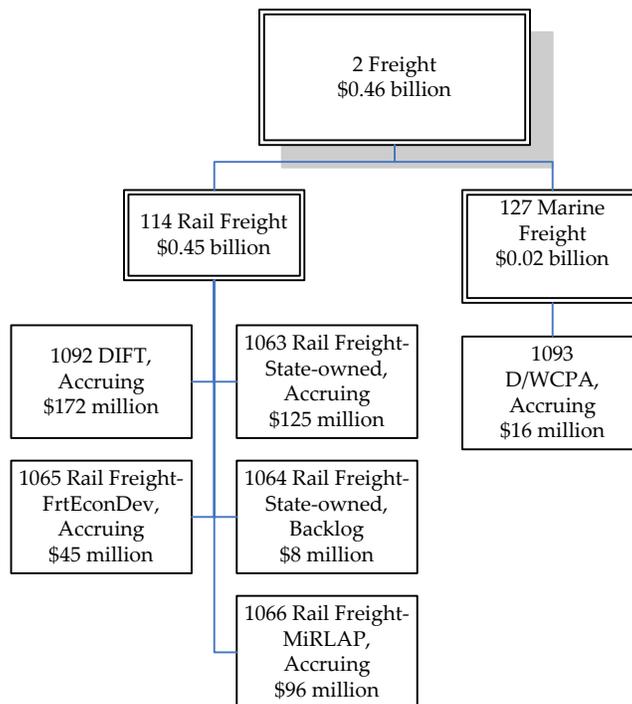
1. Property management activities and some capital projects on the state-owned rail lines.
2. The Freight Economic Development Program, which provides loans (designed to be converted to grants provided certain conditions are met) primarily to businesses locating on rail lines and needing to construct rail spurs. The loans can fund up to 50 percent of the rail infrastructure portion of the project.
3. The Michigan Rail Loan Assistance Program (MiRLAP), a revolving loan fund designed to preserve and improve rail freight infrastructure.
4. The Detroit Intermodal Freight Terminal (DIFT), an effort to consolidate a number of individual rail yards in the Detroit metropolitan area into one facility, including both rail infrastructure and associated roadway enhancements to improve access and efficiency for trucks as well as trains. Fifteen million dollars are assumed grown and inflated (\$2005) from years 2008 through 2017 for the calculation of the DIFT cost, since it is anticipated to take 10 years to complete.
5. Detroit/Wayne County Port Authority (D/WCPA) operations are partially funded by the state and are included at \$500,000 per year, escalating at five-percent per year.

Excepting the DIFT, all programs/activities listed above are funded with Comprehensive Transportation Fund (CTF) monies, while the source of funding for the DIFT project remains uncertain today.

The decision not to include costs for Marine Freight was based on the fact that the identified needs and revenue sources are self-contained and would not be included in this analysis. The most pressing Marine Freight need is for a new Soo Lock to handle today's larger vessels that cannot be accommodated by two of the existing locks. Federal law requires cost sharing on the part of all eight Great Lakes states, payable over the estimated project life of 50 years. A dedicated reserve fund designed to cover Michigan's share was established in 2001. No additional costs are anticipated. Congress authorized construction of the new lock in the Water Resources Development Act of 1986. The US Army Corps of Engineers estimates the total cost of the new lock to be \$225 million.

The \$462 million in Freight needs (in \$2005) over the 25 years is shown in **Figure 3**. Significantly, nearly all Freight needs are accruing needs; less than two percent represent the backlog.

Figure 3: Freight Needs Structure



Source: Wilbur Smith Associates

2.1.4 Highway Expansion Needs

The character of traffic flow (or traffic congestion) can be described by assigning segments of the system a Level of Service (LOS) using the letters A through F, with A being the least congested and F being the most congested. The LOS for a roadway segment is currently determined using the methodologies presented in the *2000 Highway Capacity Manual*. The department has a congestion performance threshold of LOS E for non-freeways (i.e., LOS A, B, C, and D are considered acceptable) and LOS F for freeways (i.e., LOS A, B, C, D, and E are considered acceptable). Using the statewide travel demand model, the needs for adding lanes to existing roadways (no new roadways) was determined using the following methodology:

1. Add new lanes on existing deficient roads in 2005, 2015, 2025, and 2030. This lane addition process was constrained against a cap on the number of lanes allowed (12 lanes maximum for freeways and eight lanes maximum for non-freeways). Lanes were added until either: (1) the LOS thresholds were met, or (2) the maximum lanes were reached.
2. The added new lanes in 2005 were considered backlog (spread one-sixth over 2006-2011), the lanes needed to be added in 2015 were split one-tenth over years 2006-2015,

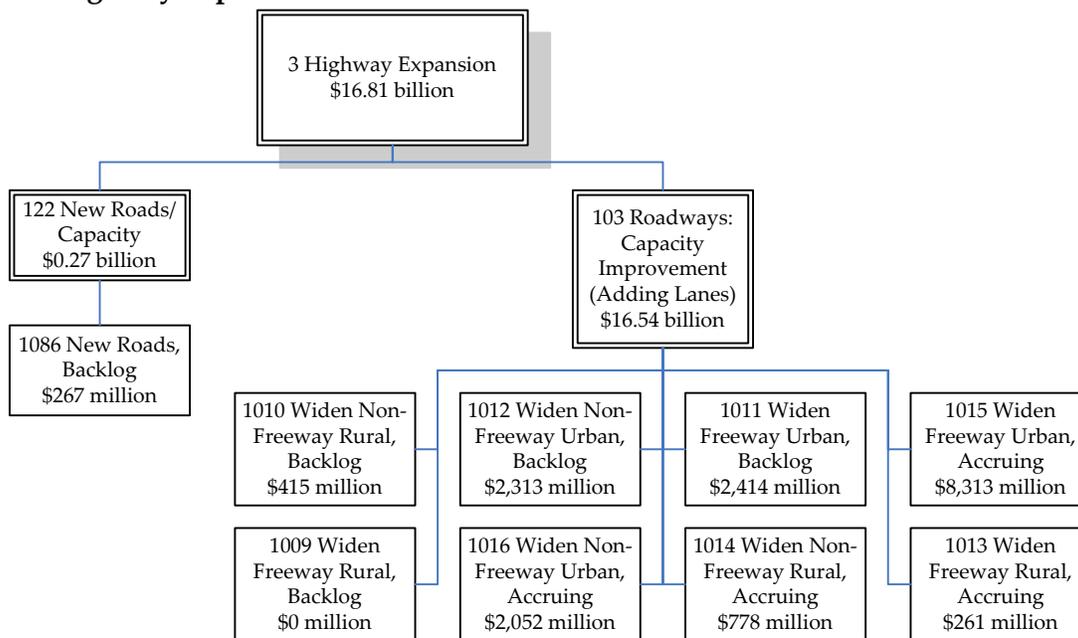
the lanes needed to be added in 2025 were split one-tenth over years 2016 – 2025, and the lanes needed to be added in 2030 were split one-fifth over years 2026 – 2030.

- Lane mile unit costs were developed for the freeway urban, freeway rural, non-freeway urban, and non-freeway rural, escalating up five-percent annually from 2006 through 2030. The added lane miles are multiplied against these rates. The annual costs were then brought back to 2005 dollars (using the standard 3.1-percent discount rate).

The new alignment needs represent the estimated cost of three unspecified new alignment roads somewhere in the state.

The \$16.81 billion in Highway Expansion needs (in \$2005) over the 25 years is shown in **Figure 4**. The backlog of Highway Expansions needs represents about one-third of the total needs identified.

Figure 4: Highway Expansion Needs Structure



Source: Wilbur Smith Associates

2.1.5 Highway Other Needs

Highway Other captures two needs categories: (1) Borders and (2) Other Highway Capital.

2.1.5.1 Borders

- Work to ensure adequate transportation capacity at Michigan’s border crossings to facilitate, advance, and, in part, provide for the seamless movement of people and goods between Michigan and Ontario and between Michigan and its bordering states;

2. Provide for the protection of, and upgrade the transportation facilities on, our borders through collaborative initiatives with the private sector and other governmental agencies to provide an appropriate level of redundancy among crossings and to ensure continued access for international trade and commerce between the US and Canada;
3. Study needs for improving and expanding the transportation structures and infrastructures and identify advancing technologies through persistent research and analysis in order to continue to adapt to the demands of international trade and commerce;
4. Work to enhance cooperation, coordination, and communication with US and Canadian border inspection and transportation agencies, local and regional governments, private operators, crossing users, neighborhoods, and other stakeholders affected by border crossings, in order to facilitate continued improvement to both the mobility and safety of border crossings; and
5. Work cooperatively with the other agencies responsible for improvements to border inspection processes, and encourage them to facilitate the movement of low-risk passengers and cargo.

2.1.5.2 Other Highway Capital

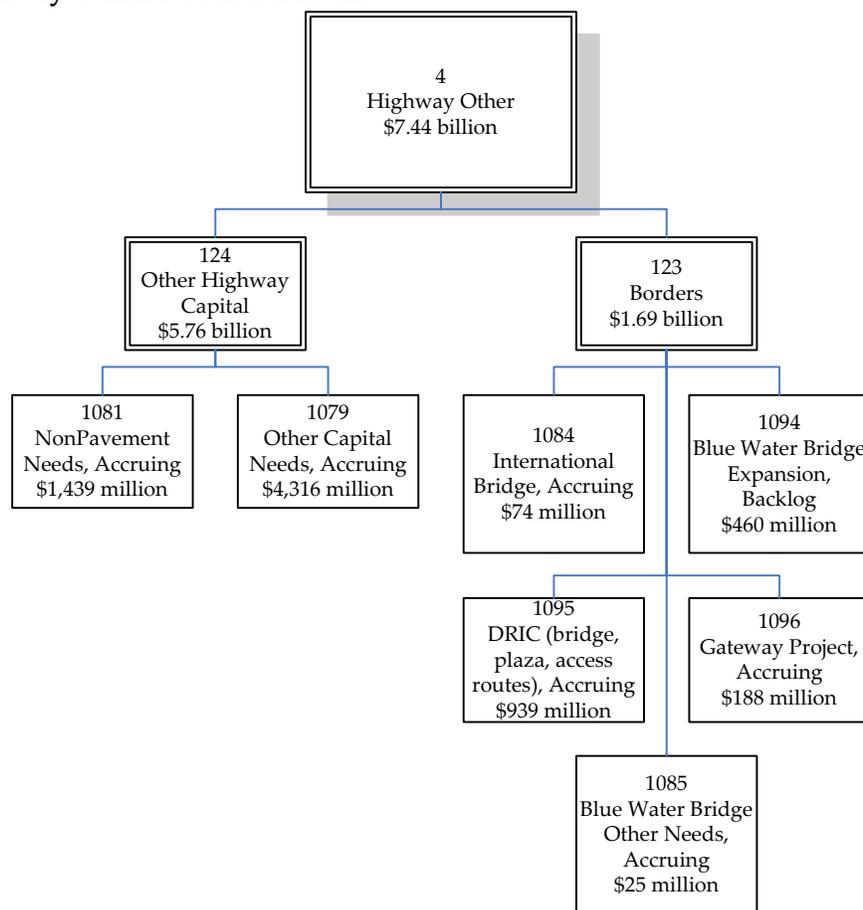
The Other Highway Capital category includes non-pavement and other capital needs, including:

- *Enhancements.* The Transportation Enhancement (TE) program is a grant program that funds projects that enhance Michigan's intermodal transportation system and improve the quality of life for Michigan citizens. Typical TE projects are non-motorized transportation facilities, transportation aesthetics, or historical preservation;
- *Non-discretionary "M" projects.* The non-discretionary M program is a 100-percent state-funded program. Several statewide programs are funded annually, and include: (1) drain assessment (MDOT pays assessments to drainage districts for lands that are within a given district), (2) emergency/disaster (MDOT's response to the governor's declared disasters and emergencies), and (3) bridge high load hit (for projects when structures are damaged due to high load hits);
- *Program development scoping.* This is also a 100-percent state-funded program, intended to be used for scoping of future road and bridge preservation projects;
- *Weigh stations, noise abatement, lighting, and recreation trails.* Weigh station funds are used to maintain existing weigh stations including, ramps, static scales, and electronic weighing sensors in the pavement, parking lots, signing, and building structures. Noise abatement funds are used to construct new noise abatement walls as requested in participation with local agencies. Freeway lighting funds are used for maintaining and replacing existing freeway lighting. Recreation trails funds are

- available to develop and maintain recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses;
- *Railroad crossings on trunklines.* These funds are for trunkline road and bridge projects impacting railroad crossings and maintenance activities;
 - *Transportation Economic Development Fund Category A Projects.* These are economic development projects undertaken to promote increased economic potential and improve the quality of life through support of job creation and retention in Michigan. Eligible projects are those that address needs of the transportation system, such as safety, accessibility, or any other condition that is critical to an economic development project. These projects relate to agriculture, food processing, tourism, forestry, high technology research, mining, and office centers of 50,000-square feet or more in size. The goal is to create or retain permanent jobs that are immediate and non-speculative, and would immediately increase the tax base of the local area and positively impact local employment; and
 - *Advance right-of-way acquisitions.* Funding to purchase real estate for protective purchase for anticipated needs and opportunity buys to improve highway operations.

The \$7.44 billion in Highway Other needs (in \$2005) over the 25 years is shown in **Figure 5**. Significantly, the largest share of these needs, more than 90 percent, is identified as accruing needs; the backlog is almost nine percent of the total identified.

Figure 5: Highway Other Needs Structure



Source: Wilbur Smith Associates

2.1.6 Highway Preservation Needs

The largest needs category is the preservation of the highway infrastructure. This is comprised of two major elements: pavements and bridges. The primary preservation needs are in pavements (\$26.3 billion) compared to bridges (\$4.7 billion). **Figure 6** provides a detailed layout of how these numbers were calculated.

2.1.6.1 Highway Pavement Preservation

Needs were determined by using MDOT's Road Quality Forecasting System (RQFS) to forecast future pavement condition designed to achieve and sustain an ideal pavement condition state of 95-percent good for freeway pavements and 85-percent good for non-freeway pavements, as well as effectively manage existing good pavements.

A description of pavement resurfacing, reconstruction, and preventive maintenance is provided below:

1. Road reconstruction fixes are long-term fixes that typically involve removing the entire pavement structure, removing and restoring the sand sub-base, and replacing the entire

pavement structure. Examples include: hot-mix asphalt reconstruction and concrete reconstruction. Fix life for this type of work is generally greater than 20 years.

2. Pavement resurfacing or rehabilitation fixes are medium-term fixes that typically involve removing the top layer of existing pavement surface, making structural repairs to the underlying surface, and applying a new pavement surface. Examples include: mill and resurface, crush and shape with multiple course hot-mix asphalt overlay, and multiple course hot-mix asphalt overlay. Fix life for this type of work is between 10 and 20 years.
3. Road preventive maintenance fixes are short-term fixes that are designed to retard future deterioration of a pavement facility and improve the functional condition, delaying the time that major improvements will be needed. Examples include: crack treatments, micro-surfacing, thin overlays, diamond grinding, and full-depth concrete repairs. Fix life for this type of work ranges from two to 10 years, depending on the fix.

2.1.6.2 Highway Bridges Preservation

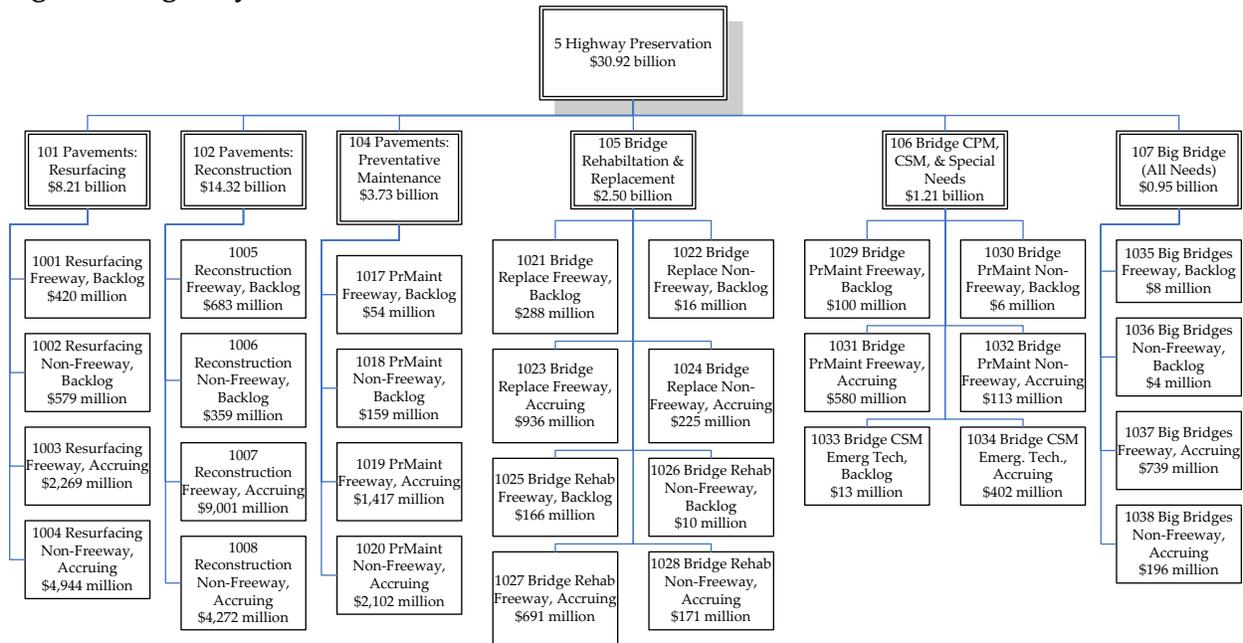
Needs for bridges were determined using MDOT's Bridge Condition Forecast System (BCFS) to forecast future freeway and non-freeway bridge condition based upon a balanced mix of fixes made up of (1) bridge replacement, (2) rehabilitation, and (3) preventive maintenance. These three categories are described below:

1. Bridge replacement projects include deck replacements, superstructure replacements, and entire bridge replacements.
2. Rehabilitation projects include rigid deck overlays, superstructure repairs, extensive substructure repairs, and partial substructure replacements. These projects most often are done on poor bridges, elevating them to a good condition state.
3. Bridge preventive maintenance projects sustain the current condition of bridges and most often address the needs of the fair category to prevent them from becoming poor. Examples of bridge preventive maintenance projects include bridge painting, pin and hanger replacements, concrete patching, and deck expansion joint repair or replacement. Special needs projects include repair or providing temporary support of bridges having extensive deterioration or damage.

The "Big Bridge" category is a unique subset of MDOT's trunkline bridge inventory that includes 12 movable bridges, three concrete segmental box beam bridges, 13 "large deck" bridges (bridges with deck areas in excess of 100,000-square feet), and the new tied arch bridge on I-94 over US-24. These 29 bridges are unique not only from an engineering standpoint, but also because they represent large capital investments in terms of their initial construction costs, and more importantly, in terms of their long-term preservation and rehabilitation costs. The goal is to preserve and maintain all of these bridges in a continuously good to fair condition, since it is very expensive to replace them.

The \$30.92 billion in Highway Preservation needs (in \$2005) over the 25 years is shown in **Figure 6**. The largest share of these needs, more than 90 percent, is accruing needs; the backlog is about just over nine percent of the total identified.

Figure 6: Highway Preservation Needs Structure



Source: Wilbur Smith Associates

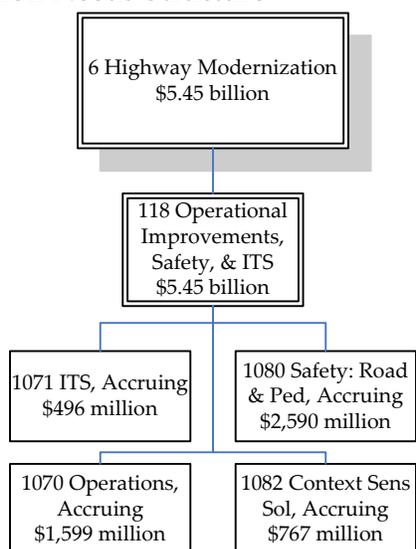
2.1.7 Highway Modernization Needs

The Highway Modernization needs include operation improvements, intelligent transportation systems (ITS), and safety. These are low-cost (compared to Highway Expansion) improvements that affect the efficient and effective movement of people and goods and improve the safety of the traveling public and environment. Managing travel and controlling traffic are necessary elements of managing traffic congestion.

The ITS, safety, and operational needs are statewide. The safety and operational improvements include signing, pavement markings, traffic signals, guardrail/attenuators, and safety programs (turn lanes, intersection improvements etc.).

The \$5.45 billion in Highway Modernization needs (in \$2005) over the 25 years is shown in Figure 7. All these needs are anticipated to be accruing needs.

Figure 7: Highway Modernization Needs Structure



Source: Wilbur Smith Associates

2.1.8 Multi-modal Preservation Needs

The Multi-modal Preservation needs involve the preservation of existing public transportation services as well as carpool and non-motorized transportation modes. The Multi-modal Preservation program is comprised of four categories: bike and pedestrian, transit, intercity passenger, and carpooling. For transit and intercity passenger, preservation includes routine expansion/growth in services provided by existing providers. The primary preservation needs are in transit, which has \$11.05 billion of the \$12.22 billion in Multi-modal Preservation needs. Figure 8 provides a detailed layout of how these numbers were calculated.

2.1.8.1 Bike/Pedestrian

The needs for the bike/pedestrian system are estimated based on the cost of upgrading 7,000 miles of non-freeway trunkline highways currently without 4-foot paved shoulders or sidewalks. A unit cost of \$60,000 per mile (\$2005) was escalated four-percent per year over the life of the plan, generating estimated needs of approximately \$730 million over the 25-year plan (in \$2005). Even though this would expand the non-motorized network, this work is included under Multi-modal Preservation, because paved shoulders also help to preserve the roadway; it is the 4-foot or greater width of the paved shoulder that determines its use as a non-motorized facility. It is important to note that this estimate does not include the cost to retrofit the many bridges necessary to complete current non-motorized systems in urban areas which lack connectivity. From a practical and engineering perspective, projects of this nature can really only be accomplished in conjunction with a scheduled bridge project; for this reason, no estimate for that type of work is included.

2.1.8.2 Transit and Marine Passenger

The transit operating and capital needs are the needs of 79 local public transportation systems and 40 specialized transportation providers that currently receive financial support from MDOT. Only those needs that would historically be met with state funds appropriated to MDOT or with federal funds apportioned to MDOT are included. Needs that would be met with federal funds apportioned/awarded directly to transit agencies are not included. The costs of preserving the existing system with routine expansion (not major expansion) are included in these needs.

Generally, MDOT assists transit by providing a percentage of the total costs (operating or capital); it does not purchase increments of service, it participates in a percentage of the cost. For example, transit operating need was calculated, in part, by projecting out local operating expenses and assuming MDOT would provide the maximum percentage of those expenses as provided for in the Michigan Public Act of 1951 (Act 51). Transit capital needs were calculated, in part, by projecting capital needs as determined by local agencies, assuming the local agency would secure federal funds for those needs and assuming MDOT would fund 20 percent of the need in the form of match to federal capital awards.

There are two public marine passenger systems that are eligible for state transit funds. There are additional ferry services carrying combinations of autos, trucks, passengers, and freight; however, they are not considered part of the public transit network. The operating needs of these two systems are built into transit operating needs and revenue projections because, by law, they receive local bus operating assistance. The marine passenger capital needs are routine capital needs for these two systems and are based on prior year needs and state assistance levels. Major capital needs, such as new vessels, would have to be met with federal earmarks and are not included in this needs category.

2.1.8.3 Intercity Bus and Passenger Rail (Intercity Passenger)

The intercity bus needs are based on the assumption that MDOT will continue to provide operating and capital assistance to sustain those intercity bus services that are currently dependent on state support. For example, operating needs are based on the projected cost of maintaining existing service contracts in the Upper Peninsula and Northern Lower Peninsula.

The needs do not include the overall needs of the entire intercity bus network in Michigan. There has been no effort made to define what the private carriers may consider to be their financial need to continue to operate in Michigan.

The passenger rail operating needs are based on the assumption that MDOT will continue to provide operating and capital assistance to sustain those passenger rail services that are currently dependent on state support. Operational needs assume the same level of service and it is assumed that Amtrak will continue to use the current cost system. In addition, operational needs assume Amtrak will continue to operate and cover all costs on the Detroit/Chicago High Speed Rail Corridor; these costs are not included in this category.

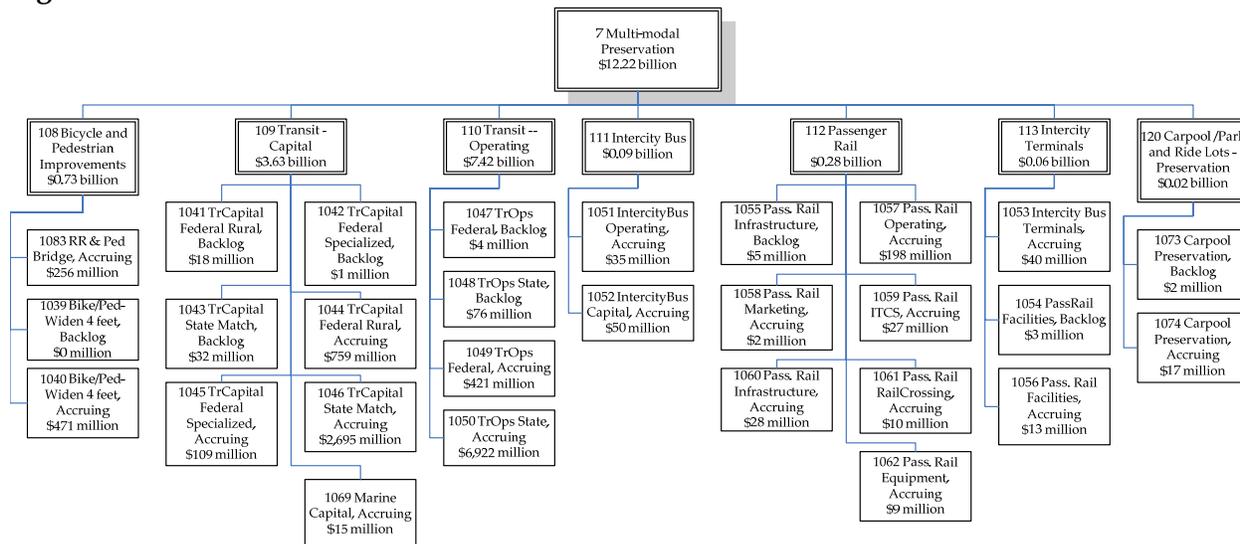
The passenger rail capital needs are those needs that would be historically met with state funds appropriated to MDOT or federal funds apportioned to MDOT. Generally, MDOT assists passenger rail needs by providing a percentage of the total capital costs for selected projects.

2.1.8.4 Carpool/Park and Ride Lots

The state currently has 55 carpool lots in poor condition. The average cost of resurfacing, grading, and other miscellaneous work for each of these lots is approximately \$35,000. The carpool program currently spends \$600,000 per year on lot preservation, which yields approximately 17-lots per year. At this level of maintenance it is estimated that six lots degrade into poor condition per year. To maintain all the carpool lots in good condition, the program would need approximately \$1.9 million to eliminate the backlog of poor carpool lots and an annual budget of \$850,000 per year. Over the course of 25 years, with an inflation rate of four percent, it is estimated that the carpool lot program will need \$19 million (in \$2005).

The \$12.22 billion in Multi-modal Preservation needs (in \$2005) over the 25 years is shown in **Figure 8**. Nearly all these needs (99%) are anticipated to be accruing needs; most passenger transit systems do not carry a documented backlog of needs, but instead reduce or curtail service.

Figure 8: Multi-modal Preservation Needs Structure



Source: Wilbur Smith Associates

2.1.9 Multi-modal Expansion Needs

The expansion of multi-modal modes is separate and distinct from the operations of these modes. The Multi-modal Expansion category is comprised of three primary modes: transit/marine passenger, intercity passenger, and carpooling; there are no bike/pedestrian expansion needs. Again, the primary expansion needs are in transit: \$2.29 billion of the \$2.72 billion in multi-modal needs are for transit. Figure 9 provides a detailed layout of how these numbers were calculated.

2.1.9.1 Transit and Marine Passenger

There are no expansion needs for local bus transit and marine passenger other than the routine expansion that was built into the preservation needs.

The transit expansion needs consist of new regional and/or downtown rapid transit service in several of Michigan’s urbanized areas. Since these expansions are still in the planning phase, projected capital and operating costs are not available. To illustrate the need, capital and operating estimates from a 2001 comprehensive regional transit plan for southeast Michigan were used. In addition, the assumption was made that MDOT would participate in transit expansion in the same way it participates in local bus transit services; i.e., it would provide 50 percent of the operating costs and 20 percent of the capital costs (in the form of match to federal grants). The needs were calculated using \$480 million of capital needs in 2011 (in \$YOE) and then about \$125 million (in \$YOE) annual operating needs starting in 2012 and increasing at 3.1-percent per year over the remainder of the plan.

2.1.9.2 Intercity Bus and Passenger Rail (Intercity Passenger)

There are four expansion categories in the Intercity Passenger program:

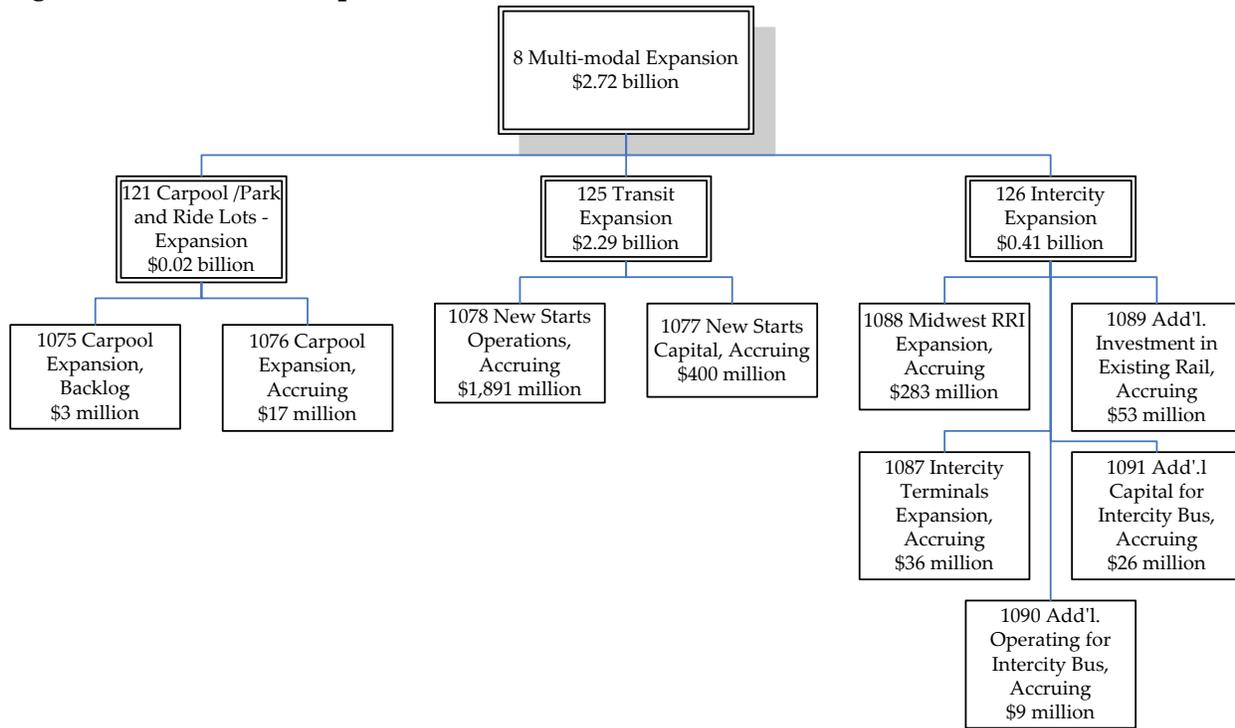
1. *Midwest Regional Rail Initiative.* The needs assume the state would provide the 20-percent state match for this initiative; it does not include the additional federal funds.
2. *Additional investment in intercity passenger rail.* This includes the Battle Creek West Track Project and three siding projects totaling 24 miles.
3. *Intercity bus capital and operation expansion.* This includes the projected operating and capital costs of the state supporting one additional intercity bus route in anticipation that private service will continue to provide such service.
4. *Expansion of intercity terminals.* This includes new facilities in Troy, Detroit, Dearborn, and Grand Rapids, as well as renovation of the Jackson terminal.

2.1.9.3 Carpool/Park and Ride Lots

The backlog of carpool lots is approximately 15 lots; the construction of these lots is estimated to cost \$3 million. During the next five years, there is an accruing need of 60 new lots. The cost of constructing the new lots is estimated at \$17 million. The elimination of the backlog need, plus the construction of the accruing need, would meet the department's Carpool Lot Program need for the foreseeable future.

The \$2.72 billion in Multi-modal Expansion needs (in \$2005) over the 25 years is shown in **Figure 9**. Nearly all these needs (99.9%) are anticipated to be accruing needs; most passenger transit systems do not carry a documented backlog of needs, but instead reduce or curtail service.

Figure 9: Multi-modal Expansion Needs Structure



Source: Wilbur Smith Associates

2.1.10 Summary of Needs

The total 25-year needs for Michigan's entire transportation system is \$81.30 billion (\$2005). A breakdown of the accruing and backlog needs by category is shown in **Table 2**.

Table 2: Backlog and Accruing Needs (in \$2005)

#	Category	Backlog	Accruing	Total
101	Pavements: Resurfacing	\$1.00 billion	\$7.21 billion	\$8.21 billion
102	Pavements: Reconstruction	\$1.04 billion	\$13.27 billion	\$14.32 billion
103	Roadways: Capacity Improvement (Adding Lanes)	\$5.14 billion	\$11.40 billion	\$16.54 billion
104	Pavements: Preventive Maintenance	\$0.21 billion	\$3.52 billion	\$3.73 billion
105	Bridge Rehabilitation & Replacement	\$0.48 billion	\$2.02 billion	\$2.50 billion
106	Bridge Preventive Maintenance & Special Needs	\$0.12 billion	\$1.09 billion	\$1.21 billion
107	Big Bridge (All Needs)	\$0.01 billion	\$0.93 billion	\$0.95 billion
108	Bicycle and Pedestrian Improvements (Preservation)	\$0.00 billion	\$0.73 billion	\$0.73 billion
109	Transit – Capital (Preservation)	\$0.05 billion	\$3.58 billion	\$3.63 billion
110	Transit – Operating (Preservation)	\$0.08 billion	\$7.34 billion	\$7.42 billion
111	Intercity Bus (Preservation)	\$0.00 billion	\$0.09 billion	\$0.09 billion
112	Passenger Rail (Preservation)	\$0.00 billion	\$0.27 billion	\$0.28 billion
113	Intercity Terminals (Preservation)	\$0.00 billion	\$0.05 billion	\$0.06 billion
114	Rail Freight (Preservation)	\$0.01 billion	\$0.44 billion	\$0.45 billion
115	Aviation (Preservation)	\$1.60 billion	\$3.68 billion	\$5.28 billion
118	Operational Improvements, Safety, & ITS	\$0.00 billion	\$5.45 billion	\$5.45 billion
120	Carpool /Park and Ride Lots – Preservation	\$0.00 billion	\$0.02 billion	\$0.02 billion
121	Carpool /Park and Ride Lots – Expansion	\$0.00 billion	\$0.02 billion	\$0.02 billion
122	New Roads/Capacity	\$0.27 billion	\$0.00 billion	\$0.27 billion
123	Borders	\$0.46 billion	\$1.23 billion	\$1.69 billion
124	Other Highway Capital	\$0.00 billion	\$5.76 billion	\$5.76 billion
125	Transit Expansion	\$0.00 billion	\$2.29 billion	\$2.29 billion
126	Intercity Expansion	\$0.00 billion	\$0.41 billion	\$0.41 billion
127	Marine Freight (Preservation)	\$0.00 billion	\$0.02 billion	\$0.02 billion
	Total	\$10.48 billion	\$70.81 billion	\$81.30 billion

Source: Wilbur Smith Associates

Note: Some values showing \$0.00 billion may not actually be zero, but too small to display. Some numbers may not add up, due to rounding (e.g., #102, \$1.04 B and \$13.27 B are summed and rounded to \$14.32 B, not \$14.31 B)

2.2 Revenue Analyses

Revenues available to the department over the 25-year plan were determined using the numbers from the *Finance Technical Report*. The revenues in this report are consistent with the numbers in the *Finance Technical Report*.

There are four high-level fund types described in this report. **Table 3** provides the 2005 base dollars, escalation rate, and the revenues available for the four high-level revenue programs. The escalation rate was applied to the 2005 base dollars then brought back to 2005 dollars using the discount rate of 3.1 percent.

Table 3: Assumptions of Gross Revenues, by Revenue Programs

<i>Fund</i>	<i>2005 Base</i>	<i>Escalation Rate</i>	<i>2006 – 2030 (\$2005)</i>
Highway Program	Federal: \$689.5 million	Federal: 4.89%	\$21.727 B
	State: \$751.3 million	State: 4.04%	\$21.179 B
Transit Program	Federal: \$23.7 million	Federal: 4.34%	\$0.696 B
	State: \$185.8 million	State: 3.22%	\$4.717 B
Intercity and Freight Program	Federal: \$1.4 million	Federal: 4.30%	\$0.041 B
	State: \$20.4 million	State: 3.22%	\$0.518 B
Aviation Program	Federal: \$104.0 million	Federal: 0.00%	\$1.791 B
	State: \$11.3 million	State: 1.04%	\$0.220 B

Source: Wilbur Smith Associates, as derived from the *MI Transportation Plan Finance Technical Report*

The revenues available from the four major programs were added together to get the total revenues available for the plan. The Highway Program required three deductions (debt service, non-capital uses, and routine maintenance) and one additional revenue source of bond proceeds. These are all shown in **Table 4**. The federal and state Highway Program revenues were escalated using 4.89 percent and 4.04 percent, respectively, which are based on the trend of historical revenues available to the State Trunkline Fund (STF). This estimate encompasses growth due to economic activities, as well as the built in traditional fuel and vehicle tax increases that have occurred at both a state and federal level over the historical 20-year timeframe.

Table 4: Total Funds Available, by Revenue Program

<i>Fund</i>	<i>2006 -2030 Revenues (\$2005)</i>	<i>Adjustments</i>	<i>Available 2006 – 2030 (\$2005)</i>
		+\$0.878 B Bond Proceeds	
		-\$3.118 B Debt Service	
Highway Program	Federal \$21.727 B	-\$4.588 B Non-capital uses	\$29.050 B
	State \$21.180 B	-\$7.028 B Routine maintenance	
	Total: \$42.907 B	-\$13.857 Total adjustments	
Transit Program	Federal \$0.696 B		
	State \$4.717 B	None	\$5.413 B
	Total \$5.413B		
Intercity and Freight Program	Federal \$0.041 B		
	State \$0.518 B	None	\$0.559 B
	Total \$0.559 B		
Aviation Program	Federal \$1.791 B		
	State \$0.220 B	None	\$2.010 B
	Total \$2.010 B		
Total	\$50.889 B	-\$13.857 B	\$37.032 B

Source: Wilbur Smith Associates

Based on the four programs above, the revenue was distributed to the categories listed in **Table 5**. The distribution of the revenues is applied to each category assuming continuation of current program emphasis.

Table 5: Revenues, by Category (in \$2005 over 25 years)

<i>#</i>	<i>Category</i>	<i>Total</i>
101	Pavements: Resurfacing	\$5.773 billion
102	Pavements: Reconstruction	\$5.411 billion
103	Roadways: Capacity Improvement (Adding Lanes)	\$2.024 billion
104	Pavements: Preventive Maintenance	\$2.783 billion
105	Bridge Rehabilitation & Replacement	\$3.409 billion
106	Bridge Preventive Maintenance & Special Needs	\$1.007 billion
107	Big Bridge (All Needs)	\$0.460 billion
108	Bicycle and Pedestrian Improvements (Preservation)	\$0.013 billion
109	Transit – Capital (Preservation)	\$0.775 billion
110	Transit – Operating (Preservation)	\$4.611 billion
111	Intercity Bus (Preservation)	\$0.365 billion
112	Passenger Rail (Preservation)	Included in #111
113	Intercity Terminals (Preservation)	Included in #111
114	Rail Freight (Preservation)	\$0.220 billion
115	Aviation (Preservation)	\$2.010 billion
118	Operational Improvements, Safety, & ITS	\$2.666 billion
120	Carpool /Park and Ride Lots – Preservation	\$0.014 billion
121	Carpool /Park and Ride Lots – Expansion	\$0.017 billion
122	New Roads/Capacity	\$0.206 billion
123	Borders	\$2.089 billion
124	Other Highway Capital	\$3.178 billion
125	Transit Expansion	\$0.000 billion
126	Intercity Expansion	\$0.000 billion
127	Marine Freight (Preservation)	\$0.000 billion
	Total	\$37.032 billion

Source: Wilbur Smith Associates

2.3 Revenue Gap Analyses

The revenue gaps are simply the difference between the available revenues over the 25 years and the needs over the 25 years, all expressed in 2005 dollars. The revenue gap over the 25 years (in \$2005) is \$44.26 billion. **Table 6** shows the gap for the detailed categories.

Table 6: Needs, Revenues, and Gaps, by Category (in \$2005 over 25 years)

#	Program	Needs	Revenues	Gap
101	Pavements: Resurfacing	\$8.21 billion	\$5.77 billion	-\$2.44 billion
102	Pavements: Reconstruction	\$14.32 billion	\$5.41 billion	-\$8.90 billion
103	Roadways: Capacity Improvement (Adding Lanes)	\$16.54 billion	\$2.02 billion	-\$14.52 billion
104	Pavements: Preventive Maintenance	\$3.73 billion	\$2.78 billion	-\$0.95 billion
105	Bridge Rehabilitation & Replacement	\$2.50 billion	\$3.41 billion	\$0.91 billion
106	Bridge Preventive Maintenance & Special Needs	\$1.21 billion	\$1.01 billion	-\$0.21 billion
107	Big Bridge (All Needs)	\$0.95 billion	\$0.46 billion	-\$0.49 billion
108	Bicycle and Pedestrian Improvements (Preservation)	\$0.73 billion	\$0.01 billion	-\$0.71 billion
109	Transit – Capital (Preservation)	\$3.63 billion	\$0.78 billion	-\$2.85 billion
110	Transit – Operating (Preservation)	\$7.42 billion	\$4.61 billion	-\$2.81 billion
111, 112, 113	Intercity Bus, Passenger Rail, and Intercity Terminals (Preservation)	\$0.42 billion	\$0.37 billion	-\$0.05 billion
114	Rail Freight (Preservation)	\$0.45 billion	\$0.22 billion	-\$0.23 billion
115	Aviation (Preservation)	\$5.28 billion	\$2.01 billion	-\$3.27 billion
118	Operational Improvements, Safety, & ITS	\$5.45 billion	\$2.67 billion	-\$2.79 billion
120	Carpool /Park and Ride Lots – Preservation	\$0.02 billion	\$0.01 billion	\$0.00 billion
121	Carpool /Park and Ride Lots – Expansion	\$0.02 billion	\$0.02 billion	\$0.00 billion
122	New Roads/Capacity	\$0.27 billion	\$0.21 billion	-\$0.06 billion
123	Borders	\$1.69 billion	\$2.09 billion	\$0.40 billion
124	Other Highway Capital	\$5.76 billion	\$3.18 billion	-\$2.58 billion
125	Transit Expansion	\$2.29 billion	\$0.00 billion	-\$2.29 billion
126	Intercity Expansion	\$0.41 billion	\$0.00 billion	-\$0.41 billion
127	Marine Freight (Preservation)	\$0.02 billion	\$0.00 billion	-\$0.02 billion
	Total	\$81.30 billion	\$37.03 billion	-\$44.26 billion

Source: Wilbur Smith Associates

Note: Some numbers may not add up, due to rounding (e.g., #106, the difference between \$1.21 B and \$1.01 B is rounded to \$2.01 B, not \$2.00 B)

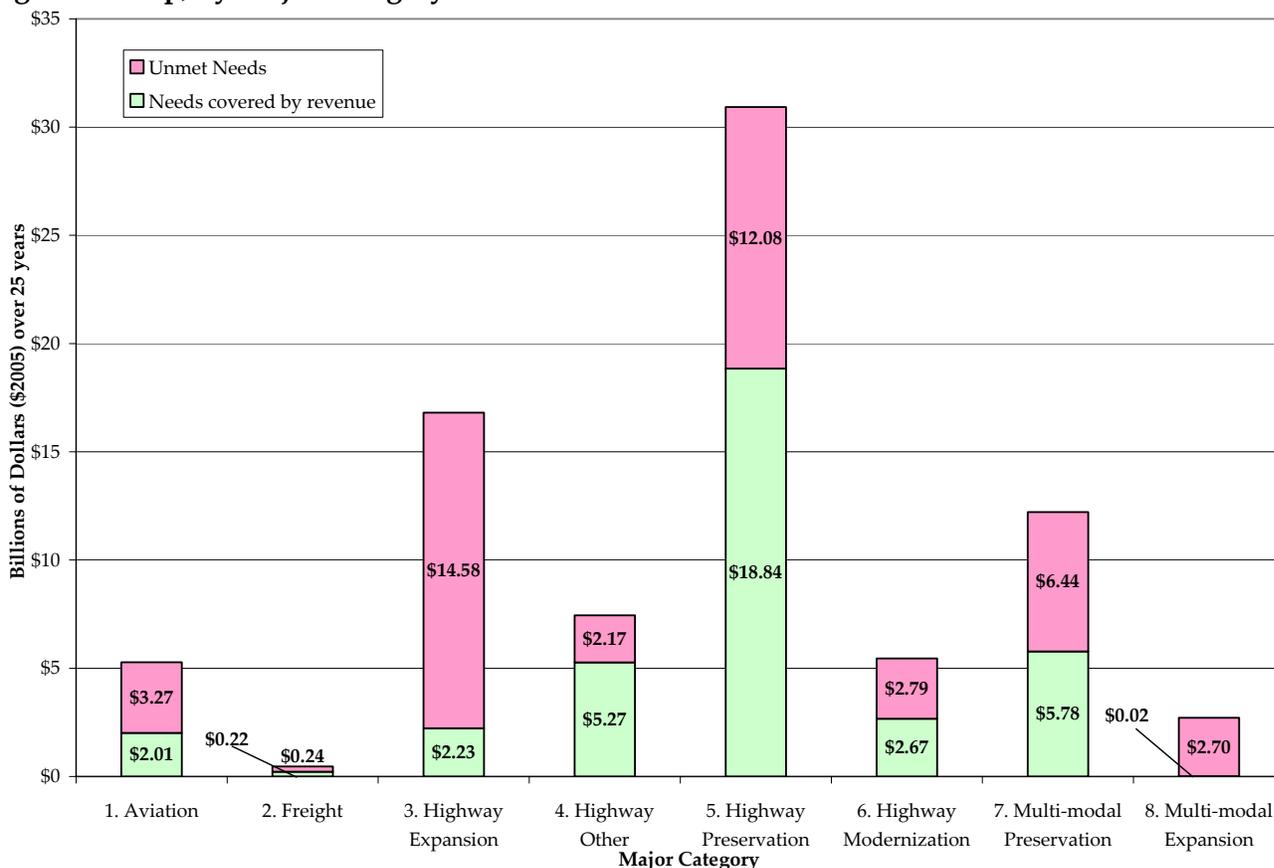
Table 7 and **Figure 10** show these gaps grouped into the eight major categories, providing a better look at the big picture. Highway Preservation has the greatest need (\$30.9 billion), but Highway Expansion has the greatest gap (\$14.6 billion). Multi-modal Expansion, however, has the lowest percentage of the gap covered by revenues (only 0.6% of the needs are met).

Table 7: Summary of Gap by Major Category (in \$2005 over 25 years)

#	Major Category	Needs	Revenues	Gaps	% of needs in category that are met	% of gap
1	Aviation	\$5.28 B	\$2.01 B	\$3.27 B	38.1%	7.4%
2	Freight	\$0.46 B	\$0.22 B	\$0.24 B	47.6%	0.5%
3	Highway Expansion	\$16.81 B	\$2.23 B	\$14.58 B	13.3%	32.9%
4	Highway Other	\$7.44 B	\$5.27 B	\$2.17 B	70.8%	4.9%
5	Highway Preservation	\$30.92 B	\$18.84 B	\$12.08 B	60.9%	27.3%
6	Highway Modernization	\$5.45 B	\$2.67 B	\$2.79 B	48.9%	6.3%
7	Multi-modal Preservation	\$12.21 B	\$5.78 B	\$6.44 B	47.3%	14.5%
8	Multi-modal Expansion	\$2.72 B	\$0.02 B	\$2.70 B	0.6%	6.1%
	Total	\$81.30 B	\$37.03 B	\$44.26 B	45.6%	100.0%

Source: Wilbur Smith Associates

Figure 10: Gap, by Major Category



Source: Wilbur Smith Associates

Chapter 3. Investment Packages

The 2030 *Preferred Vision* is a transportation system oriented toward choices, access, integration, and regional sensitivity. The public sees transportation as fundamental to economic development and quality of life in Michigan. They desire a 2030 transportation system which is innovative, holistic, sustainable, environmentally sound, and energy-efficient.

The most noteworthy elements are widespread support for transit, for non-motorized travel, the retrofit of cities for pedestrians, for high-speed intercity travel, and for integration of land use and transportation planning. The public expects that, looking back from the perspective of 2030, transit is as easy to use as any other mode of transportation. The approach to auto traffic emphasizes the need for energy efficiency along with the need to maintain and improve traffic corridors, with systems integration and excellent maintenance. Innovative and separate facilities for freight movement are desired. New approaches to financing transportation are called for. Because of the diversity of the state, it is expected that future transportation systems

development will pay attention to regional differences and commonalities, both during design and in implementation.

Investment packages are different ways to invest transportation revenues to achieve the Preferred Vision of *MI Transportation Plan*. They consider how possible changes in policies, such as the allocation of state transportation revenues between investment categories, as well as additional revenues, may affect Michigan's transportation infrastructure and programs. Comparing investment packages provides insight into how the preferred investment level may affect Michigan's transportation system performance and program goals.

Four illustrative investment packages are considered in this analysis:

1. *"Business as Usual."* The "Business as Usual" package explores the implications of living with the revenue gaps described in the base case presented in **Chapter 2, Base Case**. This future assumes no state transportation revenues beyond those associated with the base case revenues described in **Chapter 2**, and an allocation of these funds among state programs in ways consistent with how revenues are allocated today.
2. *"Change the Mix."* The "Change the Mix" package explores the implications of seeking to improve efficiency by investing projected revenues into a different mix of programs. This future also assumes no state transportation revenues beyond those associated with the base case revenues described in **Chapter 2**. "Change the Mix" considers reducing Highway Preservation revenues to allocate more funds to Multi-modal Preservation and Highway Modernization programs associated with the seamless and multi-modal system consistent with the Preferred Vision of *MI Transportation Plan*.
3. *"Move Ahead."* The "Move Ahead" package explores the implications of raising additional revenue beyond those associated with the base case revenues by 16 percent and investing the additional revenue into Multi-modal Preservation and Highway Modernization programs without taking projected revenues away from existing programs. The "Move Ahead" package entails both increasing overall state transportation revenues and changing some of the Act 51 stipulations regarding the allocation of these revenues.
4. *"Flexible New Revenue."* The "Flexible New Revenue" package explores the implications of raising additional revenue through user fees consistent the "Move Ahead" package as well as dedicated new revenue sources to support system preservation while funding Multi-modal Preservation and Highway Modernization programs consistent with the Preferred Vision of *MI Transportation Plan*. The "Flexible New Revenue" future entails increasing the overall state transportation revenues by 42 percent to preserve existing assets and to invest in Multi-modal Preservation and Highway Modernization programs.

Each possible package has implications for the degree to which projected needs are met for specific program areas, and how the system can be expected to perform to 2030. The merits of different investment packages are assessed with respect to:

1. The vision and goals of *MI Transportation Plan*;
2. The decision principles of *MI Transportation Plan*; and
3. The expected and desired performance of Michigan's state transportation system.

Each illustrative package also has implications for Michigan's economy, which will be further explored in the economic impact analysis of *MI Transportation Plan*.

3.1 Challenges of the Investment Packages

The revenue gap identified in **Chapter 2, Base Case** of this report represents shortfalls in each of Michigan's state transportation program areas. With an expected shortfall of \$44.1 billion to the year 2030, fully funding all state transportation programs would require a revenue increase of 119 percent. Because of the potentially adverse economic implications of raising this level of revenue from Michigan's economy, the investment packages seek to manage this gap by:

1. Investing revenues more efficiently in programs that may reduce needs across the system; and
2. Raising revenue to levels that may achieve desired performance levels for critical system components.

There is no investment package presented in this report that fully eliminates the gaps identified in **Chapter 2, Base Case**. Instead, packages are structured as potential pathways to the Preferred Vision of *MI Transportation Plan* based on:

1. The attributes of a seamless, multi-modal, and efficient system associated with the Preferred Vision;
2. The goals and objectives developed for *MI Transportation Plan*;
3. The decision principles for the integrated system identified in the *Integration Technical Report*; and
4. The quantifiable targets for system preservation utilized by MDOT's road quality and bridge condition forecasting programs.

3.2 Pathways to the Vision: Description of the Four Investment Packages

While the "Business as Usual" base case presented does not make any policy changes pursuant to the vision of *MI Transportation Plan*, it provides a helpful baseline against which to measure other potential strategies. In exploring and comparing investment packages, one important criterion is that a future investment strategy should come closer to the Preferred Vision than the "Business as Usual" alternative. For this reason, the investment and needs levels of "Business as Usual" are presented as a potential future with investment, need, and performance implications, followed by three other possible futures represented by the other packages.

3.2.1 Investment Package #1: Business as Usual

3.2.1.1 Rationale

The rationale of the “Business as Usual” investment package is that today’s revenue estimates and Act 51 provisions regarding the allocation of state transportation revenues represent policies that may stay in place in the future.

Under “Business as Usual,” MDOT’s 2030 revenue forecast is based on a growth rate that reflects the historical pattern of state transportation revenue from 1985 to 2004. The rate includes all the state revenue to the State Trunkline Fund (STF) and encompasses growth due to economic activities, as well as additional fuel and vehicle tax increases that occurred over the 20-year timeframe. An alternative to the historic growth rate was developed to account for any potential shortfall in revenue. A conservative approach used the historical annual growth rate and applied a 90-percent factor; the result is an annual growth rate of 4.04 percent.

The 2030 revenue forecast must also account for annual inflation. The annual inflation rate used is 3.1 percent, which is the average annual compounded increase of the Consumer Price Index-All Urban Consumers, Detroit, for the period covering 1985-2004 (US Bureau of Labor Statistics).

If current policies enable MDOT to pursue the Preferred Vision of *MI Transportation Plan*, then implementation is a matter of how programs are delivered. If “Business as Usual” is sufficient to achieve the vision, other strategic decisions about revenue levels and allocation need not be considered. Analysis of the “Business as Usual” future shows the implications of keeping current policies in place to the year 2030.

3.2.1.2 Investment Levels

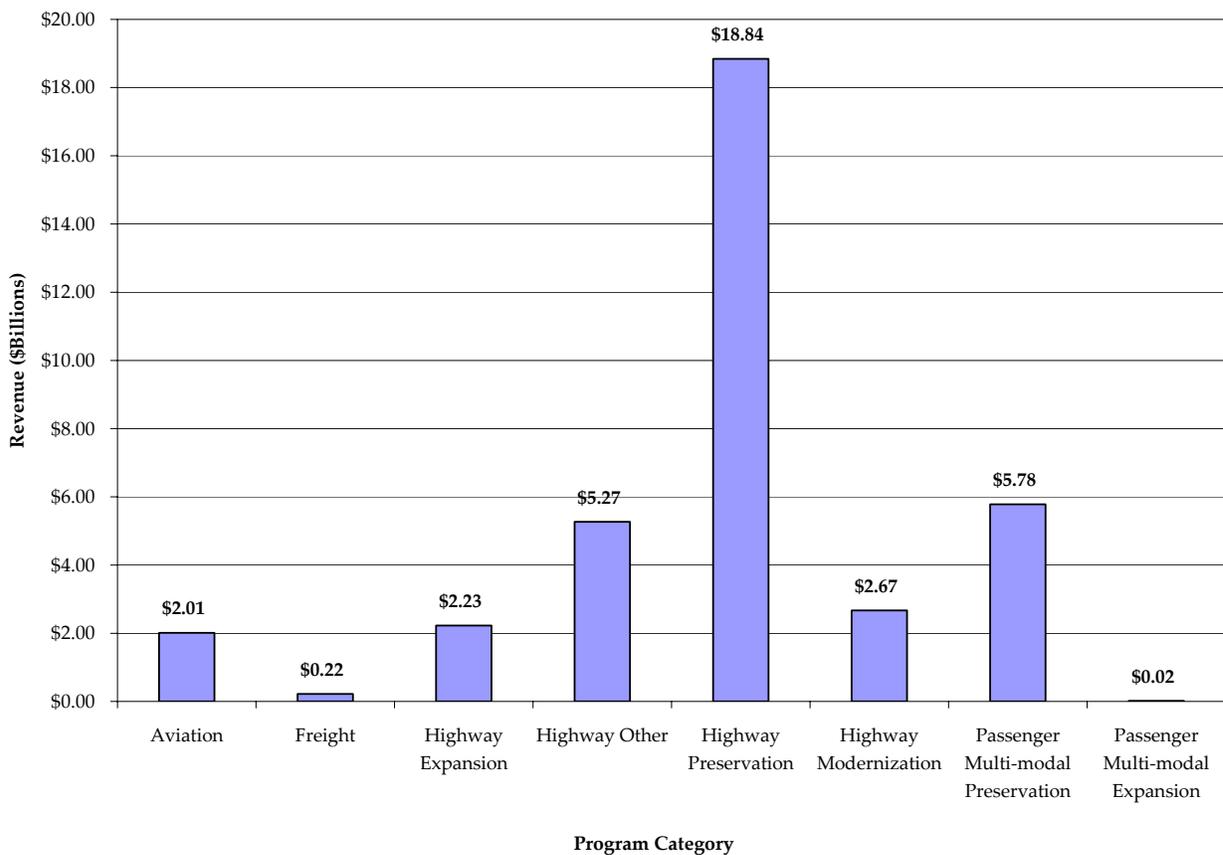
The investment levels in different program areas under a “Business as Usual” future are presented in **Table 8** and **Figure 11**.

Table 8: Investment in Programs under “Business as Usual” Future

<i>Program</i>	<i>Revenue Invested (\$billions)—25 years</i>	<i>% of Revenue Invested</i>
Aviation	\$2.01	5.4%
Freight	\$0.22	0.6%
Highway Expansion	\$2.23	6.0%
Highway Other	\$5.27	14.2%
Highway Preservation	\$18.84	50.9%
Highway Modernization	\$2.67	7.2%
Multi-modal Preservation	\$5.78	15.6%
Multi-modal Expansion	\$0.02	0.0%
Total	\$37.03	100.0%

Source: Wilbur Smith Associates

Figure 11: Investment in Programs under “Business as Usual” Future



Source: Wilbur Smith Associates

The largest share of revenue under this scenario is invested in preserving Michigan's highway infrastructure. Highway Preservation accounts for more than half (50.9%) of revenues invested under this package. Multi-modal Preservation (maintaining current levels of transit service and preserving carpool parking lots) and Highway Other programs (including non-pavement infrastructure) are categories accounting for significant levels of investment, utilizing 15.6 percent and 14.2 percent of revenues, respectively. While just over seven percent of revenues are invested in Highway Modernization (including signals, operational improvements, safety, and ITS), less than one-tenth of a percent is invested in expansion of multi-modal passenger services. Highway Expansion and Aviation account for six percent and just fewer than five and a half percent of revenues, respectively, invested under the "Business as Usual" scenario.

The allocation of revenues under "Business as Usual" reflects the high priority and success of MDOT's current asset management programs as described in the *Highway and Bridge Technical Report* and the *Conditions and Performance Technical Report of MI Transportation Plan*. This investment strategy seeks to sustain MDOT's stated goals of 85-percent good in pavements and bridges for non-freeway highways and 95-percent good in pavements and bridges for Michigan's state-owned freeways. However, continuation of this investment strategy does not allocate a large share of funds to maintain or expand multi-modal services, or provide operational, safety, and technology improvements that may support intermodal linkages for the "seamless" system described in the Preferred Vision of *MI Transportation Plan*.

3.2.1.3 Unmet Needs

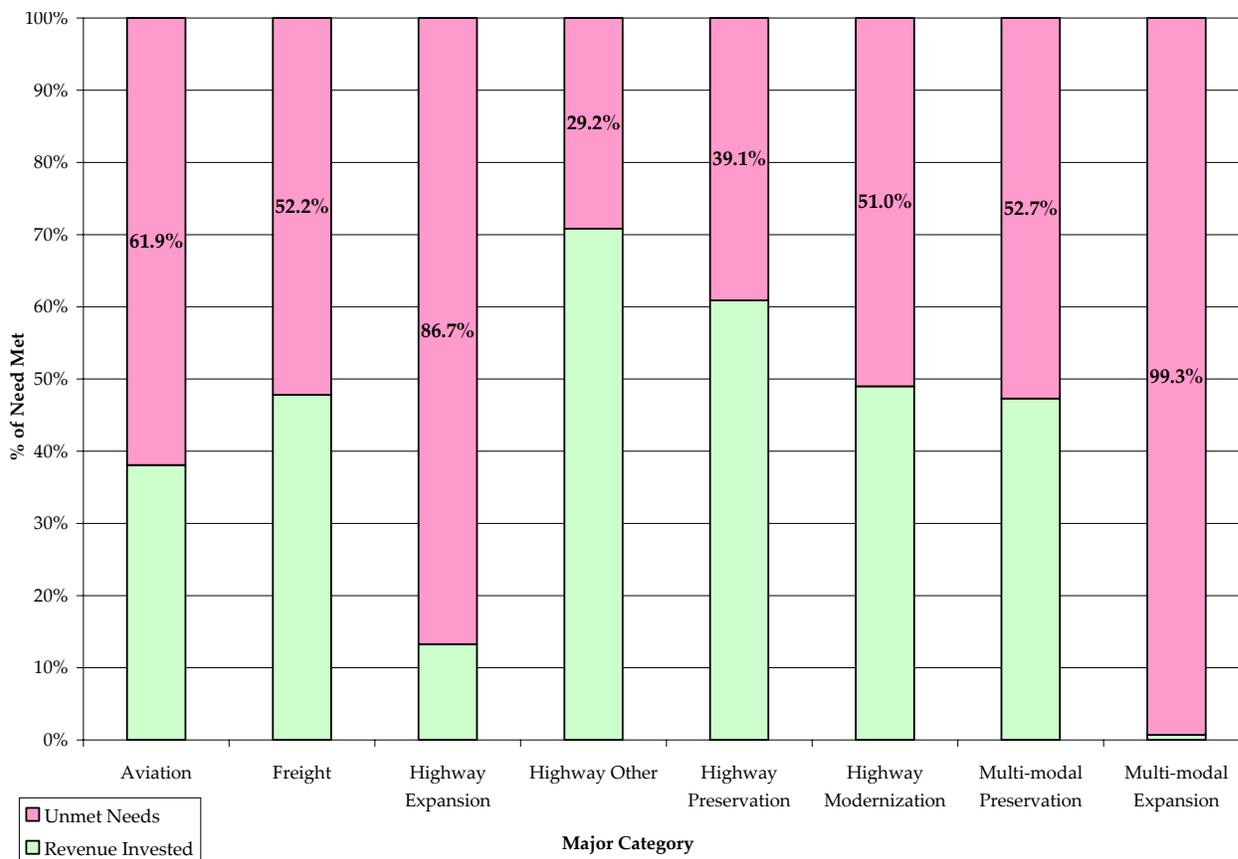
Maintaining MDOT's current preservation targets for highways and bridges, supporting today's levels of multi-modal services and expanding Michigan's transportation system in the future, would require more revenue than is available under the "Business as Usual" future. **Table 9** and **Figure 12** compare the projected revenues invested in each area against the projected needs for each program area.

Table 9: Needs Met Under “Business as Usual” Future

<i>Program</i>	Revenue Invested (\$Billions)	Total Needs (\$Billions)	Gap (\$Billions)	% of Needs Met by this Package
Aviation	\$2.01	\$5.28	\$3.27	38.1%
Freight	\$0.22	\$0.46	\$0.24	47.6%
Highway Expansion	\$2.23	\$16.81	\$14.58	13.3%
Highway Other	\$5.27	\$7.44	\$2.17	70.8%
Highway Preservation	\$18.84	\$30.92	\$12.08	60.9%
Highway Modernization	\$2.67	\$5.45	\$2.78	48.9%
Multi-modal Preservation	\$5.78	\$12.21	\$6.43	47.3%
Multi-modal Expansion	\$0.02	\$2.72	\$2.70	0.6%
Total	\$37.03	\$81.30	\$44.26	45.6%

Source: Wilbur Smith Associates

Figure 12: Needs Met/Not Met Under “Business as Usual” Future



Source: Wilbur Smith Associates

While the “Business as Usual” investment package maintains a high concentration of investment in Highway Preservation to build on progress towards current 85-percent and 95-percent good targets, projected revenue levels are only sufficient to meet 60 percent of identified preservation needs. The current allocation of projected revenues will cover 71 percent of Highway Other (or non-pavement highway needs), and will cover approximately half the needs of Michigan’s Highway Modernization programs to the year 2030. The analysis shows that with today’s funding levels the “Business as Usual” allocation of revenues will cover less than half of the needs to support today’s levels of Multi-modal Preservation (transit, maintaining bicycle and pedestrian facilities, and carpool parking lots) as well as less than half of the needs for Freight and Aviation major categories. The expansion of highway and multi-modal systems cannot be supported under “Business as Usual,” meeting only 13.3 percent and 0.7 percent of needs respectively.

3.2.1.4 Condition and Performance Implications

The expected conditions and performance of Michigan’s transportation system under the “Business as Usual” future will not keep pace with the conditions and performance of the system today. Unmet preservation needs will adversely affect Michigan’s highways and bridges, as unmet preservation and expansion needs for Multi-modal and Highway programs will allow travel times to increase.

Table 10 shows the expected measures of Michigan’s highway system conditions and performance under the “Business as Usual” future.

Table 10: Highway System Conditions and Performance Implications of “Business as Usual” in the Year 2030

<i>Performance Measure</i>	<i>Highway Condition or Performance Area</i>	<i>Level Achieved with “Business as Usual”</i>
Pavement Condition	Freeway Percentage Good (Remaining Service Life)	75%
	Non-Freeway Percentage Good (Remaining Service Life)	66%
	Systemwide Percentage Good (Remaining Service Life)	69%
Bridge Condition	Freeway Percentage Good Bridges Achieved	89%
	Non-Freeway Percentage Good Bridges Achieved	77%
Delay Due to Congestion or Deficient Pavement/Bridge Condition	Freeway Delay (Daily-Vehicle-Hours)	93,118
	Non-Freeway Delay (Daily-Vehicle-Hours)	126,775
	Trunkline System Delay (Daily-Vehicle-Hours)	219,893
Highway Miles Without Congestion	Percentage of Freeway Miles Uncongested in 2030	78%
	Percentage of Non-Freeway Miles Uncongested in 2030	90%
	Percentage of Freeway Miles Approaching Congested in 2030	28%
	Percentage of Non-Freeway Miles Approaching Congested in 2030	14%

Source: Michigan Department of Transportation Road Quality Forecasting System, Bridge Condition Forecast System, and Statewide Travel Demand Model

Note 1: Delay is the difference between the vehicle-hours traveled at free-flow travel speeds and the vehicles-hours traveled at congested travel speeds.

Note 2: Traffic flow is characterized by Level of Service, or LOS. Alpha letter coded for LOS are defined in the 2000 Highway Capacity Manual as A-F. “Approaching congestion” is level of service (LOS) D or E on freeways and LOS D on non-freeways.

While the “Business as Usual” future concentrates investment in Highway Preservation, revenue gaps will allow freeway and non-freeway pavement conditions to fall to 75-percent good and 66-percent good, respectively, by the year 2030. This condition is well below Michigan’s established targets of 95 percent and 85 percent described in the *Conditions and Performance Technical Report* of *MI Transportation Plan*. Bridge conditions also fall short of established targets, achieving 89-percent good and 77-percent good for freeway and non-freeway bridges, respectively. This indicates that, even by concentrating existing revenue

levels in Highway Preservation as they are today, MDOT's preservation targets will not be attainable with projected funding levels.

While affording the addition of approximately 119-lane miles to urban interstates and freeways, in 2030 (adding lanes to 82 percent of today's congested urban freeways), the "Business as Usual" future will still leave 22 percent of Michigan's freeway miles in congested conditions, and 10 percent of non-freeway miles congested. Furthermore, the "Business as Usual" future is expected to leave 28 percent of Michigan's freeway miles approaching congestion, and 14 percent of non-freeway miles in approaching congested conditions. However, the congestion situation may further deteriorate as unmet needs for Highway Modernization or Multi-modal Preservation programs place additional trips and demands on the trunkline system. With no substantive investment in additional Highway Modernization or Multi-modal Expansion programs, this congestion is not expected to be mitigated by any other type of capital improvement.

Overall, the analysis of the "Business as Usual" future shows that today's projected revenue levels and investment strategy will not sustain the current Highway Preservation goal. This future will not only fail to invest in Multi-modal Preservation and Highway Modernization programs for the seamless vision of *MI Transportation Plan*, but will actually be inadequate to preserve today's levels of performance in these areas. These findings indicate that exploration of additional revenues and other investment strategies may yield results more consistent with the vision of *MI Transportation Plan*.

3.2.2 Investment Package #2: Change the Mix

3.2.2.1 Rationale

The rationale of the "Change the Mix" investment package is that it may be possible to better invest today's revenue estimates by changing the allocation of state transportation revenues into different programs. This illustrative package explores the possibility that the seamless, multi-modal transportation system of the Preferred Vision of *MI Transportation Plan* may be undertaken by changing where state revenues are invested without increasing transportation revenue in other than traditional ways. The only program category with enough revenue to significantly be re-invested in other categories is the preservation category, which the "Business as Usual" analysis has shown will already fall short, even if funded at today's levels. Analysis of the "Change the Mix" future shows the implications of a reallocation of \$2.82 billion of preservation revenues into Highway Modernization and Multi-modal Preservation programs. Investment levels, unmet needs, and performance implications are compared against "Business as Usual" to highlight the features of this package.

3.2.2.2 Investment Levels

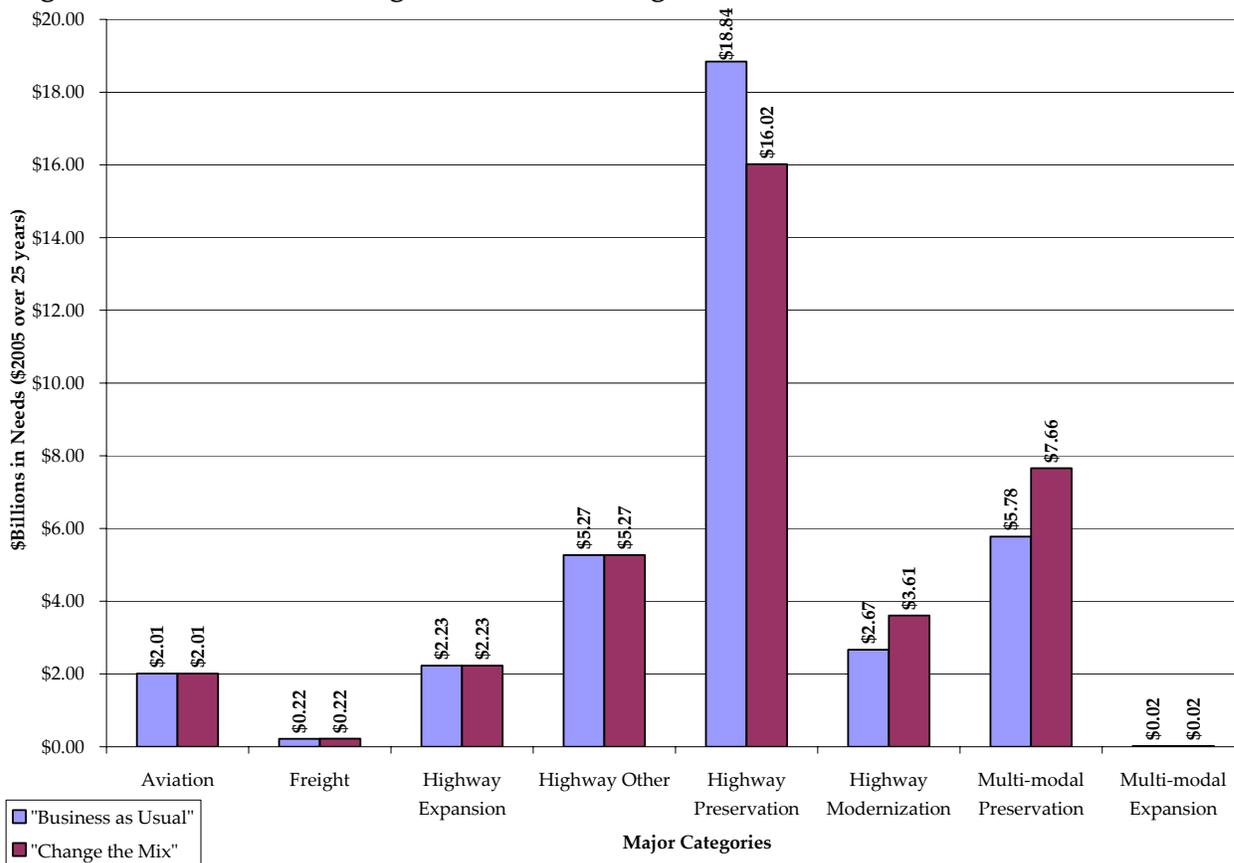
The Investment Levels in different program areas under a "Change the Mix" future are presented **Table 11** and **Figure 13**.

Table 11: Investment in Programs under “Change the Mix” Future

Program	"Business as Usual"		"Change the Mix"		Difference in Revenue vs. "Business as Usual" (\$Billions)
	Revenue Invested (\$Billions)	% of Revenue Invested	Revenue Invested (\$Billions)	% of Revenue Invested	
Aviation	\$2.01	5.4%	\$2.01	5.4%	\$0.00
Freight	\$0.22	0.6%	\$0.22	0.6%	\$0.00
Highway Expansion	\$2.23	6.0%	\$2.23	6.0%	\$0.00
Highway Other	\$5.27	14.2%	\$5.27	14.2%	\$0.00
Highway Preservation	\$18.84	50.9%	\$16.02	43.3%	-\$2.82
Highway Modernization	\$2.67	7.2%	\$3.61	9.7%	\$0.94
Multi-modal Preservation	\$5.78	15.6%	\$7.66	20.7%	\$1.88
Multi-modal Expansion	\$0.02	0.0%	\$0.02	0.0%	\$0.00
Total	\$37.03	100.0%	\$37.03	100.0%	\$0.00

Source: Wilbur Smith Associates

Figure 13: Investment in Programs under “Change the Mix” Future



Source: Wilbur Smith Associates

By taking \$2.82 billion from the Highway Preservation category for investment into Highway Modernization and Multi-modal Preservation categories consistent with the Preferred Vision of *MI Transportation Plan*, it is possible to increase Multi-modal Preservation funding by \$1.88 billion and Highway Modernization programs by \$940 million over the 25-year planning period. This represents a 15-percent reduction in Highway Preservation revenues, but a 33-percent increase in revenues for the Multi-modal Preservation programs and a 35-percent increase in revenues for Highway Modernization programs. The Highway Modernization funding includes additional revenue for operational, safety, and ITS programs. The investment in Multi-modal Preservation programs preserves more of Michigan’s carpool parking lots and leaves less of a shortfall for transit capital and operations than “Business as Usual.” The investment in these two categories is consistent with the seamless multi-modal vision of *MI Transportation Plan*. It may also help manage the need for Highway Expansion and Freight improvements through direct and indirect impacts on accessibility, safety, capacity, and operations. This “leverage” on Freight needs arises because an investment in Rail Freight programs could cause a reduction in trucks on the road. Likewise, an investment in carpool parking lots could reduce the number of rush hour single-occupancy vehicles.

3.2.2.3 Unmet Needs

Changing the investment mix without additional revenue still leaves significant revenue gaps for all program categories.

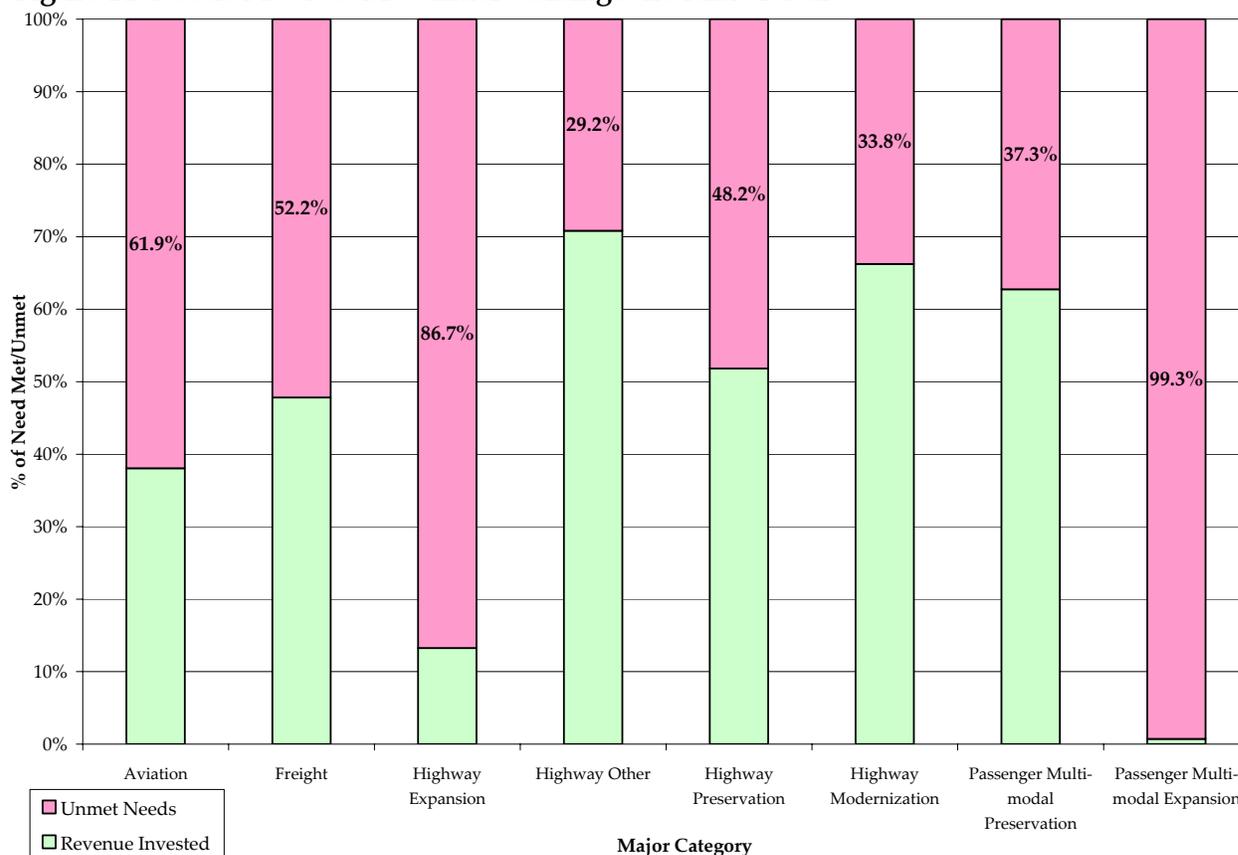
Table 12 and Figure 14 compare the projected revenues invested in each area against the projected needs for each program area, contrasting the “Change the Mix” future to the “Business as Usual” baseline.

Table 12: Needs Met Under “Change the Mix” Future

Program	"Business as Usual"			"Change The Mix"		
	Revenue Invested (\$Billions)	Total Needs (\$Billions)	% of Needs Met by this Package	Revenue Invested (\$Billions)	% of Needs Met by this Package	Difference in % Needs Met vs. "Business as Usual"
Aviation	\$2.01	\$5.28	38.1%	\$2.01	38.1%	0.0%
Freight	\$0.22	\$0.46	47.7%	\$0.22	47.7%	0.0%
Highway Expansion	\$2.23	\$16.81	13.3%	\$2.23	13.3%	0.0%
Highway Other	\$5.27	\$7.44	70.8%	\$5.27	70.8%	0.0%
Highway Preservation	\$18.84	\$30.92	60.9%	\$16.02	51.8%	-9.1%
Highway Modernization	\$2.67	\$5.45	48.9%	\$3.61	66.2%	17.3%
Multi-modal Preservation	\$5.78	\$12.21	47.3%	\$7.66	62.7%	15.4%
Multi-modal Expansion	\$0.02	\$2.72	0.6%	\$0.02	0.6%	0.0%
Total	\$37.03	\$81.30	45.5%	\$37.03	45.5%	0.0%

Source: Wilbur Smith Associates

Figure 14: Needs Met/Not Met under “Change the Mix” Future



Source: Wilbur Smith Associates

Proportionately, changing the investment mix in favor of Highway Modernization and Multi-modal Preservation programs makes more progress towards meeting the financial needs of these programs than it detracts from the preservation needs. This is because these are smaller programs. The \$2.82 billion reallocated from preservation covers a larger share of these needs than it would of the larger preservation need amount.

By changing the investment mix, MDOT can cover nearly 70 percent of Highway Modernization needs to the year 2030, and more than 60 percent of the needs to preserve today’s levels of Multi-modal programs. This would come at the expense of increasing the shortfall in Highway Preservation by nine percent and would still not make revenues available to expand Multi-modal programs or to increase funding for additional Highway Expansion.

3.2.2.4 Condition Performance Implications

Like with the “Business as Usual” future, the expected conditions and performance of Michigan’s transportation system under the “Change the Mix” future will not keep pace with the conditions and performance of the system today. With reduced revenues, unmet

preservation needs will even more adversely affect Michigan’s highways and bridges, as unmet preservation and expansion needs for Multi-modal and Highway programs will still allow travel times to increase. However, covering a larger share of Highway Modernization and Multi-modal Preservation needs is expected to mitigate the congestion problem better than the “Business as Usual” case.

Table 13 shows the expected measures of Michigan’s highway system conditions and performance under the “Change the Mix” future.

Table 13: Highway System Conditions and Performance Implications of “Change the Mix” in the Year 2030

<i>Performance Measure</i>	<i>Highway Condition or Performance Area</i>	<i>Level Achieved with “Business as Usual”</i>	<i>Level Achieved with “Change the Mix”</i>	<i>Change in Performance with “Change the Mix”</i>
Pavement Condition	Freeway Percentage Good (Remaining Service Life)	75%	63%	-12%
	Non-Freeway Percentage Good (Remaining Service Life)	66%	56%	-10%
	Systemwide Percentage Good (Remaining Service Life)	69%	58%	-11%
Bridge Condition	Freeway Percentage Good Bridges Achieved	89%	82%	-7%
	Non-Freeway Percentage Good Bridges Achieved	77%	73%	-4%
Delay Due to Congestion or Deficient Road/Bridge Condition	Freeway Delay (Daily-Vehicle-Hours)	93,118	141,987	48,869
	Non-Freeway Delay (Daily-Vehicle-Hours)	126,775	164,062	37,287
	Trunkline System Delay (Daily-Vehicle-Hours)	219,893	306,049	86,156
Highway Miles Without Congestion	Percentage of Freeway Miles Uncongested in 2030	78%	78%	0%
	Percentage of Non-Freeway Miles Uncongested in 2030	90%	90%	0%
	Percentage of Freeway Miles Approaching Congested in 2030	28%	28%	0%
	Percentage of Non-Freeway Miles Approaching Congested in 2030	14%	14%	0%

Source: Michigan Department of Transportation Road Quality Forecasting System, Bridge Condition Forecast System, and Statewide Travel Demand Model

By reducing the revenues available for Highway Preservation, the “Change the Mix” future is expected to result in a 12-percent reduction in the attainable percent good freeway pavements and a 10-percent reduction in the percent good non-freeway pavements when compared to “Business as Usual”. The percentage of good bridges is also expected to decline by seven percent and four percent, respectively. Pavement and bridge conditions at these levels are expected to generate more than 86,000 hours of additional delay. It is not possible to quantify the degree to which projected increases in delay may be mitigated by preserving a larger share of Multi-modal Preservation and Highway Modernization funding.

The adverse implications of reduced preservation revenues will not be offset by investments in expanded Highway Modernization and Multi-modal Preservation programs as the revenues allocated to these categories will still fall short of needs to maintain today’s service levels. In all likelihood, the increases in travel time and delay due to deteriorating road and bridge conditions will be exacerbated by some outstanding shortfalls in Multi-modal Preservation and Highway Modernization programs. An additional concern raised by the “Change the Mix” future is the possibility that with large percentages of roads and bridges in less than good condition, some facilities may deteriorate to levels where less expensive fixes such as overlays become insufficient, and more expensive fixes such as reconstruction are needed.

Overall, the analysis of the “Change the Mix” future highlights the potential pitfalls of seeking to invest in the Preferred Vision of *MI Transportation Plan* without additional revenues. If existing assets are not preserved, many of the mobility, safety, and environmental opportunities of a more seamless multi-modal system can be offset by the delay and expense associated with deteriorating highways and bridges. These findings suggest that other strategies involving additional revenues may be required to pursue the vision with better success than the “Change the Mix” future.

3.2.3 Investment Package #3: Move Ahead

3.2.3.1 Rationale

The rationale of the “Move Ahead” investment package is that revenue increases under “Business as Usual” (see **Section 3.2.1.1, Rationale of “Business as Usual” Package**) may be modestly supplemented by greater increases revenues, making it possible to invest in Highway Modernization and Multi-modal Preservation programs consistent with the vision, while maintaining the “Business as Usual” levels of investment in Highway Preservation and other programs. This package explores the possibility that covering needs in these areas may offset some of the adverse implications of pavement and bridge deterioration while supporting modest increases in Highway Preservation funding to avoid the adverse impacts seen in the “Change the Mix” package.

In “Move Ahead” and “Business as Usual”, levels of revenue are maintained for Highway Expansion and Highway Other. However, additional increases in revenues are anticipated

to create an additional \$130 million in 2008 and 2009 (in year of expenditure dollars, \$YOE), with an additional \$440 million (\$YOE) annually in year 2010 and beyond. This additional revenue has an approximate present value of \$6.2 billion. While this amount is not sufficient to address all unmet Highway Preservation needs, the new revenue can close a large share of gaps in Highway Modernization, Freight, and the Multi-modal Preservation programs associated with the vision.

In the “Move Ahead” future, instead of investing these additional revenues according to current allocation policies, they are all invested primarily in the Highway Modernization, Multi-modal Preservation, and Freight categories, with a modest increase in Highway Preservation revenue. This approach invests additional revenues to close “seams” in the system in pursuit of the *MI Transportation Plan* vision without exacerbating projected Highway Preservation shortfalls.

3.2.3.2 Investment Levels

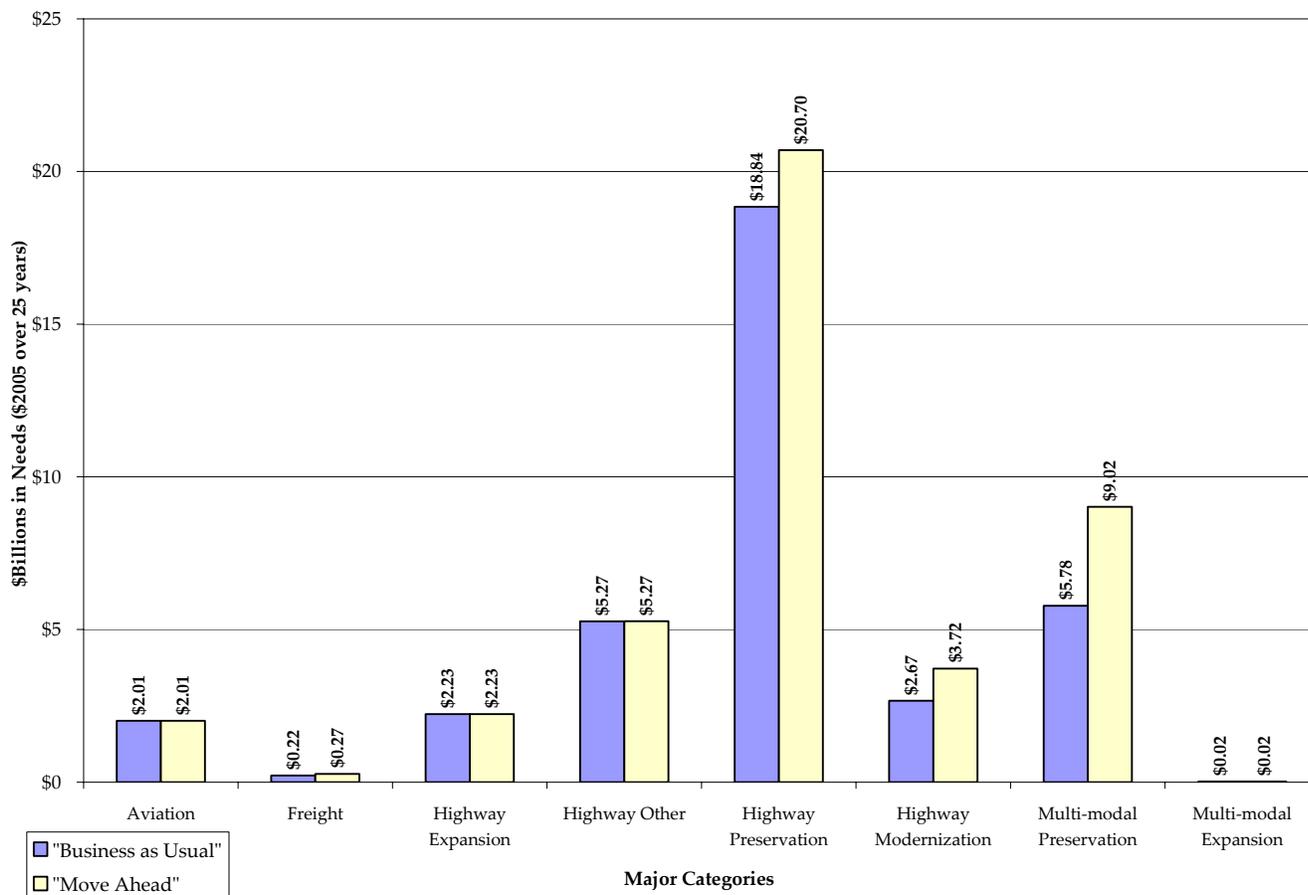
The investment levels in different program areas under a “Move Ahead” future are presented in **Table 14** and **Figure 15**.

Table 14: Investment in Programs under “Move Ahead” Future

<i>Program</i>	<i>“Business as Usual”</i>		<i>“Move Ahead”</i>		
	<i>Revenue Invested (\$Billions)</i>	<i>% of Revenue Invested</i>	<i>Revenue Invested (\$Billions)</i>	<i>% of Revenue Invested</i>	<i>Difference in Revenue versus “Business as Usual” (\$Billions)</i>
Aviation	\$2.01	5.4%	\$2.01	4.6%	\$0.00
Freight	\$0.22	0.6%	\$0.27	0.6%	\$0.05
Highway Expansion	\$2.23	6.0%	\$2.23	5.2%	\$0.00
Highway Other	\$5.27	14.2%	\$5.27	12.2%	\$0.00
Highway Preservation	\$18.84	50.9%	\$20.70	47.9%	\$1.86
Highway Modernization	\$2.67	7.2%	\$3.72	8.6%	\$1.05
Multi-modal Preservation	\$5.78	15.6%	\$9.02	20.9%	\$3.24
Multi-modal Expansion	\$0.02	0.0%	\$0.02	0.0%	\$0.00
Total	\$37.03	100.0%	\$43.24	100.0%	\$6.21

Source: Wilbur Smith Associates

Figure 15: Investment in Programs under “Move Ahead” Future



Source: Wilbur Smith Associates

By investing \$4.33 billion of the \$6.2 billion of additional new revenue in Multi-modal Preservation, Highway Modernization, and Freight categories, it is possible to increase Multi-modal Preservation funding by \$3.24 billion (an increase of 56 percent over “Business as Usual”), Highway Modernization programs by more than \$1 billion (an increase of 39 percent over the base case), and Freight by \$0.05 billion (an increase of 23 percent over the base case). Investing the remaining additional \$1.86 billion in Highway Preservation increases the Highway Preservation budget by almost 10 percent as well.

This is achieved without reducing projected revenues for Highway Expansion or Highway Other programs to levels below “Business as Usual”. The investments in these categories are consistent with the seamless multi-modal vision of *MI Transportation Plan*, and may assist in managing Highway Expansion needs through the impact of direct and indirect leverage on capacity, safety, and operations.

3.2.3.3 Unmet Needs

Investing more new revenues in Highway Modernization, Multi-modal Preservation, and Freight programs, and modest Highway Preservation increases still leaves revenue gaps for all program categories. However, the revenue gaps are smaller and more balanced between programs than with the “Change the Mix” or “Business as Usual” futures.

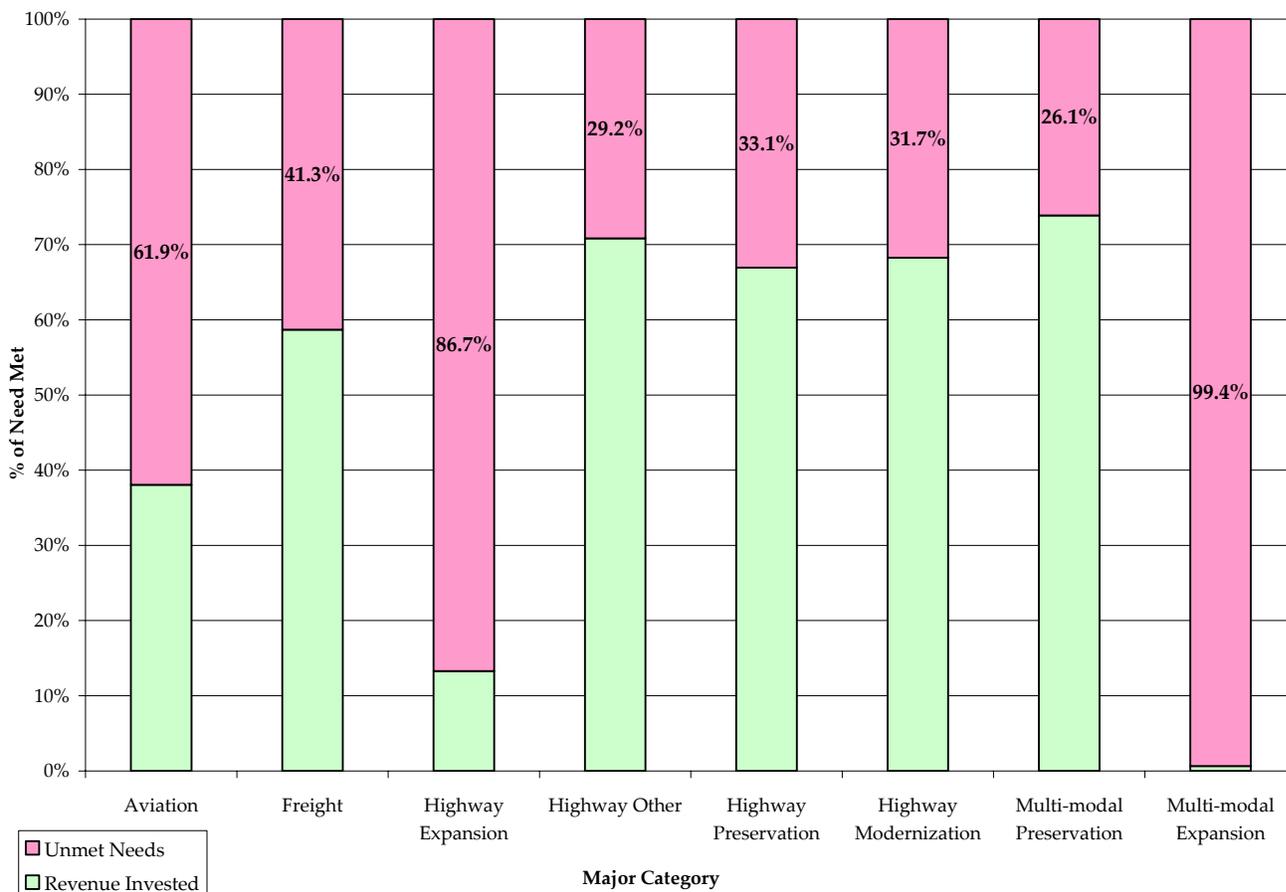
Table 15 and Figure 16 compare the projected revenues invested in each area against the projected needs for each program area, contrasting the “Move Ahead” future to the “Business as Usual” baseline.

Table 15: Needs Met Under “Move Ahead” Future

Program	"Business as Usual"			"Move Ahead"		
	Revenue Invested (\$Billions)	Total Needs (\$Billions)	% of Needs Met by this Package	Revenue Invested (\$Billions)	% of Needs Met by this Package	Difference in % Needs Met vs. "Business as Usual"
Aviation	\$2.01	\$5.28	38.1%	\$2.01	38.1%	0.0%
Freight	\$0.22	\$0.46	47.7%	\$0.27	58.7%	10.9%
Highway Expansion	\$2.23	\$16.81	13.3%	\$2.23	13.3%	0.0%
Highway Other	\$5.27	\$7.44	70.8%	\$5.27	70.8%	0.0%
Highway Preservation	\$18.84	\$30.92	60.9%	\$20.70	66.9%	6.0%
Highway Modernization	\$2.67	\$5.45	48.9%	\$3.72	68.3%	19.3%
Multi-modal Preservation	\$5.78	\$12.21	47.3%	\$9.02	73.9%	26.5%
Multi-modal Expansion	\$0.02	\$2.72	0.6%	\$0.02	0.6%	0.0%
Total	\$37.03	\$81.30	45.5%	\$43.24	53.2%	7.6%

Source: Wilbur Smith Associates

Figure 16: Needs Met/Not Met Under “Move Ahead” Future



Source: Wilbur Smith Associates

The “Move Ahead” future makes significant progress towards meeting the needs of Highway Modernization, Multi-modal Preservation, and Freight programs, covering almost 70 percent of Highway Modernization, nearly 74 percent of Multi-modal Preservation needs, and approximately 60 percent of Freight needs, while affording almost a 10-percent increase (over the base case) in projected revenues for Highway Preservation.

3.2.3.4 Condition and Performance Implications

The expected conditions and performance of Michigan’s transportation system under the “Move Ahead” future, while still lagging behind today’s conditions and performance, will be significantly enhanced over “Business as Usual” by the investment of the additional revenues in the system. Meeting a larger percentage of Multi-modal Preservation, Freight, and Highway Modernization needs is expected to mitigate the mobility, safety, and capacity problems expected under “Business as Usual,” while the increase in Highway Preservation

revenue will yield better pavement and bridge conditions than can be attained without the additional revenues.

Table 16 shows the expected measures of Michigan’s highway system conditions and performance under the “Move Ahead” future.

Table 16: Highway System Conditions and Performance Implications of “Move Ahead” in the Year 2030

<i>Performance Measure</i>	<i>Highway Condition or Performance Area</i>	<i>Level Achieved with “Business as Usual”</i>	<i>Level Achieved with “Move Ahead”</i>	<i>Change in Performance with “Move Ahead”</i>
Pavement Condition	Freeway Percentage Good (Remaining Service Life)	75%	82%	7%
	Non-Freeway Percentage Good (Remaining Service Life)	66%	72%	6%
	Systemwide Percentage Good (Remaining Service Life)	69%	75%	6%
Bridge Condition	Freeway Bridges Achieved	89%	92%	3%
	Non-Freeway Bridges Achieved	77%	80%	3%
Delay Due to Congestion or Deficient Road/Bridge Condition	Freeway Delay (Daily-Vehicle-Hours)	93,118	67,045	-26,073
	Non-Freeway Delay (Daily-Vehicle-Hours)	126,775	104,403	-22,372
	Trunkline System Delay (Daily-Vehicle-Hours)	219,893	171,448	-48,445
Highway Miles Without Congestion	Percentage of Freeway Miles Uncongested in 2030	78%	78%	0%
	Percentage of Non-Freeway Miles Uncongested in 2030	90%	90%	0%
	Percentage of Freeway Miles Approaching Congested in 2030	28%	28%	0%
	Percentage of Non-Freeway Miles Approaching Congested in 2030	14%	14%	0%

Source: Michigan Department of Transportation Road Quality Forecasting System, Bridge Condition Forecast System, and Statewide Travel Demand Model

Under the “Move Ahead” future, the additional investment in Highway Preservation yields an improvement in freeway and non-freeway pavement conditions of 82-percent good and 72-percent good, respectively. While falling short of the current targets of 95 percent for freeways and 85 percent for non-freeways, these levels are superior to what can be achieved

under “Business as Usual.” The higher investment in Highway Preservation is reflected by a seven-percent increase in good condition for freeways and six-percent good for non-freeways. For bridges, the preservation level in “Move Ahead” supports 92-percent good and 80-percent good for freeway and non-freeway bridges, respectively.

With less travel time and delay attributable to deficient pavements and bridges, the “Move Ahead” future saves 20,000 hours of travel time in 2030 and 48,000 hours in daily delay when compared to “Business as Usual.” While not investing additional capital in Highway Expansion over “Business as Usual,” these savings in travel time are complemented by investments in the Multi-modal Preservation programs and meeting a larger share of needs for Highway Modernization programs. Additional benefits of Highway Modernization and Multi-modal Preservation may be explored in the economic impact analysis of *MI Transportation Plan*.

Overall, the analysis of the “Move Ahead” option finds a future superior to either “Business as Usual” or “Change the Mix.” This illustrative analysis shows that even modest increases in Highway Preservation revenues over the “Business as Usual” projection can have a significant impact on transportation efficiency. The analysis also shows that it is possible to invest in preserving today’s level of transit service and modernization programs to support the vision while also investing in preservation of basic infrastructure. It is not possible to quantify the degree to which projected increases in delay may be mitigated by preserving a larger share of transit and modernization funding. However, the “Move Ahead” analysis does show that such investments can be balanced with Highway Preservation needs.

3.2.4 Investment Package #4: Flexible New Revenue

3.2.4.1 Rationale

The rationale of the “Flexible New Revenue” illustrative investment package rests in MDOT’s desire to undertake the preferred seamless multi-modal vision while maintaining the current preservation targets of 85-percent good for non-freeway roads and bridges and 95-percent good for freeway roads and bridges. Even when the base case revenue increases of “Business as Usual” are supplemented with the additional \$6.2 billion of “Move Ahead” to fund programs supporting the vision with modest increases in Highway Preservation, the “Move Ahead” package falls short of the 85 percent and 95 percent targets. As noted in the rationale for the “Move Ahead” package, the total additional revenue of \$6.2 billion available for “Move Ahead,” even if fully devoted to preservation without regard for the *MI Transportation Plan* vision, would cover only half of the revenue gap between the projected \$18.84 billion for preservation and the needed \$30.92 billion.

The “Flexible New Revenue” package illustration considers the possibility that through additional revenues, a dedicated new revenue source could be found primarily for Highway Preservation. This would make the \$6.2 billion of “Move Ahead” fully available to cover other programs and would provide a nominal amount for the additional new revenue

source for modernization improvements directly complementing the added preservation revenue sources.

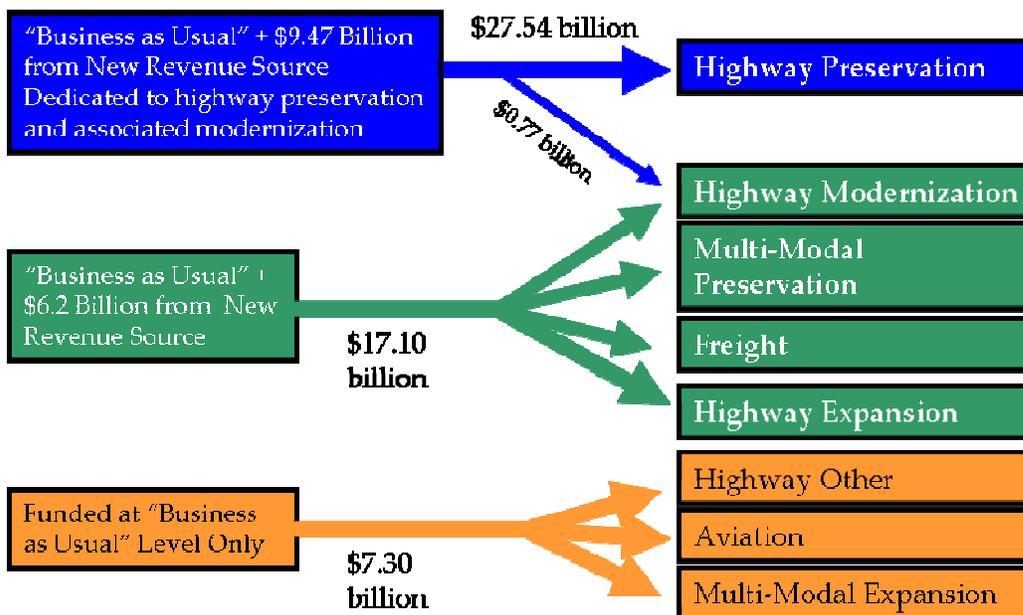
The “Business as Usual” scenario addresses approximately 60 percent of projected need to sustain the overall 90-percent good target for Michigan’s trunkline roads and bridges. If a new source of preservation revenues could be identified to provide funds for 90 percent of this need, it is possible that savings and efficiencies achieved by implementing more comprehensive “fixes” to deficient roads and bridges, and higher quality “fixes,” could sustain the 85-percent and 95-percent good preservation targets for less than \$30.92 billion.

The “Flexible New Revenue” package explores the possibility that in addition to the \$18.84 billion in “Business as Usual,” a dedicated new revenue source of \$9.47 billion for Highway Preservation is identified to fund 90 percent of the \$30.92 billion need (funding Highway Preservation at a level of approximately \$27.54 billion, with some of this revenue supporting modernization associated directly with preservation activities). More than 90 percent of this additional new revenue source would be invested directly into Highway Preservation, with the remainder invested into Highway Modernization (non-pavement amenities that may accompany preservation projects).

This would leave the other \$6.2 billion in additional revenues associated with the “Move Ahead” package available to be fully invested in Highway Modernization, Freight, Multi-modal Preservation, and Highway Expansion programs. Because under the “Flexible New Revenue” package, the preservation gap would be addressed by a new revenue source, this frees up additional revenues allocated to preservation under “Move Ahead” for a combination of Highway Expansion projects and the Multi-modal Preservation, Freight, and Highway Modernization programs.

Figure 17 illustrates how the “Flexible New Revenue” future invests “Move Ahead” revenues into different programs by considering a dedicated new revenue source for Highway Preservation.

Figure 17: Diagram of Investments in Programs under “Flexible New Revenues” Future



Source: Wilbur Smith Associates

3.2.4.2 Investment Levels

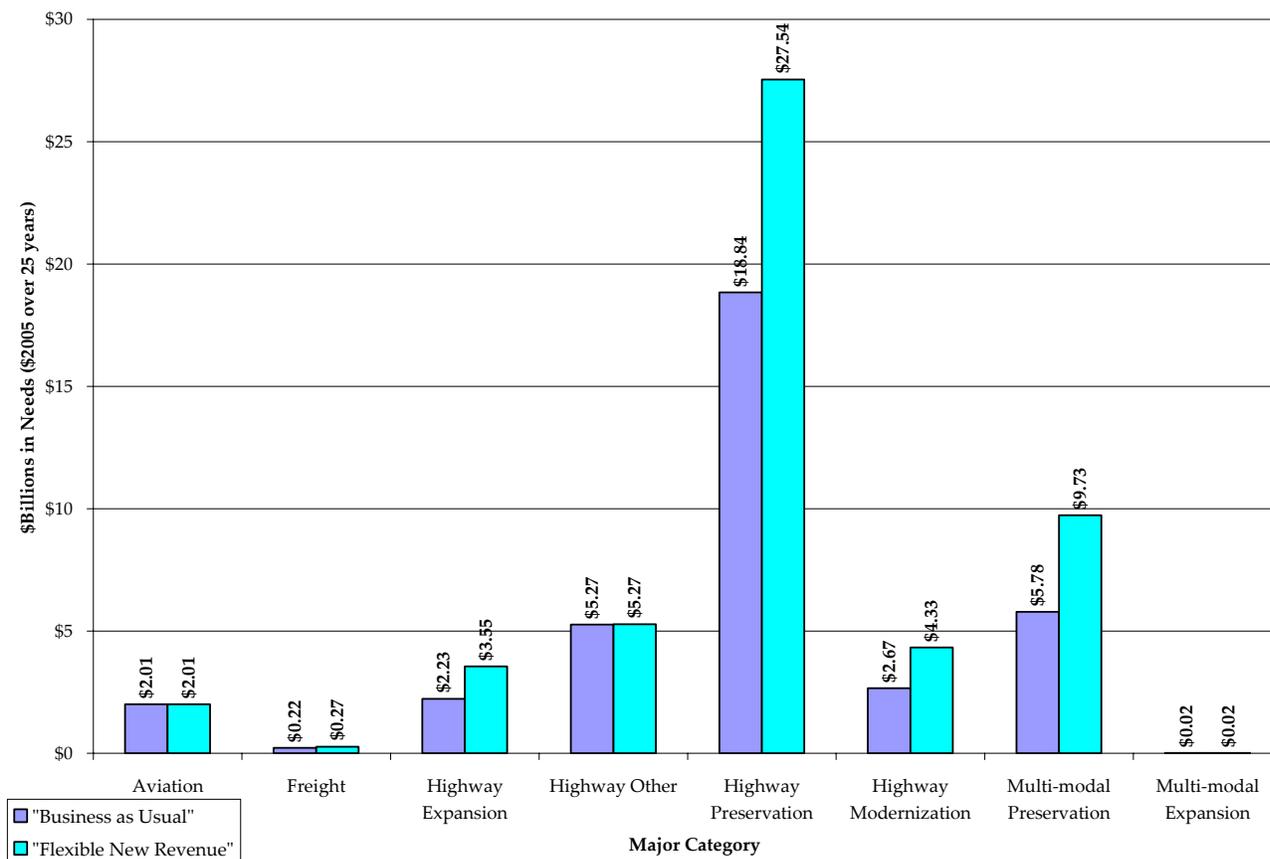
The investment levels in different program areas under a “Flexible New Revenue” future are presented in Table 17 and Figure 18.

Table 17: Investment in Programs Under “Flexible New Revenue” Future

Program	“Business as Usual”		“Flexible New Revenue”		Difference in Revenue vs. “Business as Usual” (\$Billions)
	Revenue Invested (\$Billions)	% of Revenue Invested	Revenue Invested (\$Billions)	% of Revenue Invested	
Aviation	\$2.01	5.4%	\$2.01	3.8%	\$0.00
Freight	\$0.22	0.6%	\$0.27	0.5%	\$0.05
Highway Expansion	\$2.23	6.0%	\$3.55	6.7%	\$1.32
Highway Other	\$5.27	14.2%	\$5.27	10.0%	\$0.00
Highway Preservation	\$18.84	50.9%	\$27.54	52.2%	\$8.70
Highway Modernization	\$2.67	7.2%	\$4.33	8.2%	\$1.66
Multi-modal Preservation	\$5.78	15.6%	\$9.73	18.5%	\$3.95
Multi-modal Expansion	\$0.02	0.0%	\$0.02	0.0%	\$0.00
Total	\$37.03	100.0%	\$52.71	100.0%	\$15.68

Source: Wilbur Smith Associates

Figure 18: Investment in Programs under “Flexible New Revenues” Future



Source: Wilbur Smith Associates

By providing a dedicated revenue source sufficient enough to cover 90 percent of the projected Highway Preservation needs, the “Flexible New Revenue” package increases preservation funding by \$8.7 billion over “Business as Usual.” Multi-modal Preservation programs obtain \$3.95 billion more than in “Business as Usual” and Highway Modernization programs are supported with \$1.66 billion more than “Business as Usual.” “Flexible New Revenue” also provides the same level of investment in Freight as the “Move Ahead” package, and is the only package investing in more Highway Expansion than “Business as Usual.” With an additional \$1.32 billion in Highway Expansion revenue, “Flexible New Revenue” provides sufficient revenue to add 144-lane miles to congested urban interstates and freeways. Over the life of the plan, this revenue level would be sufficient to eliminate Michigan’s 2006 backlog of expansion needs for these facilities, in addition to adding 190-lane miles to Michigan’s 2006 backlog of congested urban principal arterials.

Overall, when compared to “Business as Usual,” “Flexible New Revenue” provides 46-percent more revenue for Highway Preservation, 68-percent more revenue for Multi-modal Preservation programs, 62-percent more revenue for Highway Modernization programs, 59-percent more for Highway Expansion, and 23-percent more for Freight. However, even

with these increases, the package leaves shortfalls in most categories, most notably covering a relatively small portion of the Highway Expansion need, making no provision for Multi-modal Expansion programs while leaving the same gap in the Aviation and Highway Other categories left by other packages.

3.2.4.3 Unmet Needs

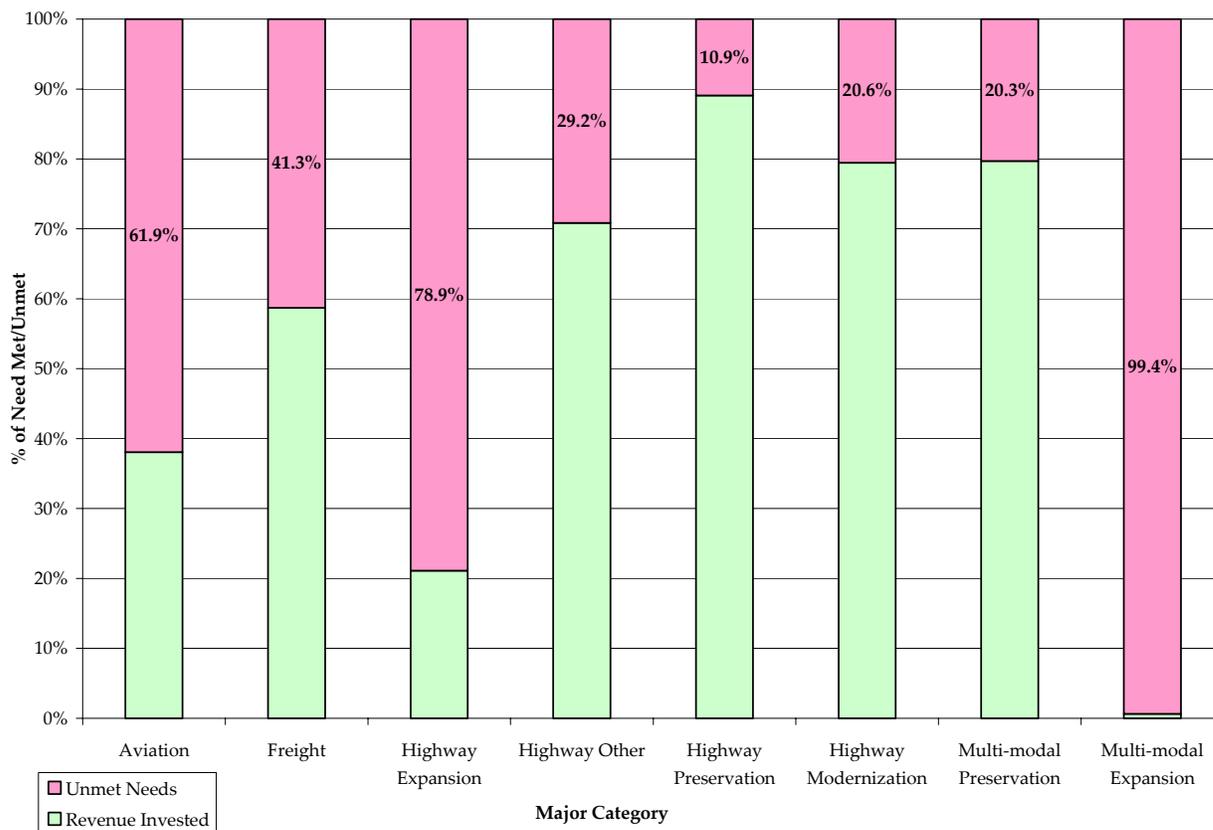
The new revenue source for Highway Preservation and the associated flexibility in additional “Move Ahead” revenues significantly closes many gaps on Michigan’s transportation system. The gaps are much smaller than under other packages and are balanced between different programs. **Table 18** and **Figure 19** compare the projected revenues invested in each area against the projected needs for each program area, contrasting the “Flexible New Revenue” future to the “Business as Usual” baseline.

Table 18: Needs Met Under “Flexible New Revenue” Future

Program	"Business as Usual"			"Flexible New Revenue"		
	Revenue Invested (\$Billion)	Total Needs (\$Billion)	% of Needs Met by this Package	Revenue Invested (\$Billion)	% of Needs Met by this Package	Difference in % Needs Met vs. "Business as Usual"
Aviation	\$2.01	\$5.28	38.1%	\$2.01	38.1%	0.0%
Freight	\$0.22	\$0.46	47.7%	\$0.27	58.7%	11.0%
Highway Expansion	\$2.23	\$16.81	13.3%	\$3.55	21.1%	7.8%
Highway Other	\$5.27	\$7.44	70.8%	\$5.27	70.8%	0.0%
Highway Preservation	\$18.84	\$30.92	60.9%	\$27.54	89.1%	28.2%
Highway Modernization	\$2.67	\$5.45	48.9%	\$4.33	79.4%	30.5%
Multi-modal Preservation	\$5.78	\$12.21	47.3%	\$9.73	79.7%	32.4%
Multi-modal Expansion	\$0.02	\$2.72	0.6%	\$0.02	0.6%	0.0%
Total	\$37.03	\$81.30	45.5%	\$52.71	64.8%	19.3%

Source: Wilbur Smith Associates

Figure 19: Needs Met/Not Met Under “Flexible New Revenue” Future



Source: Wilbur Smith Associates

The “Flexible New Revenue” future meets more of the unmet needs than any other package, covering 65 percent of Michigan’s overall transportation investment needs. Addressing 89 percent of Highway Preservation needs, it maximizes the condition of Michigan’s current highway assets to support other programs under the vision. Also, by covering 79 percent of Highway Modernization needs, it provides opportunities to offer operational, ITS and safety improvements to mitigate unmet Highway Expansion needs on principal arterials and other roadways. This illustration also covers 80 percent of the cost of maintaining today’s level of Multi-modal Preservation programs and 21 percent of Highway Expansion needs. This represents a 28-percent increase in the share of Highway Preservation needs met over “Business as Usual,” a 32-percent increase in the share of needs met for Multi-modal Preservation and a 30-percent increase in Highway Modernization needs, an 11-percent increase in the share of Freight needs met and almost an eight-percent increase in the share of Highway Expansion needs met. The Multi-modal Expansion, Highway Other, and Aviation programs are left with the same gaps as under “Business as Usual.”

3.2.4.4 Condition and Performance Implications

The expected conditions and performance of Michigan’s transportation system under the “Flexible New Revenue” future will be superior to any other investment package. Michigan’s pavement and bridge conditions under this future will exceed those achieved with “Business as Usual” or “Move Ahead” while removing today’s bottlenecks on urban freeways. This package will also mitigate accruing mobility and safety problems through Highway Modernization and Multi-modal Preservation programs as much as possible in ways consistent with the vision.

Table 19 shows the expected measures of Michigan’s highway system conditions and performance under the “Flexible New Revenue” future.

Table 19: Highway System Conditions and Performance Implications of “Flexible New Revenue” in the Year 2030

<i>Performance Measure</i>	<i>Highway Condition or Performance Area</i>	<i>Level Achieved with “Business as Usual”</i>	<i>Level Achieved with “Flexible New Revenue”</i>	<i>Change in Performance with “Flexible New Revenue”</i>
Pavement Condition	Freeway Percentage Good (Remaining Service Life)	75%	90%	15%
	Non-Freeway Percentage Good (Remaining Service Life)	66%	77%	11%
	Systemwide Percentage Good (Remaining Service Life)	69%	82%	13%
Bridge Condition	Freeway Percentage Good Bridges Achieved	89%	99%	10%
	Non-Freeway Percentage Good Bridges Achieved	77%	88%	11%
Delay Due to Congestion or Deficient Road/Bridge Condition	Freeway Delay (Daily-Vehicle-Hours)	93,118	14,600	-78,518
	Non-Freeway Delay (Daily-Vehicle-Hours)	126,775	15,835	-110,940
	Trunkline System Delay (Daily-Vehicle-Hours)	219,893	30,435	-189,458
Highway Miles Without Congestion	Percentage of Freeway Miles Uncongested in 2030	78%	81%	3%
	Percentage of Non-Freeway Miles Uncongested in 2030	90%	92%	2%
	Percentage of Freeway Miles Approaching Congested in 2030	28%	29%	1%
	Percentage of Non-Freeway Miles Approaching Congested in 2030	14%	13%	-1%

Source: Michigan Department of Transportation Road Quality Forecasting System, Bridge Condition Forecast System, and Statewide Travel Demand Model

With “Flexible New Revenue,” investment of \$27.54 billion in Highway Preservation to the year 2030 yields freeway and non-freeway pavement conditions of 90-percent and 77-percent good, respectively. This comes closer than any other package to today’s 95 and 85-percent good targets. For bridges, this investment level supports 99-percent good freeway bridges and 88-percent good non-freeway bridges, exceeding the targets of 95-percent and 85-percent good. Furthermore, the flexibility in other funds made available by the dedicated revenue for preservation supports additional investment in Highway Expansion. The combined effect of resolving existing and accruing deficient pavement and bridge conditions and investing in Highway Expansion would save more than 189,000 hours of daily delay by the year 2030 when compared to the “Business as Usual” future.

The increased capacity supported by funding additional lanes would also reduce Michigan’s congested freeway miles by one percent. With smaller gaps in Multi-modal Preservation and Highway Modernization programs than other packages, “Flexible New Revenue” would be expected to have travel time and mobility savings beyond those quantifiable in the above analysis. Funding a wide range of programs and adding to a better-maintained highway infrastructure, the “Flexible New Revenue” package has more power than any other package to manage remaining gaps through direct and indirect leverage between project types.

Overall, the analysis of the “Flexible New Revenue” illustration demonstrates that:

1. A dedicated additional revenue stream for preserving Michigan’s basic highways can serve as a “rising tide” that will free other revenues for programs consistent with the *MI Transportation Plan* vision;
2. With more revenues available to be spent on other programs, Michigan can gain significant savings in travel time and system delay; and
3. The flexibility among other programs facilitated by a dedicated revenue stream for preservation offers significant potential for leverage between other programs.

3.3 Criteria for Comparing Investment Packages

3.3.1 Leverage Potential under Different Possible Futures

The *Integration Technical Report of MI Transportation Plan* introduces the concept of leverage between different types of projects as a way to improve efficiency of transportation investments. The above analysis examines quantifiable changes in highway system condition and treats investment in non-highway categories as having the potential to also enhance system performance. However, there is currently no data or known methodology for quantifying the precise degree to which investment in statewide non-highway categories can reduce or mitigate the need for highway investments in the aggregate.

For this reason, it is possible that the above analysis may understate the potential reductions in delay and percentage of the system congested under scenarios where Highway Modernization, Multi-modal Preservation, and Freight programs are supported more than in “Business as

Usual.” Therefore, the concept of leverage is offered as a rationale for the design of the above investment packages and considered in the interpretation of the highway condition and performance results for each package. When funding is available, the application of leverage in the development of projects and in the delivery of programs is a key success factor for implementing the preferred investment level and moving toward the vision of *MI Transportation Plan*.

3.3.2 Goals, Objectives, and Measures

Each illustrative investment package is considered a pathway to the vision of *MI Transportation Plan* under different assumptions and constraints. The packages use investment in different types of programs as ways to achieve the goals of the plan. Within each package, constraints regarding Act 51 and assumed revenue levels, measures of performance that can be quantified, using the available data and systems, are applied to explore how the goals are satisfied. The goals of *MI Transportation Plan* are:

1. *Stewardship*. Preserve transportation system investments, protect the environment, and utilize public resources in a responsible manner.
2. *Safety and Security*. Continue to improve transportation safety and ensure the security of the transportation system.
3. *System Improvement*. Modernize and enhance the transportation system to improve mobility and accessibility.
4. *Efficient and Effective Operations*. Improve the efficiency and effectiveness of the transportation system and transportation services and expand MDOT’s coordination and collaboration with partners.

Table 20 further describes how each package is responsive to the overall goals of the plan.

Table 20: Investment Packages and Goals of the MI Transportation Plan

<i>Goal</i>	<i>“Business as Usual”</i>	<i>“Change the Mix”</i>	<i>“Move Ahead”</i>	<i>“Flexible New Revenue”</i>
1. Stewardship	Concentrates scarce revenues on preserving existing assets.	Attempts to balance preservation investments between Highway and Multi-modal programs.	Increases revenues to close gaps for existing assets and programs.	Seeks dedicated revenue stream for most expensive and depreciable assets (highway infrastructure).
2. Safety & Security	Invests in Highway Modernization needs where possible; however revenues are limited.	Increases investment in Safety, ITS, and Modernization programs over “Business as Usual”	Significantly reduces revenue gap for safety, ITS, and other Highway Modernization programs.	By dedicating separate funds to preservation, makes maximum funding available for Safety, ITS, and Modernization programs.
3. System Improvement	Allows expansion of urban freeways.	Allows expansion of urban freeways.	Allows expansion of urban freeways and significantly closes gaps in other areas.	By increasing funding for multiple categories, maximizes potential for improvement through leverage.
4. Efficient and Effective Operations	Seeks efficiency by investing scarce revenues in preserving assets before “fixes” become more costly.	Seeks more efficient operations by investing in Highway Modernization, but at the expense of Highway Preservation.	Significantly closes gaps in ITS and operational improvements which can efficiently manage Highway Expansion needs.	Seeks efficiency in preservation expenditures providing early “fixes” before more costly improvements become necessary.

Source: Wilbur Smith Associates

3.3.3 Statewide Investment Decision Principles

In the *Integration Technical Report* of *MI Transportation Plan*, the overall goals of the plan were assessed with respect to the specific performance barriers and opportunities faced by the users of each of MDOT's programs described in the other technical reports. Based on the issues raised in the technical reports, the overall goals, and vision of the plan, decision principles for statewide investments are offered. The decision principles provide criteria for weighing the relative merits and disadvantages of possible investment strategies. The four decision principles offered in the *Integration Technical Report* are:

1. *Invest financial resources to preserve existing system components.* Preserving existing components is critical to prevent new performance barriers from arising. For example, bus capital funds used to replace an aging bus on an existing line can help ensure continued reliable service. If this capital is not maintained, the access, safety, and mobility of transit as well as highways and other modes may be affected.
2. *When improving a system component, consider and make allowances for improvements that may be needed in integrated components.* For example, expanding transit service and placing a bus stop in a residential area may prompt the need for sidewalks and pedestrian access to the new transit stops.
3. *Seek investments that provide leverage, remove barriers, realize opportunities, and improve integration for multiple components.* For example, investment in expanding or paving carpool parking lots may help mitigate some Highway Expansion needs by reducing the number of single-occupancy vehicles on the road at peak hours. In another example, investment in reconstructing a highway with a wider shoulder may also support the provision of bicycle lanes to improve non-motorized performance.
4. *Assess performance objectives with respect to all modes.* For example, reducing fatality, injury, and crash/incident rates is a performance objective. Achieving this objective may entail the provision of other modal alternatives for users with special safety needs, the provision of bicycle and pedestrian infrastructure on roadways, and ensuring that transit vehicles and drivers are equipped for safe operations.

These decision principles can be applied to the four possible futures offered by the four investment packages. **Table 21** assesses the relative strengths and weaknesses of these four possible futures with respect to the decision principles of *MI Transportation Plan*.

Table 21: Statewide Decision Principles Applied to Investment Packages

<i>Decision Principle</i>	<i>“Business as Usual”</i>	<i>“Change the Mix”</i>	<i>“Move Ahead”</i>	<i>“Flexible New Revenue”</i>
Preserve Existing Components	<p><u>Advantage:</u> Largest Share of Investment is for preservation of roads, bridges and transit.</p> <p><u>Disadvantage:</u> Lacks resources to meet preservation goals.</p>	<p><u>Advantage:</u> Greater attempt to preserve multi-modal assets and services.</p> <p><u>Disadvantage:</u> Preserves multi-modal components at expense of highway assets.</p>	<p><u>Advantage:</u> Preserves all components better than “Business as Usual.”</p> <p><u>Disadvantage:</u> Still leaves significant gaps in Highway Preservation.</p>	<p><u>Advantage:</u> Preserves the largest percentage of highway assets, narrows multi-modal gaps.</p> <p><u>Disadvantage:</u> Most costly.</p>
Complementary Investments	<p><u>Advantage:</u> Balances gaps across different program areas.</p> <p><u>Disadvantage:</u> Cannot complement Highway Expansion with Multi-modal Expansion.</p>	<p><u>Advantage:</u> Narrows gaps in Highway Modernization to complement investment in road expansion.</p> <p><u>Disadvantage:</u> Cannot preserve highway assets needed to complement other programs.</p>	<p><u>Advantage:</u> Narrows gaps in Multi-modal Preservation in concert with Highway Modernization.</p> <p><u>Disadvantage:</u> Cannot complement Highway Expansion with Multi-modal Expansion.</p>	<p><u>Advantage:</u> Narrows gaps in most complementary programs.</p> <p><u>Disadvantage:</u> Does not complement Highway Expansion with Multi-modal Expansion.</p>
Seek Leverage	<p><u>Advantage:</u> Makes some provision for Highway Modernization, despite large gaps.</p> <p><u>Disadvantage:</u> Inadequate revenues to concentrate revenue in high-leverage programs.</p>	<p><u>Advantage:</u> Makes greater provision for Highway Modernization.</p> <p><u>Disadvantage:</u> New barriers arise as preservation gaps widen.</p>	<p><u>Advantage:</u> Invests in high-leverage Highway Modernization programs.</p> <p><u>Disadvantage:</u> Still leaves gaps in these programs.</p>	<p><u>Advantage:</u> Makes revenue available for Highway Modernization and Multi-modal programs.</p> <p><u>Disadvantage:</u> Largest increase is not for highest leverage programs.</p>
Assess Performance for All Modes	<p><u>Advantage:</u> Balances gaps across modes.</p> <p><u>Disadvantage:</u> Leaves major performance barriers in all programs.</p>	<p><u>Advantage:</u> Spreads preservation gap between highway and multi-modal.</p> <p><u>Disadvantage:</u> All modes suffer when assets are not preserved.</p>	<p><u>Advantage:</u> Narrows gaps in most categories.</p> <p><u>Disadvantage:</u> Narrows more gaps in non-highway than highway categories.</p>	<p><u>Advantage:</u> High road quality supports other modes. Dedicated road preservation leaves other revenues open for other modes.</p> <p><u>Disadvantage:</u> Disproportionately high increase in highway funding.</p>

Source: Wilbur Smith Associates

3.4 Results of Four Investment Packages

3.4.1 Comparison of Unmet Needs under Investment Packages

Each possible future considered in this report leaves unmet needs for all of Michigan's state transportation programs. The investment packages can be viewed as a succession of possible ways to spend increasing streams of revenue, with "Business as Usual" and "Change the Mix" representing the baseline, and "Move Ahead" and "Flexible New Revenue" representing ascending steps in funding levels. As possible funding levels increase, the packages seek to balance the investment of those funds against unmet needs based on the Preferred Vision, plan goals, and decision principles as described in the previous section.

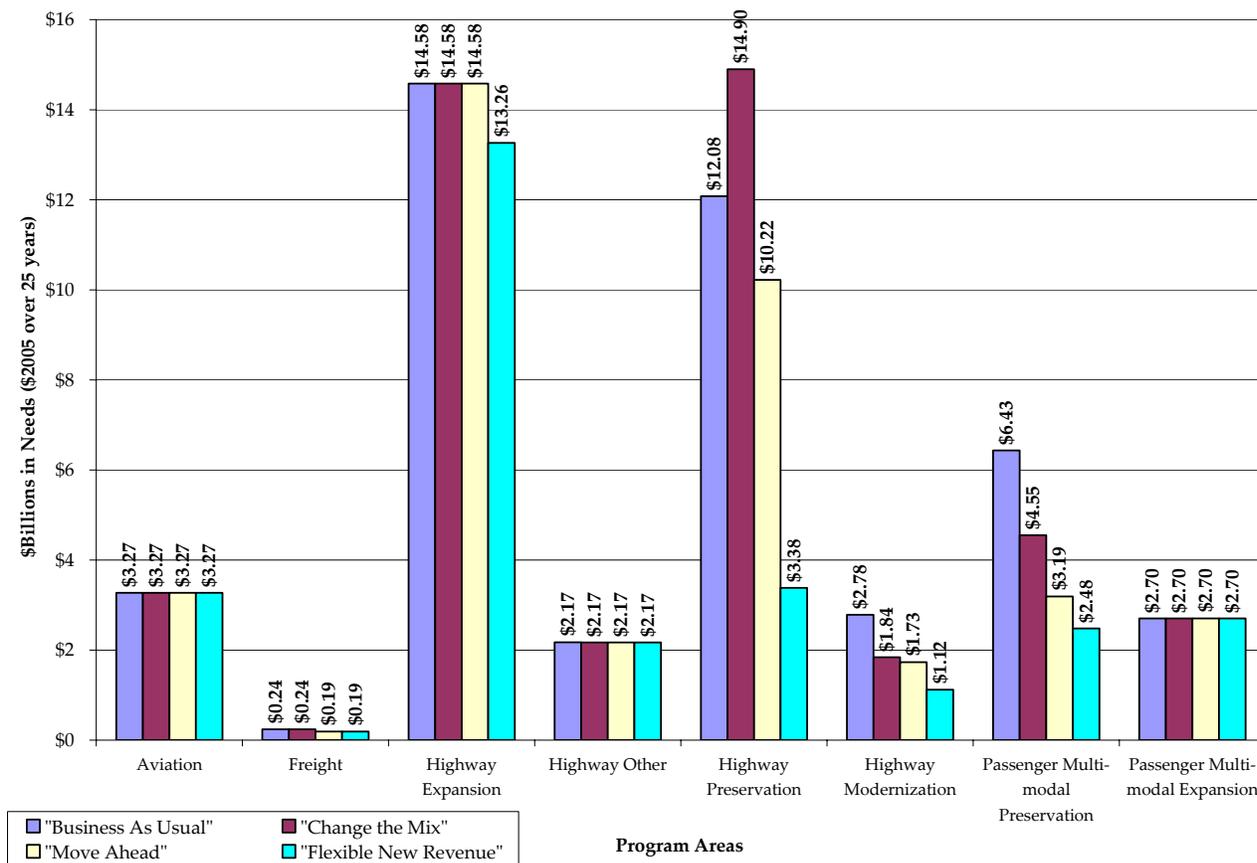
Comparing the investment packages side by side with respect to the percentage of needs met for different program areas illustrates more about the choices for allocating projected and potential revenues. **Table 22** and **Figure 20** compare the unmet needs, by program area for the four possible futures.

Table 22: Comparative Unmet Needs By Program for Four Possible Futures (\$ billions)

<i>Program</i>	<i>"Business As Usual"</i>	<i>"Change the Mix"</i>	<i>"Move Ahead"</i>	<i>"Flexible New Revenue"</i>
Aviation	\$3.27	\$3.27	\$3.27	\$3.27
Freight	\$0.24	\$0.24	\$0.19	\$0.19
Highway Expansion	\$14.58	\$14.58	\$14.58	\$13.26
Highway Other	\$2.17	\$2.17	\$2.17	\$2.17
Highway Preservation	\$12.08	\$14.90	\$10.22	\$3.38
Highway Modernization	\$2.78	\$1.84	\$1.73	\$1.12
Multi-modal Preservation	\$6.43	\$4.55	\$3.19	\$2.48
Multi-modal Expansion	\$2.70	\$2.70	\$2.70	\$2.70
Total Unmet Needs	\$44.27	\$44.27	\$38.06	\$28.58

Source: Wilbur Smith Associates

Figure 20: Unmet Needs under Possible Futures



Source: Wilbur Smith Associates

Of all of Michigan’s transportation programs, the deepest shortfalls are in Highway Preservation and Highway Expansion. This is due to the size of Michigan’s highway system, the expense of improving a lane mile of highway relative to the expense of other types of improvements, and the age of Michigan’s highway infrastructure.

Because the Preferred Vision, goals, and decision principles of *MI Transportation Plan* seek to leverage investment in Multi-modal Preservation and Highway Modernization programs to offset Highway Expansion needs, Highway Preservation becomes the deepest need of concern among the investment packages.

Figure 20 shows that while the revenue gap for this category deepens in the “Change the Mix” strategy, as new revenues become available under “Move Ahead” and “Flexible New Revenue” futures, the shortfall in preservation revenue narrows sharply. From **Figure 20** it is also visible that each investment package represents successive steps in reducing the shortfalls in Multi-modal Preservation and Highway Modernization programs, both of which are expected to leverage with the widest range of other categories.

None of the investment packages considered in this report has sought to remedy unmet needs in Aviation or Highway Other categories. This is largely due to the relative lack of potential leverage for these categories to directly or indirectly offset needs on other modes. If additional revenue streams can be identified for these categories, they may be considered in the ultimate preferred investment strategy as a variation of the “Flexible New Revenue” approach.

3.4.2 System Performance

As revenues rise in the “Move Ahead” and “Flexible New Revenue” packages, the anticipated condition and performance of Michigan’s highway infrastructure improve. The total mobility benefit of investment in Multi-modal Preservation, Highway Modernization and Freight in the investment packages cannot be quantified at this time. However, it is possible to see some degree to which the increasing investment of new revenues in preservation and expansion reduce travel times, both through improved pavement and bridge conditions and through added capacity in the “Move Ahead” and “Flexible New Revenue” futures—but this does not account for travel time savings from Highway Modernization efforts. Investing additional revenues in Highway Preservation is expected to result in improved pavement conditions.

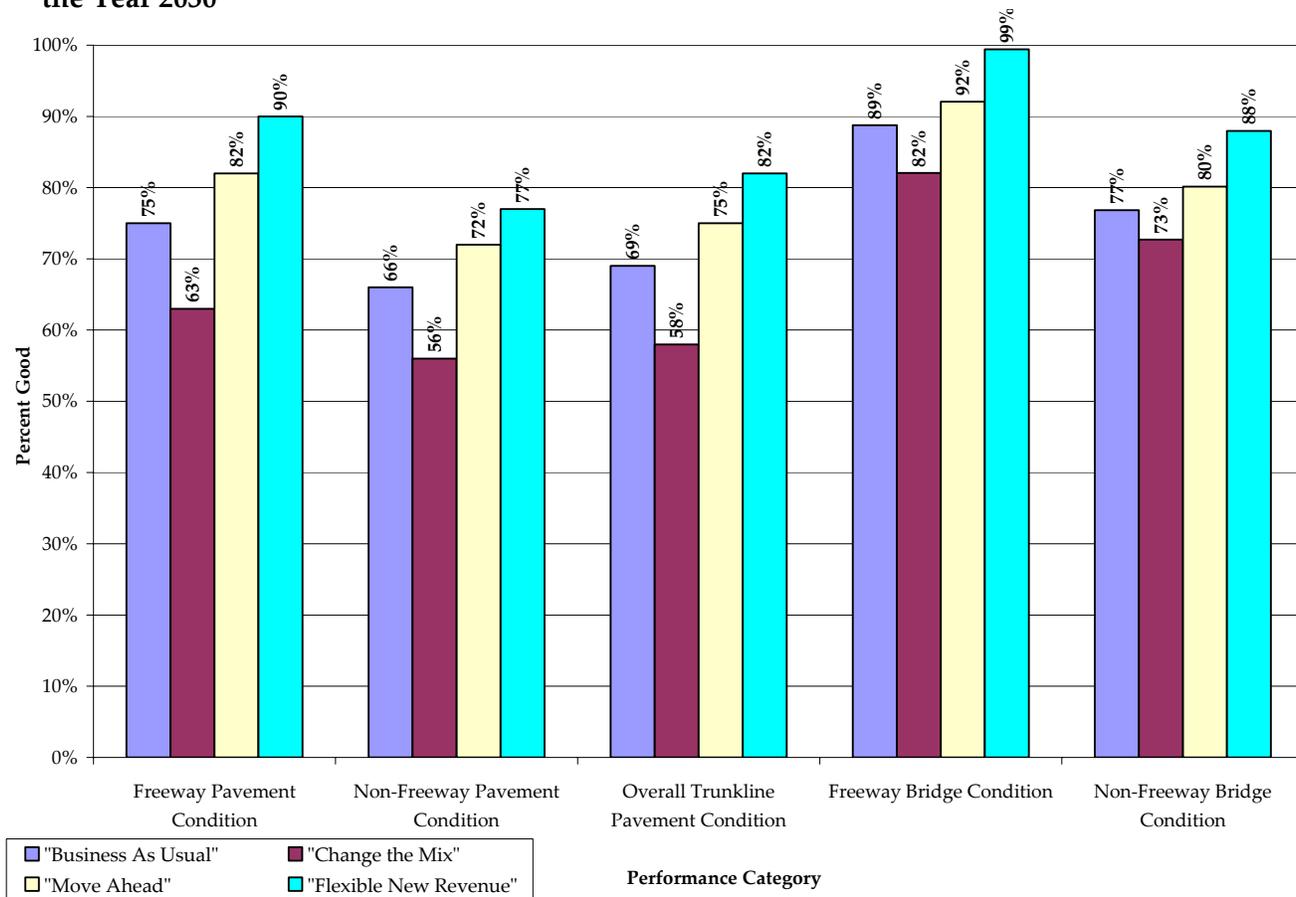
Table 23 and **Figure 21** compare the four possible futures with respect to the percentage of the system that is expected to have good pavement and bridge conditions under each investment package.

Table 23: Percent “Good” Pavement and Bridge Conditions Under Four Possible Futures in the Year 2030

<i>Program</i>	<i>“Business As Usual”</i>	<i>“Change the Mix”</i>	<i>“Move Ahead”</i>	<i>“Flexible New Revenue”</i>
Freeway Pavement Condition	75%	63%	82%	90%
Non-Freeway Pavement Condition	66%	56%	72%	77%
Overall Trunkline Pavement Condition	69%	58%	75%	82%
Freeway Bridge Condition	89%	82%	92%	99%
Non-Freeway Bridge Condition	77%	73%	80%	88%

Source: Michigan Department of Transportation Road Quality Forecasting System and Bridge Condition Forecast System

Figure 21: Percent “Good” Pavement and Bridge Conditions Under Four Possible Futures in the Year 2030



Source: Wilbur Smith Associates

With the exception of “Change the Mix,” each successive package involving additional revenue achieves an associated improvement in both bridge and pavement condition for freeways and non-freeways. The sharpest increases are in the “Flexible New Revenue” package for trunkline pavements. When preservation revenues are scarce, bridges receive a higher priority; the variation in bridge conditions between investment packages is less marked than in pavement conditions.

The relative mobility impacts of different investment packages on the trunkline highway system can be estimated in terms of hours of delay. Investments in improved highway pavement and bridge condition can reduce anticipated travel time and delay due to poor pavement condition (which reduces travel speeds or may affect highway routing). Investment in additional lanes for congested facilities through expansion programs can also reduce travel time and increase the portion of the system which is uncongested in 2030.

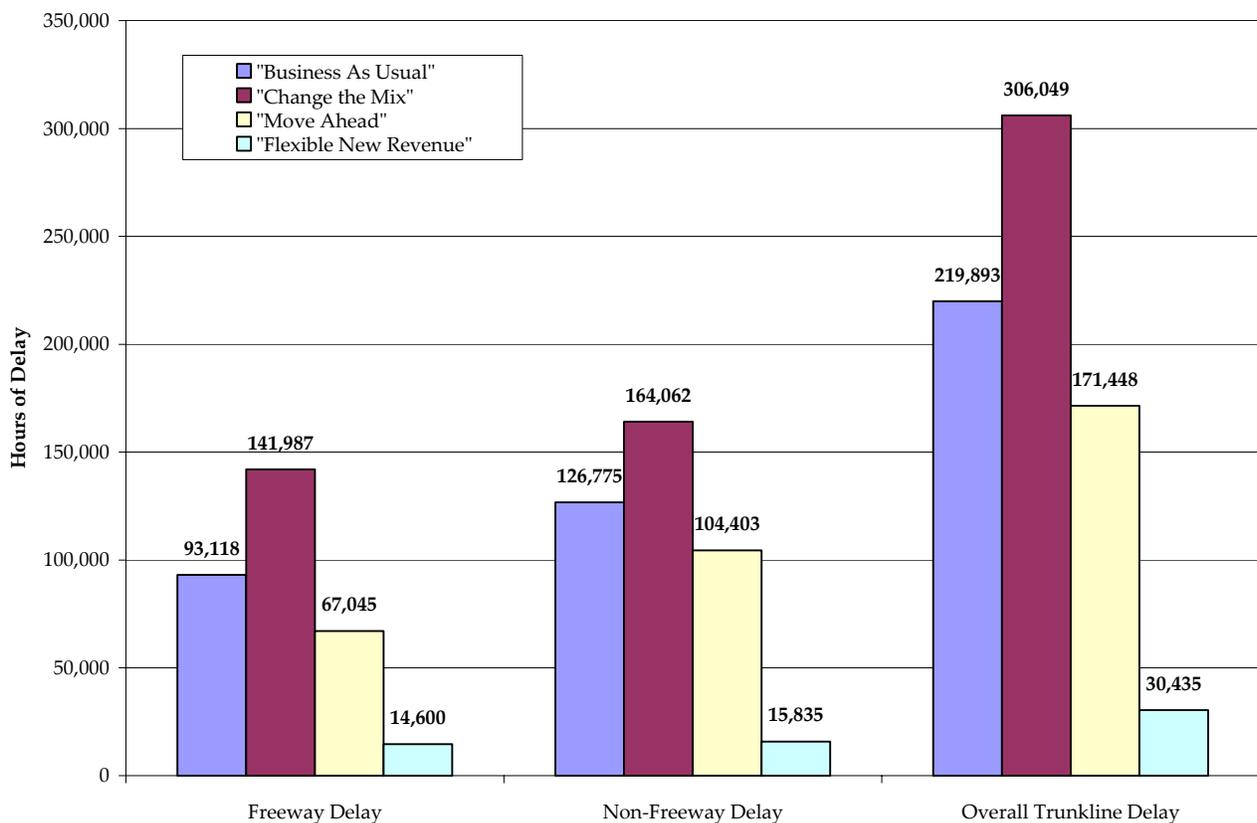
Table 24 and Figure 22 compare the delay (in daily-vehicle-hours) in the year 2030 under each of the four possible futures represented by the base case and the three other investment packages.

Table 24: Estimated Daily Delay in 2030 under Four Possible Futures

<i>Program</i>	<i>"Business As Usual"</i>	<i>"Change the Mix"</i>	<i>"Move Ahead"</i>	<i>"Flexible New Revenue"</i>
Freeway Delay	93,118	141,987	67,045	14,600
Non-Freeway Delay	126,775	164,062	104,403	15,835
Overall Trunkline Delay	219,893	306,049	171,448	30,435

Source: Michigan Department of Transportation Post-processing of Statewide Travel Demand Model

Figure 22: Daily Hours of Vehicle Travel and Delay under Four Possible Futures in the Year 2030



Source: Michigan Department of Transportation Post-processing of Statewide Travel Demand Model

The results show that vehicle delay is sensitive to the quantifiable impacts of preservation and expansion funding between the investment packages. **Figure 22** shows the sharpest reduction in vehicle delay can be observed with “Flexible New Revenue” more than with other packages. This is both because “Flexible New Revenue” improves pavement conditions, increasing free-flow travel speeds, but also because “Flexible New Revenue” is the only package that adds significantly more lane miles to congested roads than “Business as Usual.” As with pavement and bridge condition, the trend of improving system condition is consistently visible with reducing travel delay as revenues rise from “Business as Usual” and “Change the Mix” to “Move Ahead” and “Flexible New Revenue.”

The actual changes in travel time and delay may be sharper than indicated in **Table 24** and **Figure 22** because time savings associated with Highway Modernization and Multi-modal Preservation investments cannot be quantified in the same way as highway investments.

3.5 Policy Issues

The ultimate decision for *MI Transportation Plan* will culminate in a preferred investment level. The preferred investment level will seek to balance the revenue and policy constraints represented by “Business as Usual” and “Change the Mix” with the potential improvements in system performance represented by “Move Ahead” and “Flexible New Revenue.” The preferred investment level will be developed based on the comparisons in this report and will involve a more detailed allocation of revenues, as well as an assessment of the economic impact of a preferred investment level on Michigan’s earnings, output, and employment.

When the preferred investment level is implemented, further decisions will be required regarding how and where leverage may be achieved within different program areas. Other decisions will consider the potential to further extend leverage by partnering financially with local agencies or the private sector to deliver projects or programs.

The manner in which the preferred investment level is delivered at the corridor and regional level will greatly affect (and may significantly enhance) the actual levels of investment available for each program area addressed by the investment packages in this report.

3.5.1 Buying Power

Buying power is how much you can get for the same amount of money, as adjusted for inflation, or the ability of revenues to keep up with the escalation in costs. For example, if costs are increasing at three percent over five years and revenues are increasing at three percent over the same period, then there is no loss in buying power from today.

The increases in base case revenues in all categories are not keeping up with the escalation in costs (assumed to be five percent) over the 25-year period, thus there is a net loss in buying power. As shown in **Figure 23**, the additional revenues needed over the life of the plan to keep up the buying power of the base year are \$6.33 billion (which is the cumulative difference between the revenue line and the cost escalation line). The “Move Ahead” future has a revenue increase, but this package still cannot buy tomorrow what we currently have today, since the

loss in buying power is greater than the increase in revenues. Only the “Flexible New Revenue” future keeps up with the cost escalations, and thus no loss in buying power occurs under that scenario.

Figure 23: Annual Buying Power Deterioration



Source: Wilbur Smith Associates

3.5.2 Potential Sources of Flexible New Revenue

A vital consideration for the preferred investment level rests on the decision of how much additional revenue to raise for state transportation programs and from what sources. The “Flexible New Revenue” package is very appealing for its performance impact and support for the Preferred Vision of *MI Transportation Plan*. However, raising the additional \$15.67 billion above the base case to support both dedicated Highway Preservation funding and other investments supporting the vision will likely have impacts on Michigan’s economy. The economic impact analysis of *MI Transportation Plan* examines how the benefits of vehicle miles and hours saved by “Flexible New Revenue” and “Move Ahead” balance with the impact of raising these additional funds from Michigan’s economy. The economic impact analysis further explores the regions and industries to which costs and travel time savings are expected to

accrue under these illustrative investment packages, and the ultimate implications for earnings, output, and employment in Michigan's macro-economy.

If the preferred investment level is selected favoring a dedicated revenue source for preservation or other programs, further study will be required as to the feasibility of different revenue options.

3.5.3 Tolling

An additional option not represented among the investment packages is further investing in highway expansion through tolling. Tolling may be considered as another type of dedicated revenue for expansion, which would free the expansion investment in these packages to support other programs. The question of how much revenue tolling may generate for statewide Highway Expansion programs in Michigan to the year 2030 has not yet been studied. However, given the Preferred Vision of *MI Transportation Plan*, favoring Multi-modal Preservation and Highway Modernization programs, tolling may be the only way for Michigan to cover a significant share of expansion needs for urban trunklines. If there is interest in covering a larger percentage of Highway Expansion needs in the preferred investment level, toll revenue may be a consideration for the ultimate investment strategy.

It should be noted that tolling as a revenue source is attractive from several perspectives, but it is unlikely that new facilities or major capital improvements to existing facilities can be completely financed through tolls. The imposition of tolls, for some facilities, becomes a source of revenue, not a complete answer.

Chapter 4. Conclusion

"Business as Usual," "Change the Mix," "Move Ahead," and "Flexible New Revenue" represent meaningfully different possible futures for Michigan's transportation system. Constraints in revenue will make it very difficult to realize meaningful progress towards the Preferred Vision of *MI Transportation Plan* without compromising system preservation in ways that may undermine other programs. In addition to the traditional trend of revenue increases associated with "Business as Usual," greater revenues increases were explored.

If a dedicated revenue source is made available to preserve MDOT's highway and bridge conditions, it is likely that MDOT can meet its current pavement and bridge condition goals for less than \$31 billion. Such a revenue stream for preservation would also free up other projected resources to preserve current levels of multi-modal infrastructure and services as well as Highway Modernization programs. However, even under the most aggressive revenue assumptions, Michigan is expected to have significant shortfalls regarding the expansion needs of both Highways and Multi-modal programs.

Based on the comparison of these illustrative investment packages, some general conclusions can be made:

1. *Reducing preservation revenues can undermine other programs.* Pursuit of the vision of *MI Transportation Plan*, by reallocating scarce revenues from preservation to other programs, can adversely affect travel times and travel costs. These impacts may undermine the potential leverage gained by other investments in Multi-modal Preservation or Highway Modernization programs. At lower levels of revenue, the cost of Highway Preservation is higher, further draining revenues from other programs. Consequently, reallocating revenues from preservation to other areas is not recommended for the preferred investment level.
2. *Modest investments of additional revenues in Highway Preservation and Multi-modal Preservation, when balanced with other categories, can support the vision.* Even modest investments in Highway Preservation and Multi-modal Preservation, when balanced with targeted Highway Expansion, and Highway Modernization, can serve to mitigate revenue shortfalls in these areas. The analysis shows that investment levels that fall short of the 85-percent and 95-percent good pavement and bridge condition targets still offer significant improvement in travel time and delay when compared to “Business as Usual.”
3. *Additional revenue sources will be needed for Highway Expansion or Multi-modal Expansion programs.* Projected revenues cover less than 14 percent of Highway Expansion needs and less than one percent of Multi-modal Expansion needs. None of the investment packages significantly change this percentage. This is because the analysis in this report has not identified or validated any revenue source robust enough to cover a larger share of expansion needs. The problem of system expansion is further exacerbated by the fact that if the system expands, the associated preservation needs will also rise.

The preferred investment level may consider a “flexible new” revenue source for Multi-modal Expansion programs, given the strong multi-modal focus of the Preferred Vision. However, the source would have to be sufficient enough, not only to progress towards the \$27.2 billion expansion need, but also to cover the additional preservation cost of an expanded multi-modal program.

If expansion of highways is a consideration in the preferred investment level, market based solutions such as tolling or other types of user fees may be considered as variations of “Flexible New Revenue.”

4. *At the very least, buying power should be preserved.* The differences in what we can buy today from what we can buy tomorrow is growing over the life of the plan and will result in a \$6.33 billion loss in buying power. The “Move Ahead” future calls for an additional \$6.2 billion over the life of the plan; this is just short of preserving buying power. The “Business As Usual” and the “Change the Mix” investment packages, however, are significantly short of preserving buying power. The preferred investment level should, at the very least, preserve buying power.

Investment in Michigan’s transportation system can support the safety, mobility, and economic vitality of Michigan’s people and communities. This investment and gap analysis has explored

the projected shortfalls in Michigan's transportation programs to the year 2030 and the implication of pursuing the Preferred Vision under these constraints. Ultimately, the preferred investment level will utilize the results of these comparisons to arrive at a future that preserves vital assets as efficiently as possible while making revenue available for balanced transportation across the system.



MI Transportation

MICHIGAN LONG RANGE TRANSPORTATION PLAN



*Providing the highest quality integrated transportation services
for economic benefit and improved quality of life.*



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