Scenario Analysis at WYDOT

Managing Risks in the Project Pipeline

Minimizing the Impacts of Highway Funding Uncertainties

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Uncertainties Can Ruin Your Asset Management Plans

Best Laid Plans
• Optimized project selection
• Intended performance benefits
• Assumed revenue by year

STIP—"Project Pipeline"

Unplanned Outcomes
• Actual Revenue?
• Missed deliveries
• Holding Costs
• Obsolete projects
• “Hurry-up” projects
• Low performance

Project Programming


Pipeline Uncertainties
• Scope growth and project costs
• Labor and Materials price volatility
• Environmental or ROW issues
• Unplanned political priorities
• Construction cost inflation

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Larry Redd LLC
Elements of Scenario Planning

• What is a “plausible future”, and relevant dimensions?
• Scenario development – how many plausible futures to consider, are they internally coherent, and “bounding”? 
• Strategy development – what do you have control over, what will have an impact, and how do you test these?
• Simulation – can you, or should you, attempt to dynamically simulate your situation?
• “Model, Measure, Manage” and maximizing the effectiveness and adaptability of your strategies
Scenario Analysis

- Two funding scenarios --
  - “Blocky” and “Smooth”
- Strategies tested --
  - Projects programmed / year
  - Mix of projects
  - Reducing Holding Costs
  - Reducing “Hurry-up” inefficiencies
  - Reducing Uncertainty Factors – such as scope growth, design delays, political priorities, project costs
  - Use of funding projections
15 yr “Blocky” Funding Profile

Anticipated Funding

Jan 01, 2012 to Jan 01, 2022

Representative values

- dollars/yr
  - 300,000,000
  - 250,000,000
  - 225,000,000
  - 200,000,000
  - 150,000,000

150,000,000
200,000,000
250,000,000
300,000,000
Sensitivity to Pipeline Costs

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Nominal</th>
<th>Best Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holding Costs</td>
<td>4%</td>
<td>2%</td>
</tr>
<tr>
<td>Hurry Up Efficiency</td>
<td>60%</td>
<td>80%</td>
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</tbody>
</table>

Nominal Costs

Best Case Costs

% of “Anticipated” (3R4Rs) Loaded into Pipeline

$MM Paved

80 90 100 110 120

3150 3200 3250 3300 3350 3400
15 yr “Smooth” Funding Profile

Representative values
“Smooth” vs. “Blocky” Funding

$MM Paved

% of “Anticipated” (3R4Rs) Loaded into Pipeline
Parametrics -- Potential Savings

Can be significant

Subtotal – 3 to 6 %

- Blocky vs. Smooth revenue -- 1 to 5 %
- Mitigation of Uncertainty Factors -- TBD %
- “Balancing the Pipeline” – approx. 2%
- Reduction in Project Pipeline costs -- 2 to 4 %

Can be significant
Specific Results -- Strategy Selection

- Pipeline balance –
- Holding costs --
  - Crashes during delays
  - Redesign costs
- Hurry-Up costs
  - Effects on 3R4Rs
  - Effects on prices
  - Wrong treatments
- Uncertainty Factors
  - Scope growth
  - Design times
  - PCS issues

Quantify Benefits vs. “What If” Scenarios

Select & Plan Process Improvement Efforts

<table>
<thead>
<tr>
<th>Avg Annual Impact - $MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue Sources</td>
</tr>
<tr>
<td>$12</td>
</tr>
</tbody>
</table>

- Pipeline balance –
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For More Info:

• **Contact** –
  – LarryRedd@earthlink.net
  – 970-219-4732

• **White Paper Topics:**
  – 2011 TRB Paper on “Project Pipeline Risks”
  – Materials Risks and Paving Strategies
  – Asset Tradeoff Analysis and Target-setting
  – Maximizing the Effectiveness of TAM
  – Integrating SMS into Asset Management
Non-Optimum Project Pipeline Costs

Costs of “Being Too Lean”--
-Loss of Stimulus Funds, Block Grants, Special Legislative Funds
-“Hurry-up” design and devel. costs
-Non-optimum advanced const.

Holding Costs –
-“PE 10 yr Limit List”
$Millions at risk, and $Billions in projects may not get done
-Lost permit costs
-ROW and EA costs
-Development costs
-Obsolete projects
-Redesign costs

Amount of Projects Loaded into the Pipeline

“Optimum” Range
Hurry-up Paving and Inventory*

* For the “DownUp” Revenue Profile Case
Revenue Available – Including Noise

Band of “Noise” (Uncertainties)
## Strategies vs. “What you know”

<table>
<thead>
<tr>
<th>If you know:</th>
<th>Applicable Strategy</th>
<th>UpDown Savings</th>
<th>DownUp Savings</th>
<th>WYDOT Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nothing about future revenue</td>
<td>Load known $ into Pipeline</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Revenue amount for 1 year out</td>
<td>Plug in “next year’s revenue” to load Pipeline</td>
<td>1.2 %</td>
<td>0.8 %</td>
<td>0.5 %</td>
</tr>
<tr>
<td>Revenue amount for 2 years out</td>
<td>Plug in revenue “two years ahead” to load Pipeline</td>
<td>1.8 %</td>
<td>1.3 %</td>
<td>1.0 %</td>
</tr>
<tr>
<td>Revenue profile over the time horizon</td>
<td>Optimize amount loaded into the Pipeline annually</td>
<td>1.8 %</td>
<td>1.3 %</td>
<td>2.2 %</td>
</tr>
</tbody>
</table>