High Return-on-Investment Strategies (and tactics)

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Tom O’Keefe
MnDOT Metro District Program Delivery
ROI in Transportation

- National effort;
  - A Key part of Asset Management
  - Expands on Benefit Cost analysis
    - Considers life cycle costs
    - Considers travel-time reliability
    - Considers enhanced economic development
    - Considers revenue generation, i.e. for public-private partnerships
- MnDOT; a part of Performance-based Solutions
Returns for Highway projects

- Monetized returns
  - Delay reduction or miles driven reduction; Vehicle Operating Costs, Operator/Passenger Value of time
  - Crash cost reduction; property damage, injury, fatality
- Not or Not yet Monetized returns
  - Maintenance cost change/Life cycle cost
  - Trip Reliability
  - Multi modal enhancement
  - Mode shift
  - Air pollution change
  - Noise impacts
  - Aesthetic change
  - ADA accessibility
  - Economic development
  - Accessibility to jobs
  - Construction jobs
  - Property value impacts, Public health, Others?
Opportunity Costs; ROI for project vs. ROI for program

- A dollar spent to gain a low rate of return on one project is likely a dollar not spent to gain a higher rate of return somewhere else.
- Focus on the system, consider improvements based on their contribution to the system as opposed to their individual perfection.
- Evaluate project needs based on the resources available in order to meet project goals.
Immediate vs. Future Returns

- Benefit of Lower-Cost, Early Investment
- Benefit of Large Full Build Investment

User Costs ($)

User Cost for ‘No Build’

User Cost for Build Alt. X

User Cost for Build Alt. Y

Project Cost X

Project Cost Y

Current Year

Time

+30 Years

Transportation and Infrastructure Management
ROI in Planning; 610 Traffic Forecasts

Traffic volumes forecast for I94—
  ◦ Similar to those on I-494 in Bloomington

Design effect:
  ◦ Called for 12 lane cross section on I-94, 6 lanes on TH 610
  ◦ Directional movements at many of the ramps connecting I-94 and TH 610
  ◦ High ROW need
610 Traffic Forecast issues

- Volumes seemed high for the area
- Called demographic assumptions into question
- Both had dramatic effect on potential design
  - Ancillary concern that at this scale, the project would potentially be too expensive to deliver in any reasonable timeframe
This would have to look like this...
Reality or reasonableness check

- Re-examined demographics
  - Population and employment trends vs. expected 2030 figures

- Revisited volumes at key locations
  - Entering volumes at District boundary exceeded what is possible…
Revised results

- Volumes consistent with rest of the region
- Design effect:
  - Analysis of existing vs. speculative volumes provides insights as to which movements are “required”
  - Potentially allows for reduced cross section (mainline I-94 and TH 610)
- Reduced ROW impacts under reduced cross section
Congestion Management & Safety Program (CMSP)

- To identify a list of lower-cost/high-benefit projects that seek to maximize mobility and reduce crash risk at key congestion and safety problem locations
CMSP – High ROI Strategy

Lower-Cost/High-Benefit Solutions:

1. Attempt to improve mobility and/or safety
2. Utilize existing pavement and ROW to the fullest extent possible
3. Support future plans or visions
4. Have shorter implementation timeframes
5. Take advantage of other funded projects/leverage capabilities
6. Are typically less than one mile in length
7. Seek to improve transit advantages
8. Tune the system rather than expand it
Scoring performed by computing the Return Period: the Length of Time for Delay and Crash Savings to Equal Project Cost

\[
\text{Return Period} = \frac{\text{Project Cost}}{\text{Problem Magnitude} \times \text{Effectiveness}}
\]

- Return period scores range from 1 month to 235 years
- 49 out of 60 solutions have return periods shorter than 10 years
- Solutions have been categorized into 3 tiers*
  - Tier 1: Return period less than 2 years
  - Tier 2: Return period between 2 years and 6 years
  - Tier 3: Return period between 7 years and 11 years

<table>
<thead>
<tr>
<th>Quantified Attributes</th>
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<tbody>
<tr>
<td>Problem Magnitude</td>
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<tr>
<td>Sum of Existing Delay and Crash Costs</td>
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<tr>
<td>Project Cost</td>
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<td>Planning-Level Construction Cost Estimate</td>
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<tr>
<td>Effectiveness</td>
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<tr>
<td>Percent of Existing Delay and Crash Costs Solved by Proposed Solution</td>
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694/TH10/TH51 Interchange

- Performance-Based Solution = $42M compared with Full-Build = $110M
- Performance-Based Solution provides 1 fewer lane in each direction than Full-Build
- Adding 3rd lane as Dynamic Shoulder Lane from Lexington to Rice cost is approximately $30M. Full-build with 4 lanes between Lexington and Rice est’d at $185M in 2007.
- Traffic flow Level of Service with current project plus dynamic shoulder lane is equivalent to that of the full-build project.
I-494 Dynamic Shoulder Lane
- Open during periods of high demand, general purpose use
- Lane control for incident management
I494 Dynamic Shoulder Lane

- 25% cost of MnPASS lane addition
- Limits maintenance costs
- TH55 to I94
- Open 2015
High ROI in Pavements
Concrete Unbonded Overlays (also full depth asphalt reclamation) vs. Reconstruction

Unbonded Concrete Overlay

New concrete layer
Seven to ten inches of new concrete is poured over the interlayer.

Interlayer
The interlayer serves as a bond breaker to prevent cracks on the existing concrete layer from transferring to the new concrete layer. This is called “reflective cracking”. Specially-designed fabric or up to an inch of bituminous may be used for interlayer material.

Existing concrete layer
Cracks and other imperfections are patched before the interlayer is placed over the existing surface.
Concrete Unbonded Overlays

Costs: (these are mainly derived from our Pavement Management System)

- Urban Reconstruction = $2,000,000 per lane mile
- Rural Reconstruction = $1,000,000 per lane mile
- Urban Unbonded Concrete Overlay = $750,000+ per lane mile
- Rural Unbonded Concrete Overlay = $500,000 per lane mile
- Full Depth Reclamation with new Bituminous = $350,000 per lane mile
Concrete Unbonded Overlays

Expected Service Life = 35 years
Time to Construct = 1 season
Concrete Unbonded Overlays

20% of Metro Interstates renewed in last 10 years with Reconstruction or Unbonded Overlays
High ROI in Pipe Replacement
Pipe-bursting – similar to pipe lining except existing pipe is burst and a equal or somewhat larger pipe is dragged behind. Costs ~60% of open trench pipe replacement not including the traffic or other impacts of open trenching.
Pipe-bursting neighborhood
It's QUESTION TIME!!