Assessing the Role of Advanced Vehicle Technology in MPO Planning Scenarios

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Objectives and Scope

- How could advanced vehicle technology change investment priorities for MPO’s?
- What performance outcomes could be affected by low-emission and driverless technology?
- How can we use scenarios to understand how these technologies relate to transportation performance and investment priorities?
- Focus is on how performance is evaluated, not on land use, travel behavior and traffic forecasting methods.
• Compare two regional transportation investment options: One highly oriented towards Transit, one Highly Oriented toward Highways

• How would a different vehicle technology paradigm affect the comparison?

• What performance areas are most sensitive to the effects and adoption of these technologies?
Steps & Dimensions of advanced vehicle economic evaluation scenario

- Begin with traditional investment scenarios (in this case Highway Intensive Vs. Transit Intensive)
- Develop Key Advanced Vehicle Typologies
- Develop Likely Performance Characteristics
- Consider Potential Adoption Rates
- Test Effects on Investment Scenario Evaluation

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Two Investment Options

• Major Highway Investment
• Major Transit Investment
Base Case Condition

- Current Public Transportation System
- $14 million / year for Operations
- (serves about 6,000 riders per average weekday)
Transit Build Scenario

- 2040 Vision Public Transportation System
- $60 million/year for Operations
  - More routes
  - More coverage
  - Longer service hours
  - Better frequency
  - (hope to serve 18,000 riders per average weekday)
Highway Build Scenario

- Widen 7 miles of interstate from 2 lanes each direction to 3 lanes per direction.
- Cost Unknown
  - Section from Exit 29 to Karcher
    - Environmental Study recently funded
  - Section to the east is funded at $150.4 m
Questions:

Does advanced vehicle technology affect the business case for either of these investment strategies?

How can this be considered?
5 Advanced Vehicle Technologies to Consider:

- Ultra Low Emission “Owned” Car
- Ultra Low Emission “Owned” Car with Driverless Capability
- Ultra Low Emission “On-Demand” Car (Driverless)
- Ultra Low Emission Transit Bus with Driverless Capability
- Delivery/Business Truck with Driverless Capability
## Consider Potential Adoption Rates

<table>
<thead>
<tr>
<th>Technology</th>
<th>Moderate Rate</th>
<th>Aggressive Rate</th>
<th>Moderate 2050%</th>
<th>Aggressive 2050%</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULV – Owned</td>
<td>.5%</td>
<td>1%</td>
<td>16%</td>
<td>31%</td>
</tr>
<tr>
<td>ULV/Driverless - Owned</td>
<td>.25%</td>
<td>.5%</td>
<td>8.25%</td>
<td>15.75%</td>
</tr>
<tr>
<td>ULV/Driverless – On-Demand</td>
<td>.25%</td>
<td>.5%</td>
<td>8%</td>
<td>15.5%</td>
</tr>
<tr>
<td>ULV/Driverless - Transit</td>
<td>N/A</td>
<td>N/A</td>
<td>50%</td>
<td>70%</td>
</tr>
<tr>
<td>ULV Local Truck</td>
<td>N/A</td>
<td>N/A</td>
<td>20%</td>
<td>40%</td>
</tr>
</tbody>
</table>

### Deriving Adoption Rates:
- Analogous Cities/Regions (US or Abroad)
- Models in Literature
- Local Focus Groups/Interviews (auto dealers, delivery carriers, transit management)
## Consider Economic Drivers

<table>
<thead>
<tr>
<th>Technology</th>
<th>Value of Time</th>
<th>Crash Rate</th>
<th>Emissions</th>
<th>Operation &amp; Fuel Cost</th>
<th>Occupancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULV – Owned</td>
<td>=</td>
<td>=</td>
<td>↓</td>
<td>↓</td>
<td>=</td>
</tr>
<tr>
<td>ULV/Driverless – Owned</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>ULV/Driverless – On-Demand</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>ULV/Driverless – Transit</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>=</td>
</tr>
<tr>
<td>ULV Local Truck</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>=</td>
</tr>
</tbody>
</table>
## Benefits Shift Based on Vehicle Technology

<table>
<thead>
<tr>
<th>Performance Areas</th>
<th>Highway Scenario</th>
<th></th>
<th>Transit Scenario</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Moderate</td>
<td>Aggressive</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advanced</td>
<td>Vehicle</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vehicles</td>
<td>Costs</td>
<td></td>
</tr>
<tr>
<td>Vehicle Operating Costs</td>
<td>$12.20</td>
<td>$6.60</td>
<td>$2.00</td>
<td>-$55.30</td>
</tr>
<tr>
<td>Business Time &amp; Reliability Costs</td>
<td>$372.00</td>
<td>$354.10</td>
<td>$340.80</td>
<td>$188.60</td>
</tr>
<tr>
<td>Value of Personal Time &amp; Reliability</td>
<td>$648.50</td>
<td>$636.80</td>
<td>$624.90</td>
<td>$426.90</td>
</tr>
<tr>
<td>Safety Cost</td>
<td>-$34.40</td>
<td>-$32.90</td>
<td>-$31.60</td>
<td>$22.90</td>
</tr>
<tr>
<td>(C) Shipper/ Logistics Cost</td>
<td>$21.70</td>
<td>$21.70</td>
<td>$21.70</td>
<td>$10.10</td>
</tr>
<tr>
<td>(E) Social/ Environ.</td>
<td>$16.70</td>
<td>$14.50</td>
<td>$12.90</td>
<td>$4.90</td>
</tr>
<tr>
<td>Total Benefits</td>
<td>$1,036.70</td>
<td>$1,000.80</td>
<td>$970.70</td>
<td>$598.10</td>
</tr>
</tbody>
</table>
Observations Regarding Benefits

- Highway Expansion Benefits are harder to achieve as vehicle technology advances.
- Operating Costs, Travel Time and Environmental Costs less a source of benefit as vehicle technology advances.
- Safety dis-benefit (of additional VMT) is moderated by advanced vehicle technology.
- Transit Benefits may be easier to achieve due to:
  - Potential for more reliable service (especially if integrated with driverless car modes).
  - Less cost of operating and maintaining transit vehicles.
  - Less reliance on costly and high-polluting diesel.
• Economic Benefits/ROI Analysis can sensitivity of major investments to changes in vehicle technology
• Consider multiple adoption rates & technology characteristics
• Integration of additional factors can add further value such as:
  ▪ Congestion effects of Better Utilizing Existing Capacity
  ▪ Land Use Effects & Underlying Spatial Patterns
  ▪ Fiscal Effects of Reduced Fuel Consumption or Land Values
  ▪ Scenarios integrating transit with other types of mobility
Thank You!

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