This report was produced with the generous support of The McKnight Foundation.

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...this memorandum presents a draft Return on Investment methodology ...

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Introduction

The first technical memorandum and Project Stakeholder Group (PSG) meeting discussed approaches for evaluating transportation investment options. The principal question raised during the initial phase of the project was, “How should the Minnesota Department of Transportation (MnDOT) conduct a return on investment (ROI) analysis for proposed transportation investments?” Building on the discussion at the first PSG meeting, this second technical memorandum presents a draft return on investment methodology. The project and the draft ROI methodology specifically focus on the long-term needs of the state highway system, from system preservation to traveler safety, interregional mobility to regional and community priorities.

Efforts to capture and communicate the value of such a broad set of investments pose several challenges. Chief among these is the different scales of potential improvements. While familiar capital investments, including new roads and road widenings, readily allow for traditional transportation benefit-cost analysis, which is one way to describe ROI, system level investments, such as pavement and bridge preservation, rely more on approaches that weigh trade-offs among different system management strategies. Consequently, this technical memorandum proposes an ROI methodology that combines the following two approaches:

• For investment categories that lend themselves to traditional transportation benefit-cost analysis, benefit-cost ratios are developed based on a representative sampling of MnDOT projects; and
• For investment categories that rely on trade-offs among different system management strategies, benefit-cost ratios are developed based on a review of national research and best practices.

As discussed in the first phase, the purpose of this project is to assist MnDOT with the development of transportation investment options that expand flexible and efficient ways to move people and goods throughout Minnesota and support job creation and economic development in the state. The proposed ROI methodology will generate typical benefit-cost ratio ranges for different investment categories that, in turn, can help frame the evaluation of a variety of transportation investment options.
Return on Investment Categories

An important starting point for this project is the recently completed work by Minnesota’s Transportation Finance Advisory Committee (TFAC). In developing recommendations for future transportation funding in Minnesota, TFAC identified needed investments and required funding over a 20-year period for all transportation modes. For the state highway system specifically, TFAC grouped the needed investments under the following four general categories:

- Highway Reconstruction
- Deficient Bridges
- Congestion Mitigation
- Highway Safety

Within each of these general categories are a variety of investments involving different scales and contexts that one can further refine into a set of ROI investment categories. Table 1 shows the relationship of the four general TFAC categories and the eleven proposed ROI investment categories.

Again, for many of the proposed ROI investment categories, benefit-cost ratio ranges can be derived from a representative sampling of MnDOT projects. Others will rely on national best practices and case studies. The next section describes the ROI methodology for each of the investment categories relative to the two underlying questions in the TFAC report:

- Maintaining the current performance of Minnesota’s state highway system would require an investment of an additional $5 billion over the next twenty years. What would be the return on that investment?
- 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
Return on Investment Methodology

Before turning to the ROI investment methodology descriptions, it is also important to understand the ROI categories in terms of the overarching goals of the proposed incremental levels of additional funding. The following sections provide a brief overview of those goals and projected outcomes.

Maintain Current Performance

Minnesota, and MnDOT in particular, closely monitors the performance of the state’s transportation system. Based on forecasts of future conditions, the TFAC report identified an additional $5 billion needed over the next 20 years to maintain the current performance of the transportation system. According to the TFAC report, the additional funding would result in the following outcomes:

- Pavement and bridge conditions would not change
- Fatalities would continue to drop
- Congestion would increase, but a few spot improvement projects could be undertaken in isolated locations. Very few expansion projects would occur.

Given the emphasis placed on system preservation, pavement and bridge preservation are the key investment categories for understanding a return on investment from the recommended initial increment of additional funding. Other investment categories, including safety and congestion mitigation, would, however, also receive some additional funding within the first increment.
Economically Competitive & World Class System

Complementing the investment required to maintain the current system performance, TFAC also recommended $7 billion in added revenue to meet all performance targets and deliver an economically competitive and world class system. The additional funding would allow the state to achieve these important results:

- Pavement and bridge conditions targets are met
- The rate of decline in traffic fatalities and injuries is increased
- The MnPASS vision for the Twin Cities Metro area is completed. Also, a modest number of high priority expansion projects are completed.

While multi-faceted, the investment strategy to meet all performance targets and deliver an economically competitive and world class transportation system reinforces the state’s core guiding principles for transportation investment decision making by focusing on system preservation, congestion mitigation, and safety. Accordingly, all of the ROI investment categories in Table 1 would support the ROI analysis for the second increment of additional funding. The ROI methodology descriptions follow.

Pavement & Bridge Preservation

According to the U.S. Department of Transportation (USDOT), “pavement preservation represents a proactive approach in maintaining our existing highways, reducing costly, time consuming rehabilitation and reconstruction projects and the associated traffic disruptions.” Similarly, “the objective of a good bridge preservation program is to employ cost effective strategies and actions to maximize the useful life of bridges, costing much less than major reconstruction or replacement activities.” Beyond the obvious importance and desirability of well maintained roadways and bridges, poor pavement and bridge conditions can also potentially jeopardize a state’s bonding rating resulting in higher borrowing costs for state and local governments. The preservation categories both involve trade-offs among different system management strategies, and the return on investment methodology underpinning them is based on a review of national research and best practices.
potential savings between reconstruction and pavement preservation strategies...

Transportation agencies and organizations typically rely on a generalized life-cycle cost analysis to quantify savings associated with implementing pavement and bridge preservation programs. In the case of pavement, for instance, the goal is to apply the right treatment to the right pavement at the right time, and in doing so, avoid or delay costly improvements such as major roadway rehabilitation or reconstruction. While a project level life-cycle cost analysis includes both agency costs and user costs, evaluations of preservation programs tend to focus on agency costs and analyze more generally which strategies minimize costs. The cost savings associated with preservation are then expressed as a cost reduction per lane mile or as a ratio between the cost of rehabilitation and reconstruction compared to preservation. Two examples illustrate a general approach to measuring the life-cycle cost savings from preservation.

- For its 5-Year Maintenance Plan (2011) and 10-Year State Highway Operation and Protection Program Plan (2011), the California Department of Transportation (Caltrans) assumes that a dollar spent annually on preventive maintenance avoids or delays an annual amount of future rehabilitation costs. Caltrans uses the values in Table 2 to establish the cost-benefit ratios applied to its annual spending.

- Similarly, in the Federal Highway Administration’s (FHWA) Pavement Preservation Compendium II (2006), the National Center for Pavement Preservation (NCPP) illustrates the potential savings between reconstruction and pavement preservation strategies for a highway over a 25-year period. Excluding initial construction, the total costs in constant dollars is $490,000 for the reconstruction strategy and $140,000 for the preservation strategy.

### Table 2. Caltrans: Comparison of Preventive Maintenance and Rehabilitation Costs

<table>
<thead>
<tr>
<th>Capital Construction</th>
<th>Cost of Rehabilitation</th>
<th>Cost of Preventive Maintenance</th>
<th>Cost-Benefit Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAVEMENT (LANE MILE)</td>
<td>$402,000</td>
<td>$67,000</td>
<td>6:1</td>
</tr>
<tr>
<td>BRIDGE</td>
<td>$720,000</td>
<td>$60,000</td>
<td>12:1</td>
</tr>
</tbody>
</table>

Source: 10-Year State Highway Operation and Protection Program Plan, Caltrans (2011)
... new lighting, additions of green space, new medians, reconstructed sidewalks ...

strategy, or a ratio of 3.5:1. In the same article, the authors also present a general pavement option curve comparing reconstruction and rehabilitation costs to pavement preservation costs with ratios ranging from 6:1 to 10:1. In a 2009 report by the American Association of State Highway and Transportation Officials (AASHTO), an updated version of the NCPP pavement option curve shows a range of cost ratios of 6:1 to 14:1. While a generalized life-cycle cost analysis does not attempt to account for the full range of costs or incorporate benefits, it does provide a useful framework for weighing the cost savings associated with a preservation program.

Reconstruction—Urban

The full reconstruction of highways in urban settings allows MnDOT and local partners to make major improvements and changes to both the road itself as well as the underground utilities. Urban 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. Given the complexity of urban reconstruction projects, the benefits can be far reaching and include both traditional transportation measures such as travel time and safety, but also health and environmental factors.

Many applications to MnDOT’s recent Corridor Investment Management Strategy Solicitation were to fund urban reconstruction projects and as part of the project selection process were evaluated on a benefit-cost basis using the PRISM tool. Although the resulting ROI estimates included many factors, there is a strong correlation between traffic volume and ROI for these types of projects. Using representative projects with a range of traffic volumes allows one to estimate an approximate ROI for urban reconstruction projects without the need to conduct in-depth analysis of the many potential project elements.

The representative project list will include, among others:

- Main Street US 61 Downtown Improvements in Red Wing:
  The project will make multiple
replacement investments present unique challenges.

Improvements to Main Street (US 61) in downtown Red Wing, including but not limited to sewer, utility and pavement reconstruction and replacement, improved sidewalks and ramps, new and extended raised center medians, improved pedestrian crossings, upgraded signals and lighting, access management, and streetscaping improvements. This complete streets project will improve accessibility and safety, support active transportation, economic redevelopment and tourism, and reduce the highway’s environmental impacts.

- **MN 25 Improvements in Buffalo**: The project will make multiple improvements to MN 25 in Buffalo, including but not limited to pavement and sewer reconstruction, widened and improved sidewalks, bike lanes, new turn lanes, roundabout and improved intersections, and streetscaping improvements. The improvements will increase accessibility and safety, support biking and walking, and reduce flooding.

**Reconstruction–Corridor & Bridge Replacement**

Measuring the benefits of pavement rehabilitation and reconstruction and bridge repair and replacement investments present unique challenges. Because these types of investments do not typically increase facility capacity or involve new alignments, comparing proposed projects against a “base case” does not easily translate into conventional benefit-cost analysis highlighting common user benefits (travel time savings, vehicle operating costs, safety) and relying on changes in vehicle-hours traveled (VHT) and vehicle-miles traveled (VMT). Consequently, efforts to measure the benefits of reconstruction and replacement projects are limited.

One, more recent source of project level analysis is USDOT’s Transportation Investment Generating Economic Recovery (TIGER) Grant Program. Since 2009, USDOT has made grants for a wide variety of transportation projects, including reconstruction and replacement projects, through the TIGER program. TIGER grants involving bridge replacement and highway reconstruction tend to
organize the benefit-cost analysis around two approaches. The first approach, used primarily for bridge projects, compares the replacement facility with a “base case” that assumes closure of the existing facility. In this analysis, the impact of eliminating a direct route is measured as changes in VHT, VMT, and safety. The second approach defines the “base case” as the existing facility and compares it with the reconstructed or replacement facility, relying on life-cycle cost analysis to capture the state of good repair benefits. In effect, the benefit-cost argument is that by reconstructing or replacing a facility in poor condition, one can avoid frequent and expensive treatments and activities over the life of the new or reconstructed facility – 75 years in the case of a new bridge.

Given the limited number of federal or state level benefit-cost analysis of reconstruction and replacement projects, an ROI methodology based on a generalized life-cost analysis is proposed for these two investment categories.

Congestion Mitigation – General

The Congestion Management and Safety Plan is intended to identify lower cost, higher benefit improvements to 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.

For each project location, a dollar value was assigned as the magnitude of the problem. Recognizing that any project has a point of diminishing returns, the proposed solutions were not expected to solve 100 percent of the problem. Project effectiveness was estimated as a percentage of the problem addressed. This ranges from 0 percent to 79 percent for the 60 projects with quantified attributes. Cost estimates were developed based on unit costs and engineering judgment, and range from $3,000 to $19 million.

The projects were categorized into three tiers based on the return period, defined as the time after construction at which the travel...
time and crash savings equal the project cost. Tier 1 projects have a return period of less than 2 years, Tier 2 projects have a return period of 2 to 6 years, and Tier 3 projects 7 to 11 years. A small number of projects had a return period of 18 years or more and were not recommended for implementation.

The annual benefit of each project was calculated by multiplying the effectiveness by the magnitude of the problem. To calculate a return on investment, 20 years of discounted benefits were compared to the project cost. Estimates of return on investment for each tier of projects are:

- **Tier 1**: maximum B/C ratio >30, minimum B/C ratio 8.0, median B/C ratio 11.5
- **Tier 2**: maximum B/C ratio 6.3, minimum B/C ratio 1.9, median B/C ratio 3.6
- **Tier 3**: maximum B/C ratio 1.5, minimum B/C ratio 1.0, median B/C ratio 1.3

If each tier represents an equal investment, an overall return on investment can be calculated by simply averaging the median return for each tier.
Capacity Development

Return on investment is listed as the first objective criterion for project evaluation and prioritization under the Corridors of Commerce bonding program created by the Minnesota Legislature in the spring of 2013 (chapter 117, article 3). With $300 million in new bonding authority, the initial Corridors of Commerce appropriation is expected to finance only a fraction of the large-scale capacity development proposals generated statewide, including the eligible projects identified in TRIP Appendix C as “congested sections of roadway that contain chokepoints that hamper commuting or commerce” – alone totaling $571 million using the lower end of current cost estimate ranges.

Through calculations supported by the PRISM benefit-cost model, MnDOT has drafted a return on investment measure incorporating safety benefits, travel time savings, environmental externalities, and operating and life-cycle costs, reflecting the multi-dimensional impacts from these major projects. In all cases, a Capacity Development (CD) scenario is compared against a No Build (NB) baseline. At this early evaluation stage, when candidate projects lack detailed studies for benefit components and construction scope and expense, the ROI estimates that enable a preliminary ranking must rely on key assumptions, shown in the table below – which may be refined in the future with expert office review:

**Table 3. Capacity Development – Key Assumptions**

<table>
<thead>
<tr>
<th>Traffic</th>
<th>Costs</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>• AADT (and VMT) does not change between NB and CD.</td>
<td>• Unless otherwise indicated by available project documents, construction costs are allocated as:</td>
<td>• Construction duration is estimated as a function of total project costs (i.e. more expensive projects require multiple seasons).</td>
</tr>
<tr>
<td>• The future AADT trend for both scenarios is projected as a continuation of the segment compound annual growth rate for the 2002-2011 period.</td>
<td>- 70% structures, grading, sub/base, surface (40-year average life)</td>
<td>• Analysis represents 20 years of benefits following the opening of the CD facility, converted to the present value equivalent at a 2.2% discount rate.</td>
</tr>
<tr>
<td>• Travel time savings for auto and truck users reflect increased speeds under CD.</td>
<td>- 10% ROW (100-year expected life)</td>
<td>This procedure will be applied to the following TRIP projects, as well as other anticipated nominations with similar motivation and desired outcomes:</td>
</tr>
<tr>
<td></td>
<td>- 20% engineering and all other purposes (no residual value)</td>
<td>• Completion of MN 610 to I-94</td>
</tr>
<tr>
<td></td>
<td>• Incremental annual operations and maintenance expense for CD is $10,000 per added lane-mile.</td>
<td>• Expansion of MN 14 from Owatonna to Dodge Center (phased)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Expansion of MN 23 from Paynesville to Richmond</td>
</tr>
<tr>
<td></td>
<td>• Unless otherwise indicated by available project documents, construction costs are allocated as:</td>
<td></td>
</tr>
</tbody>
</table>
Active Traffic Management

The rapidly evolving application of computer and communication technologies to transportation systems offers a number of opportunities to maximize existing assets and new investments. According to FHWA, 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. To date, national research on the benefits of ATM strategies has been reported under the larger umbrella of Transportation Systems Management and Operations (TSM&O).

TSM&O can include physical and non-physical investments and addresses a broad array of project and system issues and needs. Some of these strategies are often referred to as Intelligent Transportation Systems (ITS), but include much broader activities. An important resource for assessing the benefits and costs of investment in TSM&O is, Investment Opportunities for Managing Transportation Performance through Technology, a USDOT 2009 report of the Intelligent Transportation Systems Joint Program Office. This report includes the following table which identifies deployment-ready ITS investments for either stand alone projects or technologies that can be incorporated into new or existing transportation infrastructure projects. Table 4 is based on information contained in the USDOT ITS benefits database.

Although the benefit-cost ratios reported in the USDOT table vary by TSM&O application, it is reasonable to define a range of benefit-cost ratios for TSM&O overall. The proposed methodology will develop a composite benefit-cost ratio based on a representative mix of TSM&O applications deployed in the Minnesota Department of Transportation’s ATM program, including road weather information systems, ramp metering, and traffic incident management.

Managed Lanes/MnPASS

MnPASS is the high-occupancy/toll (HOT) lane network operated by
### Table 4. USDOT: ITS Upgrades for New, Rehabilitated or Existing Infrastructure

<table>
<thead>
<tr>
<th>Category/Project</th>
<th>B/C Ratio &amp; Other Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRAFFIC SIGNAL OPTIMIZATION/RETIMING</td>
<td>17:1 to 62:1</td>
</tr>
<tr>
<td>TRAFFIC INCIDENT MANAGEMENT</td>
<td>• Safety Service Patrols Incident duration reduced 30-40%</td>
</tr>
<tr>
<td></td>
<td>• Surveillance/Detection 2:1 to 42:1</td>
</tr>
<tr>
<td></td>
<td>6:1</td>
</tr>
<tr>
<td>ROAD WEATHER INFORMATION SYSTEMS</td>
<td>2:1 to 10:1</td>
</tr>
<tr>
<td>ELECTRONIC TOLL SYSTEMS</td>
<td>2:1 to 3:1 Crash rates reduced by up to 49%</td>
</tr>
<tr>
<td></td>
<td>Speeds increased up to 57%</td>
</tr>
<tr>
<td>RAMP METERING SYSTEMS</td>
<td>15:1</td>
</tr>
<tr>
<td>COMMERCIAL VEHICLE INFORMATION SYSTEMS AND NETWORKS</td>
<td>3:1 to 5:1</td>
</tr>
<tr>
<td></td>
<td>1:1 to 50:1</td>
</tr>
<tr>
<td></td>
<td>2:1 to 12:1</td>
</tr>
<tr>
<td>BUS RAPID TRANSIT</td>
<td>2:1 to 10:1</td>
</tr>
<tr>
<td>TRAFFIC ADAPTIVE SIGNAL CONTROL</td>
<td>Improved travel time 6-11%</td>
</tr>
<tr>
<td>TRANSIT SIGNAL PRIORITY</td>
<td>Reduced transit delay 30-40%</td>
</tr>
<tr>
<td></td>
<td>Improved travel time 2-16%</td>
</tr>
<tr>
<td>TRAVELER INFORMATION/DYNAMIC MESSAGE SIGNS</td>
<td>3% decrease in crashes</td>
</tr>
<tr>
<td>WORK ZONE MANAGEMENT SYSTEMS</td>
<td>2:1 to 42:1</td>
</tr>
</tbody>
</table>
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.

A formal benefit-cost analysis was conducted on one existing MnPASS facility (I-394, west of Minneapolis) in February 2012 by the Center for Transportation Studies at the University of Minnesota. MnDOT is planning to expand the MnPASS network next to I-35E north of St. Paul (ending at Little Canada Road), with construction scheduled to begin in 2014 and continuing through 2015. Cambridge Systematics completed a benefit-cost analysis for this segment in August 2012. Additionally, a survey of travel time and vehicle operating cost savings was performed in June 2010 for 14 other candidate future MnPASS corridors, including the six identified as congestion chokepoints by TRIP:

- MN 36
- I-94, between the downtowns
- I-35W, north from Minneapolis to Blaine
- I-494, from I-94 to MSP Airport
- US 169
- MN 77

Consolidating the benefit-cost values of these opened, programmed, and potential MnPASS corridors produces the category ROI estimate range. The low end of this range can be calculated as the median of the eight benefit-cost ratios. Given the minimal project scoping available for cost estimation of the prospective TRIP locations, an alternative statistic of central tendency is given by the straight (i.e., not weighted by individual project cost) average of benefit-cost ratios.

Safety – Spot Improvement/High Risk Locations

 Provision of safe travel is the ultimate contribution made by a transportation system to broader
quality of life priorities. While a safe arrival relies on many factors outside the direct influence of MnDOT (e.g., driver behavior), infrastructure investments promote a safe driving environment, and innovations in safety treatments make this a dynamic area for research and implementation.

Regulatory agencies, including USDOT, base decision making about the cost effectiveness of safety-related investments on the “value of a statistical life” (VSL) economic concept. This measure reflects the comprehensive value an individual has demonstrated and a willingness to pay to avoid a fractional increase in the risk of death from participating in an activity. The value placed on avoiding a fatal outcome also determines the proportional cost to society of injury crashes (graded in three severities). MnDOT has adopted the well-documented federal guidance for VSL and injury per-person costs, further tailoring the crash values by applying the latest statewide crash profile showing the average number of occupants involved in a given crash type.

Safety improvements then seek to lower these expected costs by reducing total crash frequency and/or minimizing the severity of the crash distribution (e.g., averting injuries even if property damage-only crashes rise modestly). 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 costs—compared with a traditional solution
- Limited extent—compared with a major corridor expansion that may deliver significant benefits beyond safety enhancement

This representative project list will include, among others:

- **Rural Intersection Conflict Warning Systems:** Technology designed to help vehicles judge safe traffic gaps when joining a state highway at a stop-controlled intersection. Originally proposed for the federal TIGER grant program in 2012 and just awarded 85% funding for 15 pilot cities in the last TIGER solicitation.
- **St. Cloud (MN 15 and CSAH 120) Diverging Diamond Interchange:** Scheduled...
to open later in 2013 as the first application of this modern interchange design in Minnesota, which removes traffic conflict points, easing left-turn movements. It saves one-third of the expense for a standard, single-point interchange.

• District 2 MN 2 (Cass Lake to Deer River) Passing Lanes:
  Addition of three one-mile passing lanes along a 38-mile corridor expected to generate substantial safety benefit. This is a candidate project for the Corridors of Commerce bonding program to be considered during the 2014 legislative session.

Safety – Rail Grade Separation

Improvements at railroad – highway grade crossings can generate congestion and safety benefits. Rail grade separation projects reduce delay since the roadway is no longer blocked by a railroad crossing. Safety is improved by eliminating a vehicle-train conflict. The magnitude of delay benefits depends on daily highway traffic volume and the number of trains at the crossing per day, including the distribution of trains during the 24 hour period, train speed, and length.

The representative projects for the Rail Grade Separation category will include:

• St. Cloud (Sauk Rapids Bridge): As part of the environmental assessment for this project, an economic analysis was performed to evaluate the level of benefits and costs associated with grade-separated alternatives compared to the at-grade option and no-build. A sensitivity analysis was included with reduced vehicular and railroad traffic values.

• Anoka County/City of Ramsey (US 10 & CSAH 83 Interchange): The benefit-cost analysis of the preferred alternative for the EA/EAW for this project includes travel time savings quantified with the Anoka County Travel Demand Model for the grade separation of CSAH 83 from BNSF railroad.
Key Findings

The purpose of this memorandum is to present a draft return on investment methodology for evaluating 20-year transportation investment options. To capture and communicate the value of such a broad set of investments, the technical memorandum proposes an ROI methodology that combines the following two approaches:

• For investment categories that lends themselves to traditional transportation benefit-cost analysis, benefit-cost ratios are developed based on a representative sampling of MnDOT projects; and
• For investment categories that rely on trade-offs among different system management strategies, benefit-cost ratios are developed based on a review of national research and best practices.

The proposed ROI methodology will generate typical benefit-cost ratio ranges for different investment categories that, in turn, can help frame the evaluation of a variety of transportation investment options. Building on the recently completed work by Minnesota’s Transportation Finance Advisory Committee, the proposed ROI methodology aims to answer the two underlying questions in the TFAC report:

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

Although the ROI methodology description focuses on these two questions in particular, the methodology can also help answer additional questions. A third important question to consider in this project is:

• 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 lower. Which kinds of projects and programs offer the highest ROI?