Benefit-Cost Analysis for Transportation Projects

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Outline

- Introduction
- Procedure
- Models
- Issues
- Conclusions
Introduction

- Evaluation of economic advantages and disadvantages of a set of investment alternatives
- Good practice to perform benefit-cost analysis during all stages of a project
- Results important in prioritization
Procedure

Stages of benefit-cost analysis development:

- Planning
- Engineering Analysis
- Economic Valuation
- Evaluating results
Procedure

User Input information:

- Project Type
- Location
- Length of Construction Period
- Estimated Length of Peak Period
- AADT
- Crash data
Procedure

Parameters:

- Discount rate
- Value of Time
- Crash Rates
- Emission Costs
Procedure

Analysis:

Benefits:

- Travel-Time Savings
- Vehicle Operating Cost Savings
- Accident Cost Savings
- Emission Reduction
Procedure

Analysis:

Costs:

- Capital Costs
- Operational/Maintenance Costs
- Rehabilitation Costs
Models

Three main categories:

- Sketch-planning methods
- Post-processing methods
- Multiresolution/Multiscenario methods
Models

- **Sketch-planning methods:**
  - Spreadsheet based
  - Best for early stages of planning
  - Advantages:
    - Easy to use
    - Limited data required
    - Faster setup and analysis
    - Lower cost
    - Customizable

www.ces-1.com
Models

- Sketch-planning methods:
  - Disadvantages:
    - Results best for low to moderate level of analysis
    - Limited measures of effectiveness
    - Linear assumptions for user behavior
Models

- **Post-processing methods:**
  - Customized interfaces
  - Best for mid to late stages of prioritization
  - Advantages:
    - Analysis of traveler behavior
    - Data availability
    - Consistent with regional planning
    - Reusable process
Models

- **Post-processing methods:**
  - Disadvantages:
    - Effort of analysis
    - Compatibility with tools available
Models

- **Multiresolution/Multiscenario methods:**
  - Most complex method
  - Best during final design phase
  - Advantages:
    - Access both short and long term travel behaviors
    - Dynamically model conditions
    - Detail of analysis
    - Flexible method of analysis
Models

- Multiresolution/multiscenario methods:
  - Disadvantages:
    - Effort of analysis
    - Compatibility with tools available
    - Scope limited
Models

- BCA.Net
- Cal B/C
- AASTHO Redbook
- Surface Transportation Efficiency Analysis Module (STEAM)
BCA.net

- Developed by FHWA
- Web-based
- Post-processing method
Cal B/C

- Benefit-cost analysis model developed by Caltrans.
- Sketch-planning tool
- Highway and transit projects.
Cal B/C

PROJECT DATA

HIGHWAY ACCIDENT DATA

HIGHWAY DESIGN AND TRAFFIC DATA

RAIL AND TRANSIT DATA
### Parameters

This page contains all economic values and rate tables. To update economic values automatically, change "Economic Update Factor."

#### General Economic Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of Current Dollars for Model</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>Economic Update Factor (Using GDP Deflator)</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Real Discount Rate</td>
<td>3.0%</td>
<td></td>
</tr>
</tbody>
</table>

#### Travel Time Parameters

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statewide Average Hourly Wage</td>
<td>$20.30</td>
<td>$/hr</td>
</tr>
<tr>
<td>Heavy and Light Truck Drivers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Hourly Wage</td>
<td>$18.65</td>
<td>$/hr</td>
</tr>
<tr>
<td>Benefits and Costs</td>
<td>$10.15</td>
<td>$/hr</td>
</tr>
<tr>
<td>Value of Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automobile</td>
<td>$11.26</td>
<td>$/hr/per</td>
</tr>
<tr>
<td>Truck</td>
<td>$34.54</td>
<td>$/hr/veh</td>
</tr>
<tr>
<td>Auto &amp; Truck Composite</td>
<td>$16.45</td>
<td>$/hr/veh</td>
</tr>
<tr>
<td>Transit</td>
<td>$10.15</td>
<td>$/hr/per</td>
</tr>
<tr>
<td>Out-of-Vehicle Travel</td>
<td>2</td>
<td>times</td>
</tr>
<tr>
<td>Incident-Related Travel</td>
<td>3</td>
<td>times</td>
</tr>
<tr>
<td>Travel Time Uprate</td>
<td>0.0%</td>
<td>annual incr</td>
</tr>
</tbody>
</table>

#### Highway Operations Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum V/C Ratio</td>
<td>1.56</td>
<td></td>
</tr>
<tr>
<td>Percent ADT in Peak Period</td>
<td>41.0%</td>
<td>%</td>
</tr>
<tr>
<td>Percent ADT in Average Peak Hour</td>
<td>8.2%</td>
<td>%</td>
</tr>
<tr>
<td>Annualization Factor</td>
<td>365</td>
<td>days/yr</td>
</tr>
</tbody>
</table>

#### Vehicle Operating Cost Parameters

<table>
<thead>
<tr>
<th>Category</th>
<th>Alpha</th>
<th>Beta</th>
<th>Capacity (vphpl)</th>
<th>Dep. Rate (vphpl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway</td>
<td>0.20</td>
<td>10</td>
<td>2,000</td>
<td>1,800</td>
</tr>
<tr>
<td>Expressway</td>
<td>0.20</td>
<td>10</td>
<td>2,000</td>
<td>1,800</td>
</tr>
<tr>
<td>Conventional Highway</td>
<td>0.05</td>
<td>10</td>
<td>800</td>
<td>1,400</td>
</tr>
<tr>
<td>HDV Lanes</td>
<td>0.55</td>
<td>8</td>
<td>1,600</td>
<td></td>
</tr>
<tr>
<td>Non-HOV Lanes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Build</td>
<td>0.20</td>
<td>10</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>Build</td>
<td>0.20</td>
<td>10</td>
<td>2,000</td>
<td></td>
</tr>
</tbody>
</table>
AASHTO Red Book

- Developed by AASHTO
- Sketch-planning tool
- Excel spreadsheet with wizard integrated
AASHTO Red Book

Redbook Wizard

To begin, save a copy of this file under a new name, and then continue.

Go!
Roadside & Lighting Improvements
You'll need to provide the following information about roadside and lighting improvements:

* New peak hour, peak direction traffic volume (PCE/h)
* Free flow speed (mph)
* New peak direction capacity (veh/h)
* Number of accidents by type (property damage, injury, fatal)
* Agency operating costs

The following Redbook sections provide more information:

* Pages 5-38 to 5-40
* Equation 5-22
* Table 5-11
STEAM

- Developed in 1997 by FHWA
- Four module
  - User interface module
  - Trip table analysis module
  - Evaluation summary module
- Used for system-wide analysis
- Provides analysis for 7 modes of transportation
Issues

- No general consensus of valuation of economic parameters
  - Crash costs
- No one program suitable for all project types
- Agencies should provide guidance and training
Conclusion

- Best to conduct benefit-cost analysis are can be done within different stages of a project in order to measure its advantages over its disadvantages.
- Many models available to conduct Benefit-Cost analysis.
- Understand project scope to better choose level of analysis.
- Differences in economic values cause for varying results.
References

- AASHTO Redbook Wizard
- BCA.net Model
- California Life-Cycle Benefit/Cost Analysis Model

https://sites.google.com/site/benefitcostanalysis/
Questions