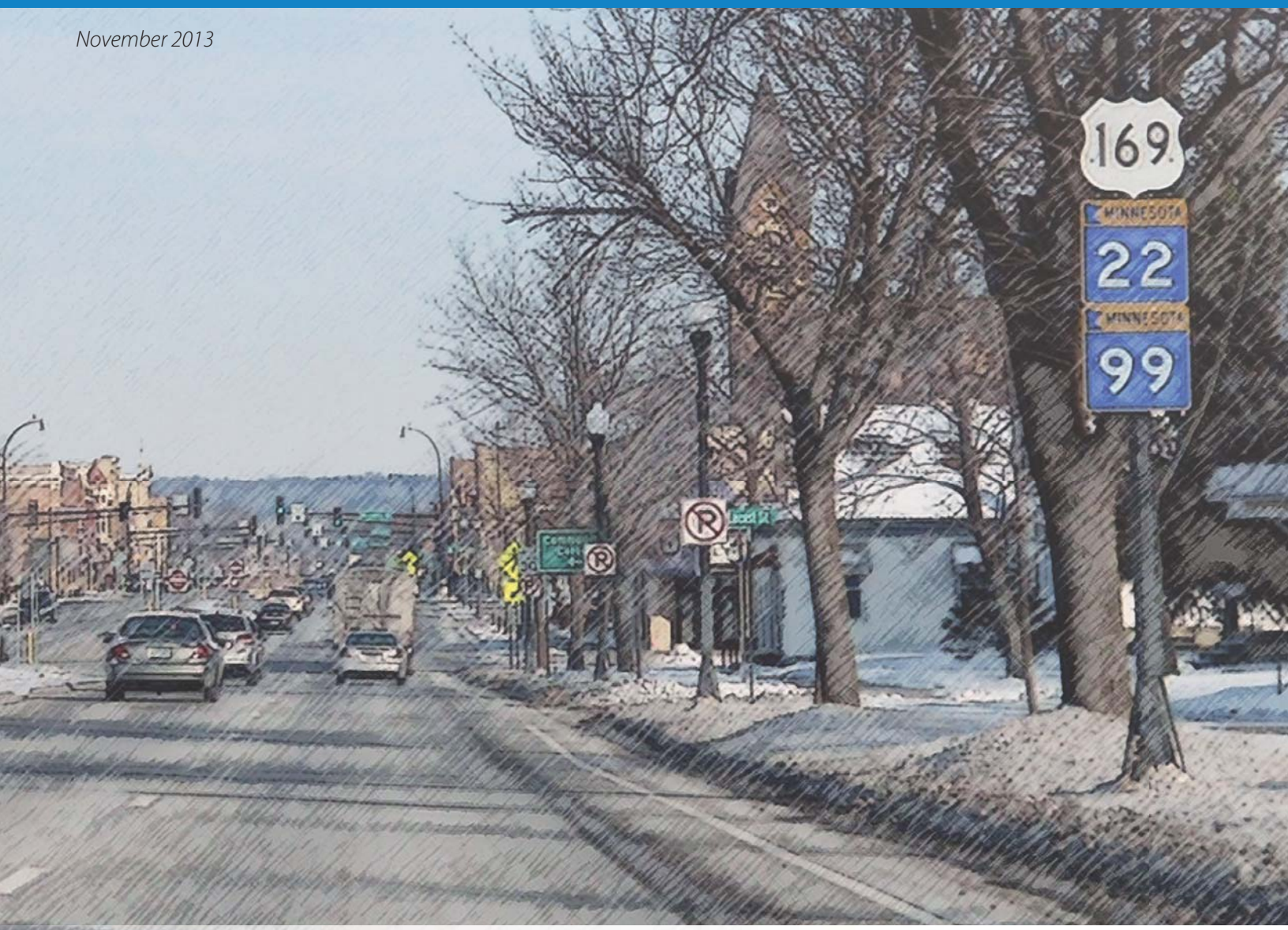
# Assessing Return on Investment in Minnesota's State Highway Program

## FINAL REPORT

*November 2013*




MINNESOTA DEPARTMENT OF TRANSPORTATION

Smart Growth America
Making Neighborhoods Great Together

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. . . transportation investment options that . . . move people and goods . . .

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# Assessing Return on Investment in Minnesota's State Highway Program

FINAL REPORT

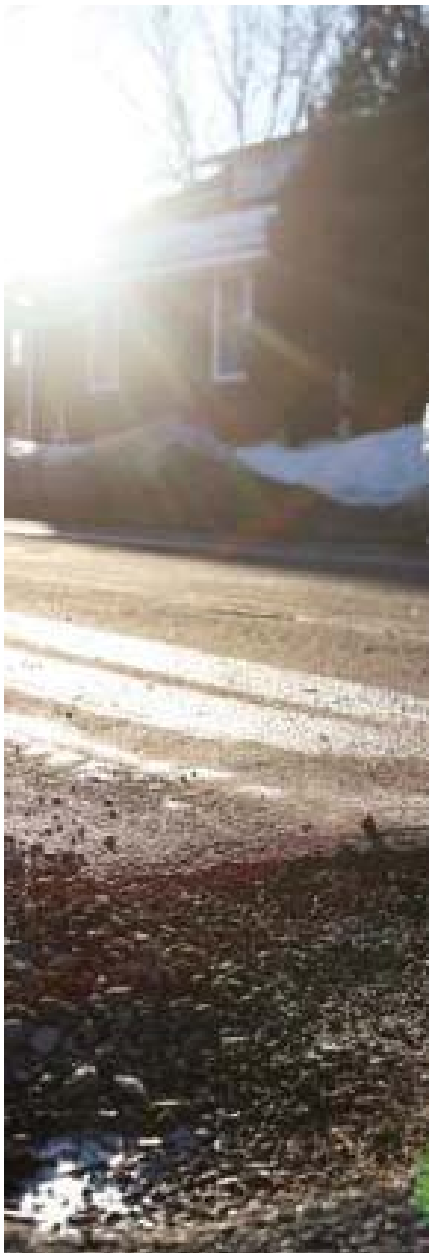
## Executive Summary

The state highway system in Minnesota operates today at a high level, meeting many of the performance goals established for the system. Over the next 20 years, however, the highway system is expected to experience a steady decline in performance, as projected state transportation revenues of $18 billion are unable to keep pace with the needs created by Minnesota's growing population and aging infrastructure. Confronted with the combined pressures of limited revenue, increasing costs, and declining performance, Minnesota's Transportation Finance Advisory Committee (TFAC) concluded in 2012 that, "the consequences of underinvesting in the state's transportation system will include deterioration in service, increasing congestion and delays, failing infrastructure, and a diminished ability to remain economically competitive in the global economy."

Practically speaking, the decline in the highway system's performance will affect businesses, residents, and visitors across the state. Based on analysis in Minnesota's 20-year State Highway Investment Plan (MnSHIP), the impacts of underinvestment will include:

- Pavement in poor condition will double from approximately 750 miles to 1,500 miles, or between 11-13% of non-interstate highways. Poor pavement conditions result in slower travel times, higher vehicle operating costs, additional safety hazards, and reduced economic competitiveness.
- More than 200 bridges on state principal arterials will be in poor condition. Weight restrictions and closures will negatively impact freight movement.
- With increasing travel times, performance targets on the Interregional Corridor System - carrying about 30 percent of all statewide travel on Greater Minnesota's most heavily traveled roads – will not be met.
- Congestion will worsen in the Twin Cities area and the Minnesota Department of Transportation (MnDOT) will have little-to-no ability to

# . . . to ensure that the system is economically competitive and world class.



address local concerns, add capacity, or support economic development at the regional and community level.

Consequently, TFAC recommended that the state invest an additional $12 billion over the next 20 years, first to maintain the current performance level of the state highway system, and then towards ensuring that the system is economically competitive and world class.

This study, undertaken with a Project Stakeholder Group (PSG) consisting of a broad spectrum of representatives from the public and private sectors, evaluates the return on investment (ROI) or business case for the additional transportation funding recommended by TFAC. The study specifically addresses and answers the following three questions:

1. Maintaining the current performance of Minnesota's state highway system would require an investment of an additional $5 billion over the next 20 years. *What would be the return on that investment?*

   **Answer:** A $5 billion investment over the next 20 years to maintain current system performance would deliver between $10 billion and $23 billion in benefits, with an average ROI of 3.1.

2. Improving Minnesota's state highway system to help the state become more economically competitive through technology and operational innovations and through high return on investment projects to reduce congestion and delays would require the investment of an additional $7 billion over the next 20 years. *What would be the return on that investment?*

   **Answer:** An additional $7 billion investment over the next 20 years to have an economically competitive and world class state highway system would deliver between $10 billion and $19 billion in benefits, with an average ROI of 2.1.

3. Within the proposed investments over the next 20 years, some projects and programs will necessarily have a higher return on investment and some will have a lower return on investment. *Which*

# . . . continue to support Minnesota's high quality of life & strong business climate . . .

*kinds of projects and programs offer the highest ROI?*

**Answer:** All ten of the highway investment categories evaluated in this study deliver ROI ranges that include economically feasible investments, i.e., the ROI is greater than 1.0. Investment categories with the highest ROIs tend to require less right-of-way acquisition and other physical inputs.

Investment decisions made in the near future will quickly determine whether the state highway system can continue to support Minnesota's high quality of life and strong business climate over the next 20 years. The results of this study indicate that there is a sound business case for making the $12 billion investment recommended by TFAC. In total, a $12 billion investment in the state highway system over the next 20 years would deliver between $21 billion and $42 billion in benefits, with an average ROI of 2.5 – or, for every dollar Minnesota invests in the state highway system, it can expect to receive two-and-a-half dollars in benefits.

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## Background

The Minnesota Department of Transportation (MnDOT) updated the *Minnesota 20-Year State Highway Investment Plan* (MnSHIP) in 2012-2013. Through the MnSHIP planning process and based on system performance targets, the plan identified total state highway system needs of $30 billion and projected revenue of $18 billion over the next 20 years resulting in a funding gap of approximately $12 billion. The needs and funding gap primarily reflect mounting pressure from an aging highway system, rising construction costs, and slow revenue growth. Based on analysis in MnSHIP, underinvestment will result in a steady decline in performance of the state highway system, including:

- Pavement in poor condition will double from approximately 750 miles to 1,500 miles, or between 11-13% of non-interstate highways. Poor pavement conditions result in slower travel times, higher vehicle operating costs, additional safety hazards, and reduced economic competitiveness.
- More than 200 bridges on state principal arterials will be in poor condition. Weight restrictions and closures will negatively impact freight movement.
- With increasing travel times, performance targets on the Interregional Corridor System - carrying about 30 percent of all statewide travel on Greater Minnesota's most heavily traveled roads – will not be met.
- Congestion will worsen in the Twin Cities area and the Minnesota Department of Transportation will have little-to-no ability to address local concerns, add capacity, or support economic development at the regional and community level.

In 2012, the Minnesota Transportation Finance Advisory Committee (TFAC) was formed to develop recommendations for funding and financing the state highway system over the next 20 years. TFAC recommended

# . . . help the state become more economically competitive . . .


meeting the full needs of the state highway system in order for Minnesota to remain economically competitive and provide a high quality of life. Following the completion of TFAC's work in December 2012, MnDOT partnered with Smart Growth America (SGA) to evaluate and understand the potential return on investment (ROI) of TFAC's recommendations. SGA works with state departments of transportation across the country to identify transportation policies and programs that enable flexible, efficient ways to increase the capacity to move people, goods, and services on state transportation systems while supporting and expediting job creation and economic development. MnSHIP served as the foundation for both TFAC's recommendations and this study.

The project team conducted the study over a period of three months, beginning in August 2013. The study process was organized around three technical memoranda and three working meetings with a Project Stakeholder Group (PSG). The PSG, consisting of 63 representatives from the public and private sectors, initially met in early August to discuss different approaches for evaluating transportation investment options summarized in the first technical memorandum. The PSG then convened again in late September to discuss and comment on a draft ROI analysis methodology, the subject of the second technical memorandum. Based on the comments and findings from the first two rounds of technical memoranda and PSG meetings, the PSG met for a final time at the end of October to review the results of the ROI analysis. The PSG served as a sounding board throughout the study and provided invaluable input to the ROI assessment.

...thestudyevaluatedabroader a set of social, economic, and environmental factors . . .

## Key Questions

In its 2012 report, TFAC recommended that Minnesota invest an additional $12 billion in the state highway system over the next 20 years in order to maintain its quality of life and compete in the global economy. The TFAC report identified two increments of needed investment over the next 20 years: (1) a $5 billion investment beyond projected revenue to maintain the current performance of the state highway system, and (2) an additional $7 billion investment to build, maintain, and operate an economically competitive and world class system. The ROI assessment specifically focused on three questions:

1. Maintaining the current performance of Minnesota's state highway system would require an investment of an additional $5 billion over the next 20 years. *What would be the return on that investment?*

2. Improving Minnesota's state highway system to help the state become more economically competitive through technology and operational innovations and through high return on investment projects to reduce congestion and delays would require the investment of an additional $7 billion over the next 20 years. *What would be the return on that investment?*

3. Within the proposed investments over the next 20 years, some projects and programs will necessarily have a higher return on investment and some will have a lower return on investment. *Which kinds of projects and programs offer the highest ROI?*

Similar to an investment portfolio, the TFAC recommendations consist of different investment classes or categories (see Appendix A) that include a wide variety of potential individual programs and projects and investment returns. Accordingly, the ROI assessment relies on a range of benefit-cost ratios derived from either benefit-cost or life-cycle cost analyses of a representative sample of projects and programs. While underlying parameters, such as timing or phasing of improvements, usable life of a facility, and analysis period, vary among the investment categories,

# . . . study used a broader a set of . . . factors . . . to evaluate investments . . .

utilizing a range of benefit-cost ratios allows the ROI assessment to bracket the overall estimated return on investment. Detailed descriptions of the investment categories, ROI methodology and assessment can be found in the study's accompanying technical report available at http://smartgrowthamerica.org/documents/minnesota-roi-tech-report.pdf.

## Assessing Return on Investment

In addition to traditional transportation benefits such as travel time savings, vehicle operating cost savings, and safety benefits, the study used a broader a set of social, economic, and environmental factors, summarized in Table 1, to evaluate investments with a proprietary tool called PRISM that MnDOT utilizes in its new Corridor Investment Management Strategy (CIMS) program.

Tables 2, 3, and 4 report the estimated ROIs for the incremental investments of $5 billion and $7 billion and the total investment of $12 billion. The tables describe the proposed investment level for each of the ten highway investment categories and the corresponding estimates of the average, low, and high benefit amounts. It is important to underscore that the recommended $5 billion and $7 billion investments would occur sequentially and are not discrete alternatives. The initial $5 billion investment would fund a wide variety of projects and


Table 1. Benefit-Cost Factors (PRISM)

| Social | Economic | Environmental |
|---|---|---|
| • Safety<br>• Bicycle/Pedestrian Health Effects<br>• Noise | • Travel Time<br>• Travel Time Reliability<br>• Vehicle Operating Costs<br>• Life Cycle Costs<br>• Loss of Agricultural Land | • Emission ($CO_2$ + Criteria Pollutants)<br>• Wetland Effects<br>• Runoff |

# The initial investment would fund a wide variety of projects . . .

Table 2. Maintain Current Performance - Return on Investment

| ROI Category | Average Investment (millions) | Percentage of Total Investment | Average Benefit (millions) | Low Benefit (millions) | High Benefit (millions) |
|---|---|---|---|---|---|
| Safety-Spot Improvement at High-Risk Locations | $662 | 12% | $2,701 | $1,684 | $3,718 |
| Pavement Preservation – Corridor | $1,377 | 26% | $2,754 | $2,203 | $3,305 |
| Pavement Reconstruction – Corridor | $106 | 2% | $93 | $53 | $133 |
| Pavement Reconstruction – Urban/Main Street | $275 | 5% | $395 | $206 | $583 |
| Bridge-Repair | $171 | 3% | $248 | $222 | $273 |
| Bridge-Replacement | $399 | 7% | $399 | $199 | $598 |
| Congestion Mitigation – General | $553 | 10% | $5,546 | $2,546 | $8,545 |
| Capacity Development | $1,146 | 21% | $1,526 | $847 | $2,204 |
| Active Traffic Management (ATM) | $79 | 1% | $703 | $608 | $798 |
| MnPASS | $632 | 12% | $2,180 | $1,661 | $2,700 |
| **Total Benefit** | n/a | n/a | $16,544 | $10,230 | $22,858 |
| **Total Investment** | $5,400 | n/a | $5,400 | $5,400 | $5,400 |
| **Return on Investment** | **n/a** | **n/a** | **3.1** | **1.9** | **4.2** |

. . . additional projects and programs necessary to meet all performance targets . . .

Table 3. Economically Competitive and World Class System - Return on Investment

| ROI Category | Average Investment (millions) | Percentage of Total Investment | Average Benefit (millions) | Low Benefit (millions) | High Benefit (millions) |
|---|---|---|---|---|---|
| Safety-Spot Improvement at High-Risk Locations | $578 | 8% | $2,324 | $1,454 | $3,195 |
| Pavement Preservation – Corridor | $1,264 | 18% | $2,528 | $2,022 | $3,034 |
| Pavement Reconstruction – Corridor | $288 | 4% | $252 | $144 | $359 |
| Pavement Reconstruction – Urban/Main Street | $408 | 6% | $585 | $305 | $864 |
| Bridge-Repair | $451 | 6% | $654 | $586 | $721 |
| Bridge-Replacement | $1,052 | 15% | $1,052 | $526 | $1,578 |
| Congestion Mitigation – General | $798 | 11% | $1,836 | $1,296 | $2,375 |
| Capacity Development | $1,246 | 18% | $1,297 | $772 | $1,821 |
| Active Traffic Management (ATM) | $114 | 2% | $1,015 | $878 | $1,151 |
| MnPASS | $912 | 13% | $3,146 | $2,397 | $3,896 |
| **Total Benefit** | n/a | n/a | $14,688 | $10,379 | $18,996 |
| **Total Investment** | $7,111 | n/a | $7,111 | $7,111 | $7,111 |
| **Return on Investment** | **n/a** | **n/a** | **2.1** | **1.5** | **2.7** |

. . . reflects the great diversity of potential projects and programs . . .

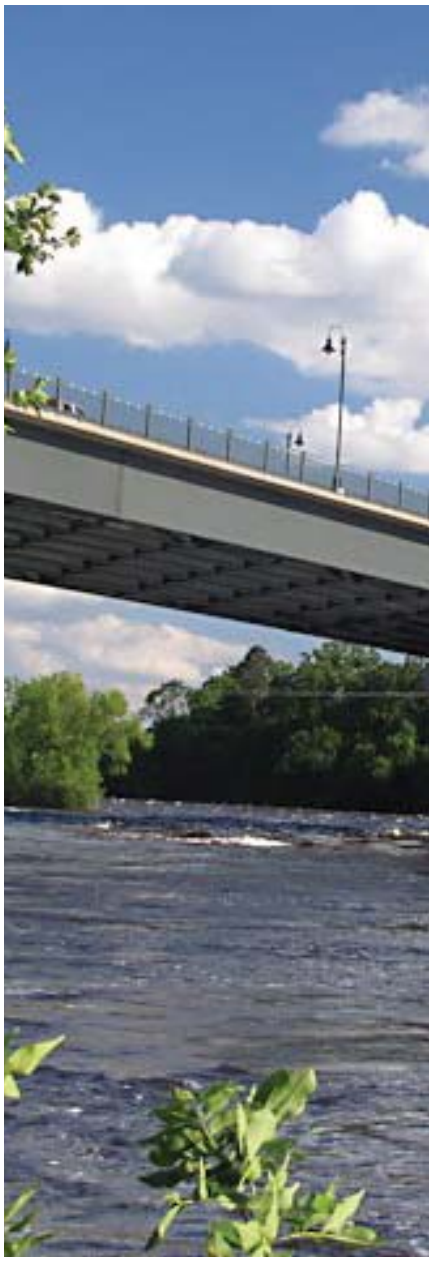
Table 4. Total TFAC State Highway System Recommendation - Return on Investment

| ROI Category | Average Investment (millions) | Percentage of Total Investment | Average Benefit (millions) | Low Benefit (millions) | High Benefit (millions) |
|---|---|---|---|---|---|
| Safety-Spot Improvement at High-Risk Locations | $1,240 | 10% | $5,025 | $3,137 | $6,913 |
| Pavement Preservation – Corridor | $2,641 | 21% | $5,282 | $4,226 | $6,338 |
| Pavement Reconstruction – Corridor | $394 | 3% | $344 | $197 | $492 |
| Pavement Reconstruction – Urban/Main Street | $683 | 5% | $979 | $511 | $1,447 |
| Bridge-Repair | $622 | 5% | $902 | $808 | $995 |
| Bridge-Replacement | $1,451 | 12% | $1,451 | $725 | $2,176 |
| Congestion Mitigation – General | $1,351 | 11% | $7,381 | $3,842 | $10,921 |
| Capacity Development | $2,392 | 19% | $2,823 | $1,620 | $4,026 |
| Active Traffic Management (ATM) | $193 | 2% | $1,718 | $1,486 | $1,949 |
| MnPASS | $1,544 | 12% | $5,327 | $4,057 | $6,596 |
| **Total Benefit** | n/a | n/a | $31,232 | $20,609 | $41,854 |
| **Total Investment** | $12,510 | n/a | $12,510 | $12,510 | $12,510 |
| **Return on Investment** | **n/a** | **n/a** | **2.5** | | |

# . . . a project total that would ultimately number in the thousands . . .

programs in each investment category that deliver the highest returns. The subsequent $7 billion investment would allow Minnesota to implement the additional projects and programs necessary to meet all performance targets for the state highway system. The first investment increment then generates a higher return before the ROI moderates slightly in the second and larger funding phase.

It is also important to highlight again that the estimated ROI range for each investment category necessarily reflects the great diversity of potential projects and programs in a state highway system investment plan, a project total that would ultimately number in the thousands. Table 5 provides an ROI point estimate and a low/high ROI range by investment category and for the overall investment. The low/high ROI ranges capture best and worst case scenarios – i.e., they combine low benefit estimates with high cost estimates to establish the low end of the range and high benefit estimates with low cost estimates to set the high end of the range.



. . . there is a sound business case for making the $12 billion investment . . .

Table 5. Return on Investment Categories – ROI Ranges

| ROI Category | Average Investment (millions) | ROI Point Estimate | Low/High ROI Range | Data Source |
|---|---|---|---|---|
| Safety-Spot Improvement at High-Risk Locations | $1,240 | 4.1 | 2.2 to 6.6 | Representative MnDOT projects – rural intersection conflict warning systems, diverging diamond interchanges, and passing lanes |
| Pavement Preservation – Corridor | $2,641 | 2.0 | 1.4 to 2.8 | Results from MnDOT's Transportation Asset Management Plan |
| Pavement Reconstruction – Corridor | $394 | 0.9 | 0.4 to 1.5 | Generalized life-cycle cost analysis framework |
| Pavement Reconstruction – Urban/Main Street | $683 | 1.4 | 0.6 to 2.5 | Representative projects in MnDOT Corridor Investment Management Strategy (CIMS) program |
| Bridge-Repair | $622 | 1.5 | 1.1 to 1.9 | Results from MnDOT's Transportation Asset Management Plan |
| Bridge-Replacement | $1,451 | 1.0 | 0.4 to 1.8 | Generalized life-cycle cost analysis framework |
| Congestion Mitigation – General | $1,351 | 5.5 | 2.5 to 9.6 | Projects included in the Metro District Congestion Management and Safety Plan |
| Capacity Development | $2,392 | 1.2 | 0.6 to 2.0 | Current scoring of projects in Corridors of Commerce process |
| Active Traffic Management (ATM) | $193 | 8.9 | 6.7 to 12.0 | MnDOT's recent four-year work plan of ATM investments and average benefit-cost ratios from USDOT |
| MnPASS | $1,544 | 3.5 | 2.3 to 5.1 | Opened, programmed, and potential MnPASS corridors |
| **TOTAL** | **$12,510** | **2.5** | **2.0 to 3.2** | |

. . . would deliver between $20 billion and $42 billion in benefits . . .

# Conclusion

The ROI assessment answers the three questions posed in this study. In particular, the results, summarized below, define the estimated range of benefits expected for each investment option and the anticipated return on investment.

1. Maintaining the current performance of Minnesota's state highway system would require an investment of an additional $5 billion over the next 20 years. *What would be the return on that investment?*

   **Answer**: A $5 billion investment over the next 20 years to maintain current system performance would deliver between $10 billion and $23 billion in benefits, with an average ROI of 3.1.

2. Improving Minnesota's state highway system to help the state become more economically competitive through technology and operational innovations and through high return on investment projects to reduce congestion and delays would require the investment of an additional $7 billion over the next 20 years. *What would be the return on that investment?*

   **Answer:** An additional $7 billion investment over the next 20 years to have an economically competitive and world class state highway system would deliver between $10 billion and $19 billion in benefits, with an average ROI of 2.1.

3. Within the proposed investments over the next 20 years, some projects and programs will necessarily have a higher return on investment and some will have a lower return on investment. *Which kinds of projects and programs offer the highest ROI?*

   **Answer:** All ten of the highway investment categories evaluated in this study deliver ROI ranges that include economically feasible investments, i.e., the ROI is greater than 1.0. Investment categories with the highest ROIs tend to require less right-of-way acquisition and other physical inputs.

ROI analysis is, of course, only one of several important pieces of information in the transportation investment decision making process. Geographic and social equity, economic development, resilience to natural and man-made emergencies, and competing funding demands are some of the many other factors that influence transportation investments. Based on the results of this study, however, there is a sound business case for making the $12 billion investment recommended by TFAC. In total, a $12 billion investment in the state highway system over the next 20 years would deliver between $21 billion and $42 billion in benefits, with an average ROI of 2.5 – or, for every dollar Minnesota invests in the state highway system, it can expect to receive two-and-a-half dollars in benefits.

# Appendix A – Return on Investment Categories

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Following are descriptions of the ten investment categories included in the ROI analysis.

## Safety – Spot Improvement/High Risk Locations

Return on investment can be evaluated against this objective by reference to a sample of recently completed, planned, or analyzed projects across Minnesota characterized by relatively low construction cost and limited extent. The representative sample of projects includes rural intersection conflict warning systems, diverging diamond interchanges, and passing lanes.

## Pavement Preservation – Corridor

Pavement preservation represents a proactive approach in maintaining existing highways, reducing costly and time-consuming rehabilitation and reconstruction projects and the associated traffic disruptions. A pavement reservation program consists primarily of three components: preventive maintenance, minor rehabilitation (nonstructural), and some routine maintenance activities

## Pavement Reconstruction – Corridor

The pavement reconstruction–corridor investment category involves reconstruction projects on corridors in Greater Minnesota outside of urban areas. Reconstruction is the replacement of the entire existing pavement structure by the placement of the equivalent or increased pavement structure. Reconstruction is required when a pavement has either failed or has become functionally obsolete.

## Pavement Reconstruction – Urban/Main Street

This category captures highway reconstruction projects in cities and towns, including main street projects. The full reconstruction of highways in urban settings allows for major improvements and changes to both the road itself as well as the underground utilities. Urban/main street reconstruction projects may involve improvements to how stormwater runoff is handled, changes in access points (access management), lane reconfigurations, new lighting, additions of green space, new medians, new or reconstructed sidewalks, and other modifications.

## Bridge Repair

Similar to the pavement–preservation category, bridge repair employs cost-effective strategies and actions to maximize the useful life of bridges. Bridge repair includes preservation actions and strategies that prevent, delay, or reduce the deterioration of bridges or bridge elements, and rehabilitation work required to restore the structural integrity of a bridge or correct major safety defects.

## Bridge Replacement

Bridge replacement involves the total replacement of a structurally deficient or functionally obsolete bridge with a new facility constructed in the same general traffic corridor. A nominal amount of approach work to connect the new facility to the existing roadway or return to the gradeline may also be included.

## Congestion Mitigation – General

Investments aimed at general congestion mitigation make lower cost, higher benefit improvements that reduce travel time and crash risk. These improvements have short time frames for implementation, attempt to maximize the use of existing pavement and right-of-way, and are typically less than one mile in length.

## Capacity Development

Capacity development, providing additional highway capacity on segments where there are currently bottlenecks in the system, is one of two goals established under the Corridors of Commerce bonding program created by the Minnesota Legislature in the spring of 2013 (chapter 117, article 3). These large-scale capacity development proposals also include projects identified in the Minnesota Transportation Finance Advisory Committee report as, "congested sections of roadway that contain chokepoints that hamper commuting or commerce."

## Active Traffic Management

Active Traffic Management (ATM) is the ability to dynamically manage recurrent and non-recurrent congestion based on prevailing

and predicted traffic conditions. Focusing on trip reliability, it maximizes the effectiveness and efficiency of the facility. Strategies include but are not limited to speed harmonization, temporary shoulder use, junction control, and dynamic signing and rerouting.

## MnPASS

MnPASS is the high-occupancy/toll (HOT) lane network operated by MnDOT. The system allows single-occupant vehicles to travel on express lanes adjacent to general purpose lanes with the payment of a variable fee that is collected electronically. MnPASS charges are dynamically set based on the level of congestion experienced in the express lane with a maximum toll of $8. MnPASS users receive benefits in the form of faster and more reliable trip times, as well as safer driving conditions given the controlled access to the express lanes. Traffic also flows more freely on the non-tolled general purpose lanes when a fraction of their volume chooses to divert to the MnPASS alternative.