Project Performance Measurement

The Key to Measuring Non-monetary Value Improvement

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Topic Overview

- Why Measure Performance?
- Adjusted Job Plan
- Using Performance Measures
- Defining Performance Measures
- Scenario Development
- Lessons Learned
- Benefits
Why Measure Performance?

- Standard Value Equation is:
  \[ \text{VALUE} = \frac{\text{FUNCTION}}{\text{COST}} \]
  OR
  \[ \text{VALUE} = \frac{\text{TOTAL PERFORMANCE}}{\text{TOTAL COST (LCC)}} \]

- Many ways to measure project cost
- Very few ways to measure project performance
Determining Value

- Value improvement requires improvement in performance and/or reduction in cost.
- The measure of performance can be related to a set of project-specific criteria.
- Criteria can be set by project team or by external steering committee.
- Adding a few sub-steps to the VE job plan can ensure workshop success and increased value.
# VE Job Plan

## Workshop Activities

<table>
<thead>
<tr>
<th>Information Phase</th>
<th>Function Analysis Phase</th>
<th>Creative Phase</th>
<th>Evaluation Phase</th>
<th>Development Phase</th>
<th>Presentation Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand Project, Risks and Issues</td>
<td>Understand Purposes of Project Parts</td>
<td>Generate Ideas for Improved Value</td>
<td>Weight Performance Measures</td>
<td>Investigate Selected Ideas</td>
<td>Combine VEPs into Scenarios, Evaluate</td>
</tr>
<tr>
<td><strong>Develop Performance Measures</strong></td>
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</tbody>
</table>

**Post-Workshop Activities**

Evaluate Recommendations
Select Changes
Document Results
Using Performance Measures

- Determine Performance Measures
- Define Performance Measures
- Weight Performance Measures
- Develop Scenarios
- Evaluate Scenarios with Performance Measures
Typical Performance Measures

- Safety Improvement
- Traffic Operations
- Environmental Impacts
- Property Impacts
- Development Potential
- Access
- Constructability
Defining Performance Measures

- Relate Performance Measures to your specific project
- Provide a well-defined scoring system
  - 1 to 10 basis (Caltrans)
  - Weighted formula
- Quantitative (measurable) vs. Qualitative (GFI)
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition</th>
<th>Rating Scale</th>
<th>Unit of Measure/Quantification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainline Traffic Operations</td>
<td>A measure of the efficiency of traffic operations as they relate directly to the mainline alignment (including on-ramps and off-ramps) based upon a 20-year projected traffic forecast.</td>
<td>10</td>
<td>LOS “A”: Free flow – excellent operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>LOS “B”: Stable flow – very good operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>LOS “C”: Stable flow – good operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>LOS “D”: Approaching unstable flow – fair operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>LOS “E”: Unstable flow – poor operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>LOS “F”: Traffic congestion for 15 minutes to 1 hour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>LOS “F”: Traffic congestion for 1 to 2 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>LOS “F”: Traffic congestion for 2 to 3 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>LOS “F”: Traffic congestion for more than 3 hours</td>
</tr>
<tr>
<td>Criteria</td>
<td>Definition</td>
<td>Scale</td>
<td></td>
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<tr>
<td>------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>
| A. SAFETY  | Long-term safety performance of Highway 11, interchanges and adjacent road system for all road users. Includes:  
- Driver expectations;  
- Human factors;  
- Design consistency;  
- Geometrics;  
- Collision rates & severity;  
- Safety during maintenance;  
- Conflict Points;  
- Roadside Safety. | Rating of 10 – Highest reasonable level of safety for road users. Roadway features are designed to exceed min. standards, driver expectations are accommodated with design consistency & positive guidance. Improved local access, increased pedestrian crossing opportunities, off-road cyclist facilities. Rating of 1 – Lowest acceptable level of safety for all road users. Crash rates and severities will be below average for the type of facility. Most roadway elements will meet minimum design criteria, consistency with design is mostly provided. No improvements to pedestrian crossing opportunities. Four elements to be rated:  
Mainline (ML) Rating 1-10  
Ramps / interchanges (RI) Rating 1-10  
Service Roads (SR) Rating 1-10  
Local Roads (LR) Rating 1-10  
Overall Safety Rating = \[
\frac{50(ML) + 17(RI) + 17(SR) + 17(LR)}{101}\]                                                                                                                                                                                                 |
## Internal Weightings

Safety(i) = [50(ML)+17(RI)+17(SR)+17(LR)]

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>a</th>
<th>a</th>
<th>a</th>
<th>TOTAL</th>
<th>%</th>
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<tbody>
<tr>
<td>Mainline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.0</td>
<td>50%</td>
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<tr>
<td>Ramps / Interchanges</td>
<td>B</td>
<td>b</td>
<td>d</td>
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<tr>
<td>Service Roads</td>
<td>C</td>
<td>c</td>
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<td></td>
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<td>17%</td>
</tr>
<tr>
<td>Local Roads</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td>17%</td>
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<tr>
<td>a More Important</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.0</td>
<td>100%</td>
</tr>
<tr>
<td>a/b Equal Importance</td>
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</table>
Weighting Performance Measures

- Various Methods
  - Importance
  - Paired Comparison
  - 100 Points
  - Consensus
  - Equal

- Should be done after Function Analysis Phase
- Do before shortlisting ideas
Evaluation Phase Shortlisting Methodologies

- Comparison (better, similar, worse)
- Advantages (choose ideas with the most)
- Ranking or Auction (1-10 with cut-off)
- Pareto “Dots” (20% of ideas)
- Probability (of success)
- Estimate (cost reduction and performance)
- Performance Measures (calculate for ideas)
Scenario Development

- First Scenario is Base Case
- Group ideas with common themes
- Separate mutually exclusive ideas
- Try to keep to 6 or less
- This step can be optional
## True Measure of Value

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Total Performance (P)</th>
<th>Total Life Cycle Cost (C) $M</th>
<th>P/C Ratio</th>
<th>Ranking</th>
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</thead>
<tbody>
<tr>
<td>Scenario A-8</td>
<td>950</td>
<td>18.7</td>
<td>50.8</td>
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<tr>
<td>Scenario I-7</td>
<td>915.3</td>
<td>7.5</td>
<td>122.0</td>
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<tr>
<td>Scenario I-11</td>
<td>600.4</td>
<td>16.0</td>
<td>37.7</td>
<td>4</td>
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<tr>
<td>Scenario I-19</td>
<td>712.5</td>
<td>7.4</td>
<td>96.3</td>
<td>2</td>
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</table>
Lessons Learned

- Don’t make the formulas too complex
- Measure relative safety improvement
- Scenarios should be used
- Helps to name scenarios
  - Consider “fun” names
- Dealing with zero weights
Dealing With a Performance Measure with Zero Weight

<table>
<thead>
<tr>
<th>Alternative</th>
<th>SAFETY</th>
<th>FEASIBILITY</th>
<th>STABILITY</th>
<th>ACCESS</th>
<th>CONSTRUCTABILITY</th>
<th>ENVIRONMENTAL</th>
<th>TOTAL</th>
<th>%</th>
<th>Alternative</th>
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<td>A a a a a a</td>
<td>5.0</td>
<td>33%</td>
<td>32%</td>
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<td></td>
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<tr>
<td>Equal Importance</td>
<td>B c d b f</td>
<td>1.0</td>
<td>7%</td>
<td>6%</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>C d c f</td>
<td>2.0</td>
<td>13%</td>
<td>12%</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>D d d</td>
<td>4.0</td>
<td>27%</td>
<td>25%</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>E f</td>
<td>0</td>
<td>0%</td>
<td>5%</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td>F</td>
<td>3.0</td>
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<td>20%</td>
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<td></td>
<td></td>
<td>15.0</td>
<td>100%</td>
<td>100%</td>
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</tbody>
</table>
Dealing With a Performance Measure with Zero Weight

1. Re-assess Marking in Matrix
2. Eliminate Performance Measure
3. Add “Token” Weight
Benefits of Using Project Performance Measures

- Can build consensus with stakeholders
- Handles conflicting criteria
- Help to focus study
- Measures how well functions are delivered
- Uses quantitative or qualitative parameters to actively measure performance
- Increases visibility of all issues
- Can justify project cost increases
- Scenarios avoid double counting of savings