Enhancing Return on Investment for MnPASS

CTS Research Conference
November 2, 2017

Minnesota Department of Transportation
Western Transportation Institute | Montana State University
SRF Consulting Group, Inc.
MnPASS System

MnPASS tolling lane projects have proven effective:

• Relieve traffic congestion
• Manage increased travel demand
• Maximize benefit of public investments
The Problem…

Traditional benefit-cost approaches:

- Move more cars
- Increase speeds
- Reduce congestion

MnPASS lanes are designed to:

- Move more people
- Provide a choice
- Improve reliability

Research conducted to improve methods and tools for estimating return on investment…
Agency Staff Interviews

Participants
• MnDOT Metro District
• MnDOT Central Office
• Metropolitan Council
• RTMC

Discussion Questions
• Existing shortcomings
• Expectations for refined methodology
• Specific elements to be included
• Other economic factors
• Unique aspects of MnPASS
Managed Lanes ROI Inclusion
Importance vs. Component Maturity

Perceived Applicability to Refined MnPASS Tools

Definite  Probable  Possible  Unlikely

Existing Tools / Easy

Discount Rate
20-year Analysis Period

Probable

Transit Benefits
Travel Time Reliability

Possible

Emergency Response

Freight

Unlikely

Safety

Carpool Formation
Impact of Being Late

Health Effects

Driverless Vehicles

New Tools / Difficult

Evaluation Maturity / Difficulty
ROI Benefit Categories

Following Steps

• Literature Search
• Individual Component Review
• Model and Data Availability Assessment
• Framework Refinement

• Travel Time Savings
• Vehicle Operating Cost Savings
• Crash Cost Savings
• Travel Time Reliability
• Transit Benefit
• Emergency Response
• Induced Traffic
• Emission Impact
• Noise Impact
Demonstration Project

Lexington Avenue

Hwy 36

~ 10.5 miles
Existing Conditions
Background Information

- The BCA was conducted to capture the forecasted changes of both base year 2010 and forecasting year 2040

<table>
<thead>
<tr>
<th>Benefit Definition</th>
<th>Cost Estimation</th>
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<tbody>
<tr>
<td>• Travel time savings</td>
<td>• Capital costs</td>
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<tr>
<td>• Vehicle operating cost savings</td>
<td>• Operation and maintenance costs</td>
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<tr>
<td>• Safety improvement</td>
<td>• Remaining capital value</td>
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</tbody>
</table>

- The preferred Build alternative was found to have a benefit-cost ratio of **2.11** from this analysis
Transit Benefits
Express Bus Service

1,500 Space Park & Ride

Current and Planned Bus-Only Shoulders

Western Transportation Institute

MONTANA STATE UNIVERSITY

College of Engineering

Consulting Group, Inc.
Transit Advantages

No Build

Bus Shoulder

MnPASS

Managed Lane
Transit Forecasts

Traffic Forecasts → CORSIM Models → Link Speeds

Mixed Traffic → BOS → Managed Lane

Bus Speeds → Bus Travel Times

Ridership Forecasts → Person Throughput
<table>
<thead>
<tr>
<th>SB: 95th Ave to CR E2</th>
<th>NB: CR E2 to TH 10</th>
<th>NB: Stinson to TH 280</th>
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<tbody>
<tr>
<td>Existing Bus Shoulder Use</td>
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</table>

* GP speeds were estimated from COSSIM model.
<table>
<thead>
<tr>
<th></th>
<th>General Purpose 1</th>
<th>General Purpose 2</th>
<th>General Purpose 3</th>
<th>General Purpose 4</th>
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</table>
| * GP speeds were estimated from COSSIM model.
2040 Managed Lane Bus Shoulder Use

Buses use managed lanes

NB: 4th St to TH 280

* GP speeds were estimated from COSSIM model.
## Bus Travel Time

CSAH 23 to Mississippi River

<table>
<thead>
<tr>
<th>Travel Time</th>
<th>AM</th>
<th>PM</th>
<th>Round Trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-hour peak period (min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SB I-35W</td>
<td>Bus</td>
<td>GP*</td>
<td>Bus</td>
</tr>
<tr>
<td>2040 No-Build</td>
<td>26</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>2040 MnPASS Build</td>
<td>20</td>
<td>28</td>
<td>24</td>
</tr>
</tbody>
</table>

*GP = General Purpose Lanes
## Ridership Forecasts

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Route 250</th>
<th>Route 252</th>
<th>Route 288</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2040 No-Build</td>
<td>3,400</td>
<td>200</td>
<td>700</td>
<td>4,300</td>
</tr>
<tr>
<td>2040 Build MnPASS</td>
<td>3,700</td>
<td>200</td>
<td>700</td>
<td>4,600</td>
</tr>
</tbody>
</table>
# The Annual Transit Benefit Estimation - Year 2040

<table>
<thead>
<tr>
<th>Measures</th>
<th>2040 No-Build</th>
<th>2040 Build</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round Trip Transit Travel Time (hr)</td>
<td>0.98</td>
<td>0.73</td>
</tr>
<tr>
<td>Round Trip Auto Travel Time (hr)</td>
<td>1.25</td>
<td>1.12</td>
</tr>
<tr>
<td>Ridership</td>
<td>4,300</td>
<td>4,600</td>
</tr>
<tr>
<td>Auto (if no MnPASS)</td>
<td>300</td>
<td>-</td>
</tr>
<tr>
<td>Total Travel Time (hr)</td>
<td>4,603</td>
<td>3,373</td>
</tr>
<tr>
<td>Value of Time ($/hr)</td>
<td>$17.65</td>
<td>$17.65</td>
</tr>
<tr>
<td>Total Cost ($)</td>
<td>$81,249</td>
<td>$59,539</td>
</tr>
<tr>
<td>Benefit ($)</td>
<td>-</td>
<td>$21,710</td>
</tr>
<tr>
<td>Annual Benefit ($)</td>
<td>-</td>
<td>$5,644,600</td>
</tr>
</tbody>
</table>
Travel Time Reliability
Reliability Evaluation Method

1. Collect 1 year of travel time data along project corridor
2. Obtain and integrate weather and crash data
3. Collect 1 year of travel time data in GP and MnPASS lanes along I-394 and I-35W South
   - Capture relationship between GP and MnPASS lanes
   - Project travel time savings for I-35W North MnPASS
Northbound – 2040 No Build
Northbound – 2040 MnPASS
Reliability by Person Trips
Peak Period/Peak Direction

- No Build
- MnPASS

- 4.0 x Free Flow
- 3.5 x Free Flow
- 3.0 x Free Flow
- 2.5 x Free Flow
- 2.0 x Free Flow
- 1.5 x Free Flow
- Free Flow
- Managed Lane
Travel Time Reliability Measurement Methodology

Day 1
- Normal
- 6 a.m. to 9 a.m.

Day 2
- Crash
- 6 a.m. to 9 a.m.

Day 3
- Crash and Snow
- 6 a.m. to 9 a.m.

Travel Time (min)

5:00 AM 7:30 AM 10:00 AM 5:00 AM

Base Travel Time (Travel Demand Model)
Variable Travel Time (Reliability Estimation)
Increased Reliability Cost
Decreased Reliability Cost
## Travel Time Reliability Calculation Results

<table>
<thead>
<tr>
<th></th>
<th>2040 No-Build</th>
<th>2040 MnPASS Build</th>
<th>2040 MnPASS Build</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Northbound</td>
<td>Southbound</td>
<td>General Purpose Lane</td>
</tr>
<tr>
<td>Reliability (Veh-Hr)</td>
<td>1,529,636</td>
<td>1,349,944</td>
<td>1,549,131</td>
</tr>
<tr>
<td>Time Value ($/Hr/Veh)</td>
<td>$22.48</td>
<td>$22.48</td>
<td>$22.48</td>
</tr>
<tr>
<td>Value of Reliability VHT ($)</td>
<td>$34,386,225</td>
<td>$30,346,732</td>
<td>$34,824,470</td>
</tr>
<tr>
<td>Subtotal User Cost ($)</td>
<td>$64,732,958</td>
<td></td>
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<tr>
<td>Annual Benefit</td>
<td></td>
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</tbody>
</table>
Benefit-Cost Analysis Results
Benefit-Cost Analysis Results

Positive Benefits by Category

- Travel Time Savings (VHT) 67.0%
- Travel Time Reliability 21.8%
- Transit Benefit 9.6%
- Safety 1.3%
- Other 1.6%
- Emergency 0.3%
Benefit-Cost Analysis Results

- Travel Time Savings: $398.4M
- Vehicle Ops Cost: $362.2M
- Crash Cost: $369.9M
- Reliability: $499.4M
- Transit: $556.6M
- Emergency Response: $558.1M
- Emissions: $550.4M
- Noise: $546.3M
- Capital Cost: $376.9M
- O&M Cost: $350.0M
- Remaining Capital Value: $385.6M

User Costs vs. Agency Costs
# Comparison Analysis and Conclusion

<table>
<thead>
<tr>
<th>Category</th>
<th>Original Framework</th>
<th>Refined Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost Component</strong></td>
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<td></td>
</tr>
<tr>
<td>Capital Cost</td>
<td>$169,466,823</td>
<td>$169,466,823</td>
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<tr>
<td>Operation and Maintenance Cost</td>
<td>$20,848,172</td>
<td>$26,838,533</td>
</tr>
<tr>
<td>Remaining Capital Value</td>
<td>-$35,522,760</td>
<td>-$35,522,760</td>
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<tr>
<td><strong>Total Cost (2015$)</strong></td>
<td><strong>$154,792,236</strong></td>
<td><strong>$160,782,596</strong></td>
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<tr>
<td><strong>Benefit Component</strong></td>
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</tr>
<tr>
<td>Travel Time Savings (VHT)</td>
<td>$368,122,531</td>
<td>$398,386,602*</td>
</tr>
<tr>
<td>Vehicle Operating Cost (VMT)</td>
<td>-$49,037,258</td>
<td>-$36,154,055*</td>
</tr>
<tr>
<td>Crash Cost/Safety</td>
<td>$6,766,596</td>
<td>$7,624,153*</td>
</tr>
<tr>
<td>Travel Time Reliability</td>
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<td>$129,588,931</td>
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<tr>
<td>Transit Benefit</td>
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<td>$57,120,143</td>
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<tr>
<td>Induced Travel</td>
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<td>-</td>
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<tr>
<td>Emergency Response</td>
<td></td>
<td>$1,521,542</td>
</tr>
<tr>
<td>Emission Impact</td>
<td></td>
<td>-$7,715,881</td>
</tr>
<tr>
<td>Noise Impact</td>
<td></td>
<td>-$4,024,296</td>
</tr>
<tr>
<td><strong>Total Benefit/Net Present Value (2015$)</strong></td>
<td><strong>$325,851,870</strong></td>
<td><strong>$546,347,139</strong></td>
</tr>
<tr>
<td><strong>Benefit-Cost Ratio</strong></td>
<td>2.11</td>
<td>3.40</td>
</tr>
</tbody>
</table>
Comparison Analysis and Conclusion

• Capture a wider range of project impacts in the alternative evaluation
• Improve the accuracy of the current MnPASS ROI methodology
• Improve the ability to verify the financial desirability of MnPASS alternatives
• Make project/alternative comparisons more comprehensive and consistent
• Provide better recommendations for practical investments
Questions?

Thank you!

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