Meeting Agenda

I. Introduction (All)

II. Review of other BCA Approaches (John Long, DKS)

III. Application of SACOG BCA Approach: Working Group Test Projects (Garett B-R, SACOG)

IV. Example of Performance Outcomes Approach on Same Test Projects (Clint Hotzen, SACOG)

V. Meeting Evaluation (All)
Project Performance Assessment
Review of BCA Approaches

SACOG PPA Work Group meeting
July 20, 2017
SACOG’s Draft BCA

- Travel time by mode
  - Auto, transit, walk, bike and freight

- Individual travel costs
  - Passenger and freight vehicular operating costs
  - Auto ownership costs

- Reliability
  - Buffer hours for auto and freight trips

- Emissions
  - CO2, PM 2.5, Nox, ROG, SO2 (Integrated with EMFAC)

- Safety
  - Road accidents (injury, fatality, property damage only)

- Public health
  - Number of people getting at least 30 minutes of physical activity a day through transportation (walk, bike, walk to/from transit)

- Project’s capital and O&M costs
Review of Other BCA Models

- Traditional BCA has focused on network level benefits
  - Travel time savings
  - Operating cost savings
  - Reduction in accidents
  - Reduction in emissions

- New BCA models include “triple bottom line” benefits and costs
  - Economic
  - Environmental
  - Social/equity

- Improved BCA models include:
  - Physical activity benefits
  - Multi-modal access benefits
  - Equity analysis

- New BCA models require travel model with appropriate resolution
BCA Tool with Triple Bottom Line

- SACOG (Sacramento)
- MTC (Bay Area)
- SANDAG (San Diego)
- Metro (Portland)
- PSRC (Seattle)
MTC’s BCA

- **Individual (Activity-Based) time by mode**
  - Travel time by mode
  - Travel Costs (tolls, operating cost and fares)
  - Physical activity (amount of walking and biking each day)
  - Household vehicle ownership cost
  - Benefits by equity groups (percent low income, minority, elderly, disability, English proficiency, single parent family, etc.)

- **Aggregate (Trip-based)**
  - Truck travel time and costs

- **Network**
  - Accidents
  - Reliability
  - Emissions
  - Noise
SANDAG’s BCA

- **Individual (Activity-Based) time by mode**
  - Travel time by mode
  - Travel Costs (tolls, operating cost and fares)
  - Physical activity (amount of walking and biking each day)
  - Household vehicle ownership cost
  - Benefits by equity groups (similar to MTC)

- **Aggregate (Trip-based)**
  - Truck travel time and costs
  - Destination, mode accessibility logsums measure (travel options) by purpose/market segment (part of FHWA research)

- **Network**
  - Accidents
  - Reliability
  - Emissions
PSRC’s BCA

- **Individual (Activity-Based) time by mode**
  - Travel time by mode
  - Travel Costs (tolls, operating cost and fares)
  - Auto travel time reliability
  - Household vehicle ownership cost
  - Benefits by equity groups (similar to MTC)

- **Aggregate**
  - Currently developing a mode-destination logsum accessibility measure

- **Truck**
  - Truck travel time and cost

- **Network**
  - Accidents
  - Emissions
PSRC’s BCA

- **Aggregate (Trip Based)**
  - Travel time and costs by mode
  - Auto travel time reliability
  - Household vehicle ownership cost
  - Physical activity (ITHIM)
  - Destination, mode accessibility logsum measure (travel options) by trip purpose
  - Truck travel time and cost
  - Benefits by equity groups (similar to MTC)

- **Network**
  - Accidents
  - Emissions (MOVES)
  - Surface water (based on VMT)
  - Noise
  - Vehicle operating costs
Working Group Measures

- Growth inducement
- The value of agricultural and ecosystem services lost by building a transportation project
- Equity
- Rural-specific measures
Growth Induced by Transportation Projects

- Induced **travel** on facility is estimated by SACSIM (change in route, mode, destination and time of day)

- Induced **growth** (land development) is a complex and controversial topic - not dealt with travel models and BCA

- Most use simple development allocation models (UPLAN)

- Research has shown that:
  - Very complex to predict the effects of transportation projects on land use development
  - Very difficult to isolate and value the BCA of land use changes and associated changes in regional travel
Value of Agricultural and Ecosystem Services Lost

Benefits people obtain from ecosystems include

- Provisioning services - such as food and water
- Regulating services - such as regulation of floods, drought, land degradation, and disease
- Supporting services - such as soil formation and nutrient cycling
- Cultural services - such as recreational, spiritual, religious and other non-material benefits.
Value of Agricultural and Ecosystem Services Lost

- This is an expansive topic with many sub-systems/services.
- Requires detailed data and analysis – such as EIS/EIR
- Need to narrow down to a small set of key impacts for BCA
- Assigning economic value of ecosystem is tricky
- Unable to identify broad application of ecosystem services BCA in the long-range transportation planning process.
- Singular exception is air quality analysis
Value of Agricultural and Ecosystem Services Lost

• While a BCA level analysis of ecosystems services may be difficult to achieve in the near term, the opportunity to develop an outcomes-based methodology may be a more viable option.

• SACOG has a robust inventory of land use and transportation data that could form the basis for a high-level assessment of impacts.
Equity Analysis

Equity analysis can be included in BCA - key dimensions include:

- Income groups
- Age groups
- Auto ownership / ability to drive
- Race/ethnicity
- Geography/neighborhoods relative to project locations
- Users of particular modes
Equity Analysis

- SACSIM uses a wide variety of household and person characteristics (income, age, auto ownership)
- So these differing preferences and situations of different population groups are taken into account
- SACSIM also simulates individual trips for specific persons and households, which gives flexibility in aggregating the trips along any desired dimensions
- Race and/or ethnic groups not in model and is often assessed by focusing on specific geographical areas with high incidence of specific population groups
Equity Analysis

- SACSIM aggregates trips into origin-destination matrices by mode and time-of-day for input to the BCA.

- SACSIM can also aggregate by population group – such as households below and above the poverty level.

- Sizes of the population groups will be different, so important to evaluate benefits on a per-capita and/or a per-household basis, rather than reporting only total benefits.

- Income is important since other variables - such as auto ownership - are related to income.

- Most recommend that value of travel time savings (VOT) used in BCA should be income-neutral.
Funding is an ongoing challenge for road maintenance, capacity and safety improvements to support agricultural and recreational activity in rural communities.

Rural areas have a lot of miles of two-lane roads that are often substandard and poorly maintained.

To support growth in this sector, transportation investments will need to be considered strategically.

SACOG recognized this and launched the Rural-Urban Connections Strategy (RUCS).
Rural-Specific Measures

- Most examples of agencies using BCA in rural areas come from state DOTs and their performance measures typically look similar to those used in urban area.

- Most examples of rural-specific measures are used in an outcome-based process and are difficult to integrate into a BCA.
Virginia DOT uses an objective and outcome based process to evaluate transportation projects and weight performance measures based on their locations – urban vs rural areas.

For rural areas, economic development has the highest weight followed by safety and accessibility.

While weighting by area type could be a good practice for an outcome based process - it is not used in a standard BCA.

While safety is included in all BCA examples, the impact of transportation improvements on economic development is not and is different for rural areas than urban areas.
<table>
<thead>
<tr>
<th>Category</th>
<th>Caltrans Measure</th>
<th>SACOG Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>Accident Rate per million vehicle miles based on:</td>
<td>• Road accidents involving an injury or fatality</td>
</tr>
<tr>
<td></td>
<td>• Accident data,</td>
<td>• Road accidents with property damage only</td>
</tr>
<tr>
<td></td>
<td>• Roadway length</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Traffic volumes (AADT)</td>
<td></td>
</tr>
<tr>
<td>System Preservation</td>
<td>Pavement Management System (PMS)</td>
<td></td>
</tr>
<tr>
<td>Mobility</td>
<td>• Travel times</td>
<td>• Travel time by mode</td>
</tr>
<tr>
<td></td>
<td>• Speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Delay (actual travel time minus free flow time)</td>
<td></td>
</tr>
<tr>
<td>Accessibility</td>
<td>Travel time between first and second fastest routes</td>
<td></td>
</tr>
<tr>
<td>Reliability</td>
<td>Travel times over numerous days or throughout year (PeMS data)</td>
<td>• Buffer hours for auto and freight trips</td>
</tr>
<tr>
<td>Productivity</td>
<td>Throughput based on volume/capacity ratio, speeds and vehicles served</td>
<td></td>
</tr>
<tr>
<td>Return on Investment</td>
<td>California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C)</td>
<td>SACOG BCA methodology</td>
</tr>
</tbody>
</table>
Rural-Specific Measures

• SACOG has performance measures for safety, mobility and reliability.

• A measure related to pavement conditions, which is a major issue for rural areas/jurisdictions, could be considered in outcome based analysis but difficult for BCA.

• SACOG should consider the following in its BCA:
  - Recognizing that traffic volumes can fluctuate by much higher percentages on some rural roadways than urban ones – that is major recreational and agricultural routes.
  - Recognize that rural roadways have higher crash rates and crashes tend to be more severe than urban areas.
Work Group Questions

Do you have any questions about the material presented?

Are there measures discussed that you want in the BCA?
III. SACOG’s Benefit Cost Analysis: Application

July Meeting Goal:
- present BCA test projects results
- working group feedback on tool and use
- discuss other measures identified by working group
Review

April:
- BCA methodology and how tools works
- 1\textsuperscript{st} round test project: SACOG application (made up project)
- 2\textsuperscript{nd} round test projects: Bay Area Projects

May
- Model overview workshop (optional)
- TRB conference

June
- 3rd round of test projects: project bundles
Upcoming

July (today’s meeting)
- 4th round of test projects (working group identified)
- feasibility of new measures

August
- threshold and sensitivity testing
- 5th round test projects(?)

September
- synthesis of working group feedback
<table>
<thead>
<tr>
<th>Time Savings</th>
<th>Transit Package</th>
<th>Bike and ped</th>
<th>HOV lanes</th>
<th>Arterial Bundle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Travel Time</td>
<td>65,000 hours</td>
<td>18,000 hours</td>
<td>722,000 hours</td>
<td>650,000 hours</td>
</tr>
<tr>
<td>Transit Travel Time</td>
<td>810,000 hours</td>
<td>40,000 hours (note trips)</td>
<td>13,000 hours</td>
<td>4,000 hours</td>
</tr>
<tr>
<td>Truck Travel Time</td>
<td>12,000 hours</td>
<td>-2,000 hours</td>
<td>124,000 hours</td>
<td>122,000 hours</td>
</tr>
<tr>
<td>Bike/Ped Travel Time</td>
<td>500 hours</td>
<td>300,000 hours</td>
<td>0 hours</td>
<td>0 hours</td>
</tr>
<tr>
<td>Additional measures</td>
<td>Transit Package</td>
<td>Bike and ped</td>
<td>HOV lanes</td>
<td>Arterial Bundle</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------</td>
<td>--------------</td>
<td>-----------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Reliability</td>
<td>65,700 hours</td>
<td>13,170 hours</td>
<td>250,000 hours</td>
<td>145,000 hours</td>
</tr>
<tr>
<td>User costs</td>
<td>7 million fewer VMT</td>
<td>1.5 fewer million VMT</td>
<td>25 million VMT</td>
<td>12 million VMT</td>
</tr>
<tr>
<td>Emissions</td>
<td>5,550 fewer metric tons</td>
<td>700 fewer metric tons</td>
<td>12,000 metric tons</td>
<td>500 metric tons</td>
</tr>
<tr>
<td>Public Health</td>
<td>1,400 active people</td>
<td>200 active people</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Feedback from June Meeting

-Umm, what about rural projects?
-Further examples please
-Let’s work through with specific projects
Test Projects: U.S. 50 HOV Lanes

• Jurisdiction: El Dorado County

• Project Description:
  – Added HOV lanes (both directions) on Highway 50 from El Dorado Hills Blvd to Cameron Park Drive.
  – Added truck climbing lane eastbound from Latrobe Rd to Bass Lake Grade
  – Ramp metering and HOV lane ramp on US50/ El Dorado Hills Blvd interchange

• Project cost: $82,358,000
Test Projects: County Road 98

• Jurisdiction: Yolo County

• Project Description:
  – Widen to include 8 foot shoulder and bike lane, 12 feet recovery area and relocated utilities and drainage
  – Widen two bridges and added left turn lanes at 3 major intersections
  – 4.5 mile project extent from Woodland to near Davis (1,400 feet south of CR29)

Project cost: $14,245,000
Test Projects: Hazel Ave Phase 1

• Jurisdiction: Sacramento County

• Project Description:
  – Widened Hazel Avenue from four to six lanes over American River Bridge to Curragh Downs Drive
  – Constructed bike/ped/equestrian lane separated from vehicle traffic by barrier
  – Improved connections to American River bike trail

• Project cost: $45,000,000
<table>
<thead>
<tr>
<th>US50 HOV lanes</th>
<th>Benefits</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Time</td>
<td>1,083,000 hours</td>
<td></td>
</tr>
<tr>
<td>Transit Time</td>
<td>7,800 hours</td>
<td></td>
</tr>
<tr>
<td>Bike/Walk Time</td>
<td>0 hours</td>
<td></td>
</tr>
<tr>
<td>Truck Time</td>
<td>166,000 hours</td>
<td></td>
</tr>
<tr>
<td>Reliability</td>
<td>144,000 hours</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td></td>
<td>35 more collisions</td>
</tr>
<tr>
<td>User operating/owner</td>
<td></td>
<td>31 million VMT</td>
</tr>
<tr>
<td>Emissions (CO2)</td>
<td></td>
<td>6,900 metric tons</td>
</tr>
<tr>
<td>Public Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction/ Operating</td>
<td></td>
<td>$4 million</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$14 million</strong></td>
<td><strong>$4.75 million</strong></td>
</tr>
<tr>
<td><strong>B/C Ratio</strong></td>
<td><strong>3.0</strong></td>
<td></td>
</tr>
<tr>
<td>CR98</td>
<td>Benefits</td>
<td>Costs</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Auto Time</td>
<td>8,437 hours</td>
<td></td>
</tr>
<tr>
<td>Transit Time</td>
<td>0 hours</td>
<td></td>
</tr>
<tr>
<td>Bike/Walk Time</td>
<td>132 hours</td>
<td></td>
</tr>
<tr>
<td>Truck Time</td>
<td>1,344 hours</td>
<td></td>
</tr>
<tr>
<td>Reliability</td>
<td>8,255 hours</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>2.3 property damage, 1.1 serious injury</td>
<td></td>
</tr>
<tr>
<td></td>
<td>collisions avoided</td>
<td></td>
</tr>
<tr>
<td>User operating/owner</td>
<td>600,000 decrease VMT</td>
<td></td>
</tr>
<tr>
<td>Emissions (CO2)</td>
<td>382 ton reduction</td>
<td></td>
</tr>
<tr>
<td>Construction/ Operating</td>
<td></td>
<td>$356,163</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$599,368</strong></td>
<td><strong>$356,163</strong></td>
</tr>
<tr>
<td>B/C Ratio</td>
<td>1.7</td>
<td></td>
</tr>
</tbody>
</table>
Annual Fatality Rate (per 100 M VMT)

Source: Caltrans Performance Monitoring Program
<table>
<thead>
<tr>
<th>Hazel Ave Phase 1</th>
<th>Benefits</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Time</td>
<td>305,000 hours</td>
<td></td>
</tr>
<tr>
<td>Transit Time</td>
<td>4,200 hours</td>
<td></td>
</tr>
<tr>
<td>Bike/Walk Time</td>
<td>170 hours</td>
<td></td>
</tr>
<tr>
<td>Truck Time</td>
<td>31,325 hours</td>
<td></td>
</tr>
<tr>
<td>Reliability</td>
<td>61,862 hours</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>12 fewer collisions</td>
<td></td>
</tr>
<tr>
<td>User operating</td>
<td></td>
<td>4 million VMT</td>
</tr>
<tr>
<td>User ownership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emissions (CO2)</td>
<td></td>
<td>465 metric tons</td>
</tr>
<tr>
<td>Public Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction/ Operating</td>
<td>$2 million</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>$6 million</td>
<td>$2.3 million</td>
</tr>
<tr>
<td>B/C Ratio</td>
<td>2.64</td>
<td></td>
</tr>
</tbody>
</table>
Performance Outcomes Assessment

Feedback from mapping tool demo:

• Consider data needed for non-SACOG programs
• Move the tool to a more accessible place on SACOG’s website
• Some data, like public health information, is difficult to interpret and may need additional context or resources to make it useful
Status Update

• Ran proof of concept on three test projects using limited dataset
  • County Road 98
  • US 50 HOV
  • Hazel Avenue
• Still compiling data relevant to performance outcomes
• Investigating capability of online mapping tool for running project reports
Performance Outcomes

• Reduce Driving
• Reduce Bottlenecks
• Increase Multi-Modal Travel / Create Transportation Options
• Create Economic Benefits
• Improve Goods Movement
• Improve Safety and Security
• State of Good Repair
## Reduce Driving and Bottlenecks

<table>
<thead>
<tr>
<th>Project Length (Mi)</th>
<th>VMT, all vehicles</th>
<th>CVMT, all vehicles</th>
<th>VMT per Resident</th>
</tr>
</thead>
<tbody>
<tr>
<td>County Road 98</td>
<td>5.50</td>
<td>11,332</td>
<td>10,929</td>
</tr>
<tr>
<td>US 50 HOV</td>
<td>12.78</td>
<td>495,753</td>
<td>487,459</td>
</tr>
<tr>
<td>Hazel Avenue</td>
<td>0.51</td>
<td>66,394</td>
<td>94,082</td>
</tr>
</tbody>
</table>
## Increase Multi-Modal Travel / Create Transportation Options

### Project Area Travel Trends

<table>
<thead>
<tr>
<th></th>
<th>Resident SOV Trip Share</th>
<th>Resident Transit Trip Share</th>
<th>Resident Walk Trip Share</th>
<th>Resident Bike Trip Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>County Road 98</td>
<td>49.6%</td>
<td>47.2%</td>
<td>-5%</td>
<td>0.4%</td>
</tr>
<tr>
<td>US 50 HOV</td>
<td>47.5%</td>
<td>46.1%</td>
<td>-3%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Hazel Avenue</td>
<td>51.1%</td>
<td>48.6%</td>
<td>-5%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>
## Improve Safety and Security

<table>
<thead>
<tr>
<th></th>
<th>Safety (2014 Transportation Injury Mapping System)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Collisions Per Project Mile Per 1,000 VMT</td>
</tr>
<tr>
<td></td>
<td>Total Bike/Ped Total Bike/Ped Total Bike/Ped</td>
</tr>
<tr>
<td>County Road 98</td>
<td>7 1 1.3 0.2 0.6 0.1</td>
</tr>
<tr>
<td>US 50 HOV</td>
<td>57 2 4.5 0.2 0.1 0.0</td>
</tr>
<tr>
<td>Hazel Avenue</td>
<td>25 0 48.7 0.0 0.4 0.0</td>
</tr>
</tbody>
</table>
Performance Outcomes Next Steps

- Identify and organize additional data by relevant outcomes
- Apply to larger set of projects and projects of different types
- Load mapping tool on PPA website
- Provide resources to help with interpretation of data
- Identify general rules for flagging projects that have potential to support specific performance outcomes