

Project Performance Assessment Working Group Meeting

July 20, 2017



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

Rural-Specific Measures

- 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

Rural-Specific Measures

- 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 1
Caltrans Performance Measures for Rural Transportation Systems**

Category	Caltrans Measure	SACOG Measure
Safety	Accident Rate per million vehicle miles based on: <ul style="list-style-type: none"> • Accident data, • Roadway length • Traffic volumes (AADT) 	<ul style="list-style-type: none"> • Road accidents involving an injury or fatality • Road accidents with property damage only
System Preservation	Pavement Management System (PMS)	
Mobility	<ul style="list-style-type: none"> • Travel times • Speed • Delay (actual travel time minus free flow time) 	<ul style="list-style-type: none"> • Travel time by mode
Accessibility	Travel time between first and second fastest routes	
Reliability	Travel times over numerous days or throughout year (PeMS data)	<ul style="list-style-type: none"> • Buffer hours for auto and freight trips
Productivity	Throughput based on volume/capacity ratio, speeds and vehicles served	
Return on Investment	California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C)	SACOG BCA methodology

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
- 1st round test project: SACOG application (made up project)
- 2nd 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

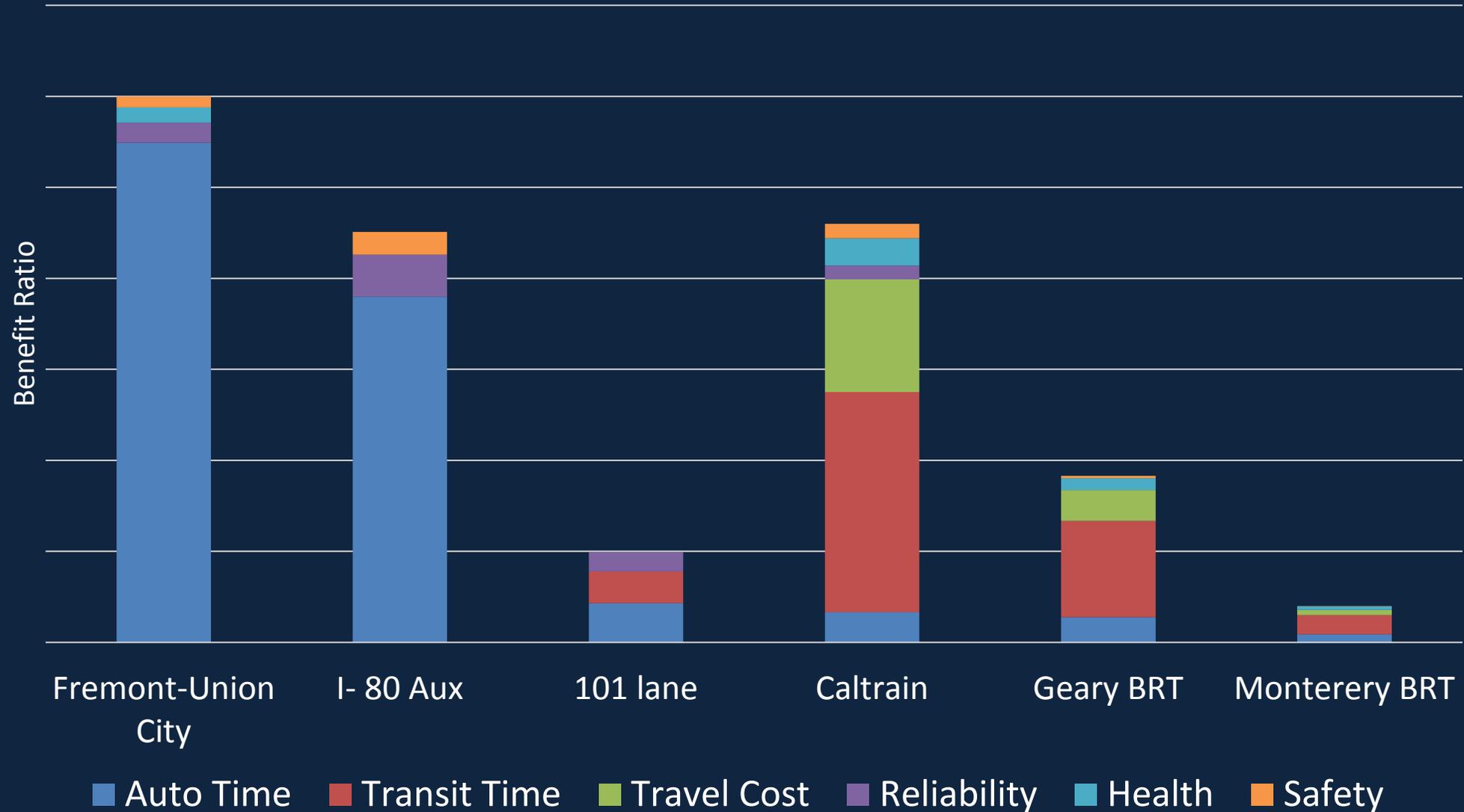
August

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

September

- synthesis of working group feedback

Bay Area Projects



	Bundle of Transportation Projects			
Time Savings	Transit Package	Bike and ped	HOV lanes	Arterial Bundle
Auto Travel Time	65,000 hours	18,000 hours	722,000 hours	650,000 hours
Transit Travel Time	810,000 hours	40,000 hours <i>(note trips)</i>	13,000 hours	4,000 hours
Truck Travel Time	12,000 hours	-2,000 hours	124,000 hours	122,000 hours
Bike/Ped Travel Time	500 hours	300,000 hours	0 hours	0 hours

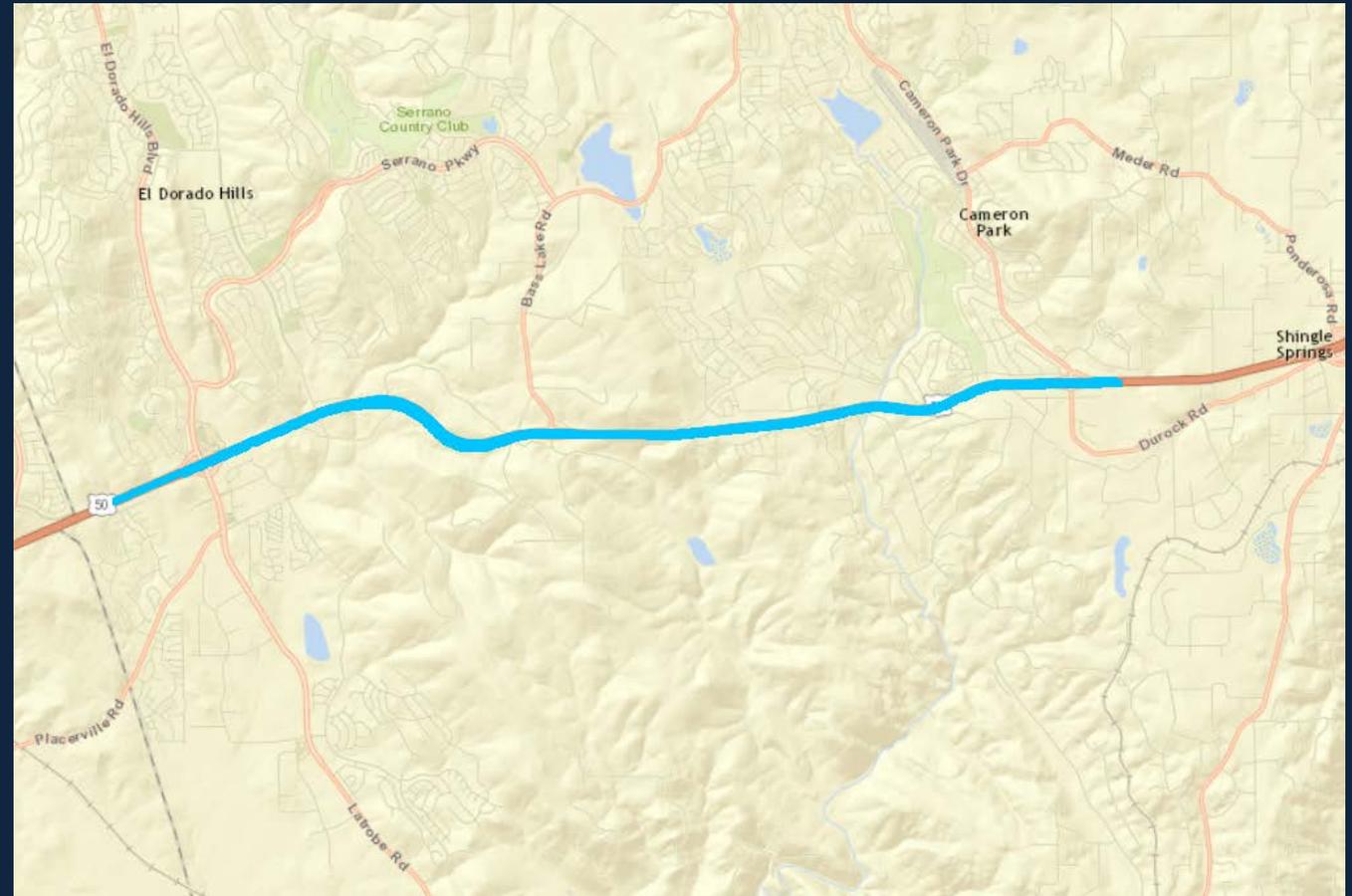
	Bundle of Transportation Projects				
Additional measures	Transit Package	Bike and ped	HOV lanes	Arterial Bundle	
Reliability	65,700 hours	13,170 hours	250,000 hours	145,000 hours	
User costs	7 million <i>fewer</i> VMT	1.5 <i>fewer</i> million VMT	25 million VMT	12 million VMT	
Emissions	5,550 <i>fewer</i> metric tons	700 <i>fewer</i> metric tons	12,000 metric tons	500 metric tons	
Public Health	1,400 active people	200 active people			

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

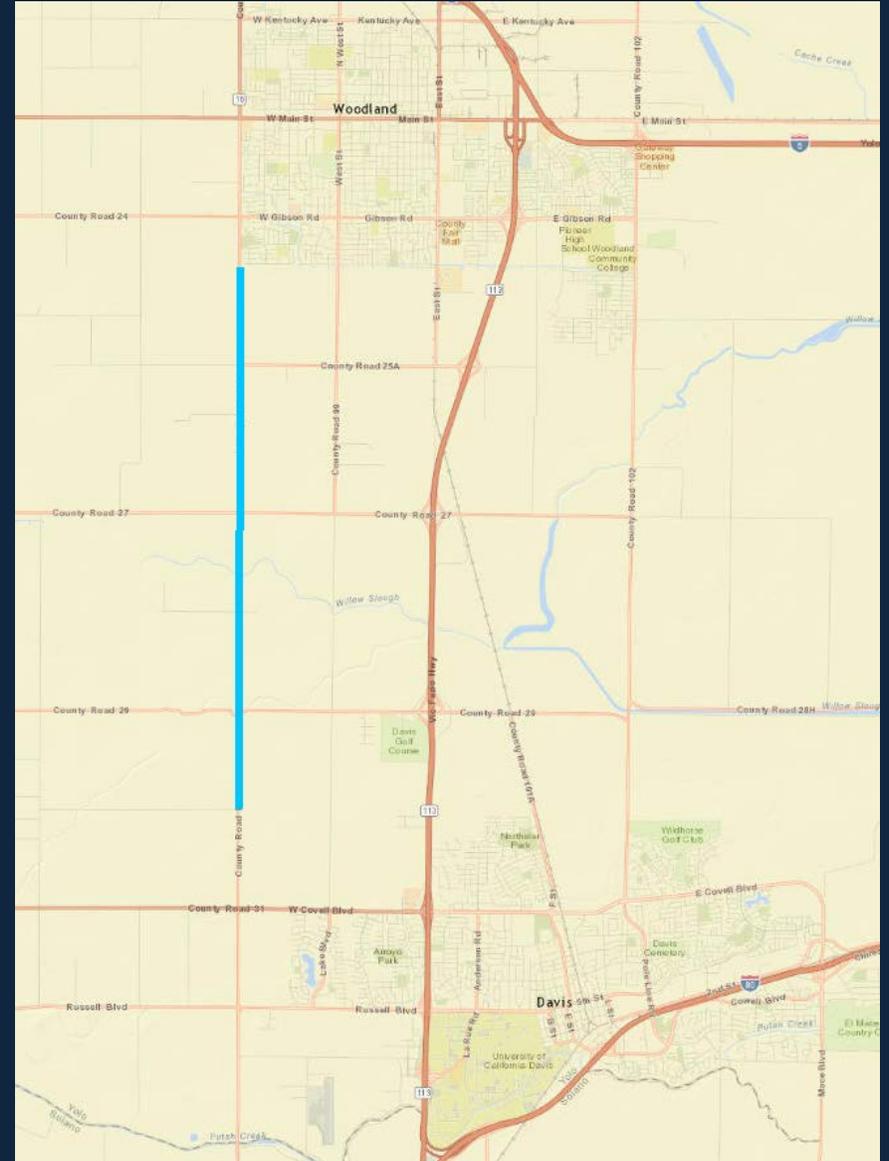
- Jurisdiction: El Dorado County
- Project Description:
 - Added HOV lanes (both directions) on Highway 50 from El Dorado Hills Blvd to Cameron Park Drive.
 - Added truck climbing lane eastbound from Latrobe Rd to Bass Lake Grade
 - Ramp metering and HOV lane ramp on US50/ El Dorado Hills Blvd interchange
- Project cost: \$82,358,000



Test Projects: County Road 98

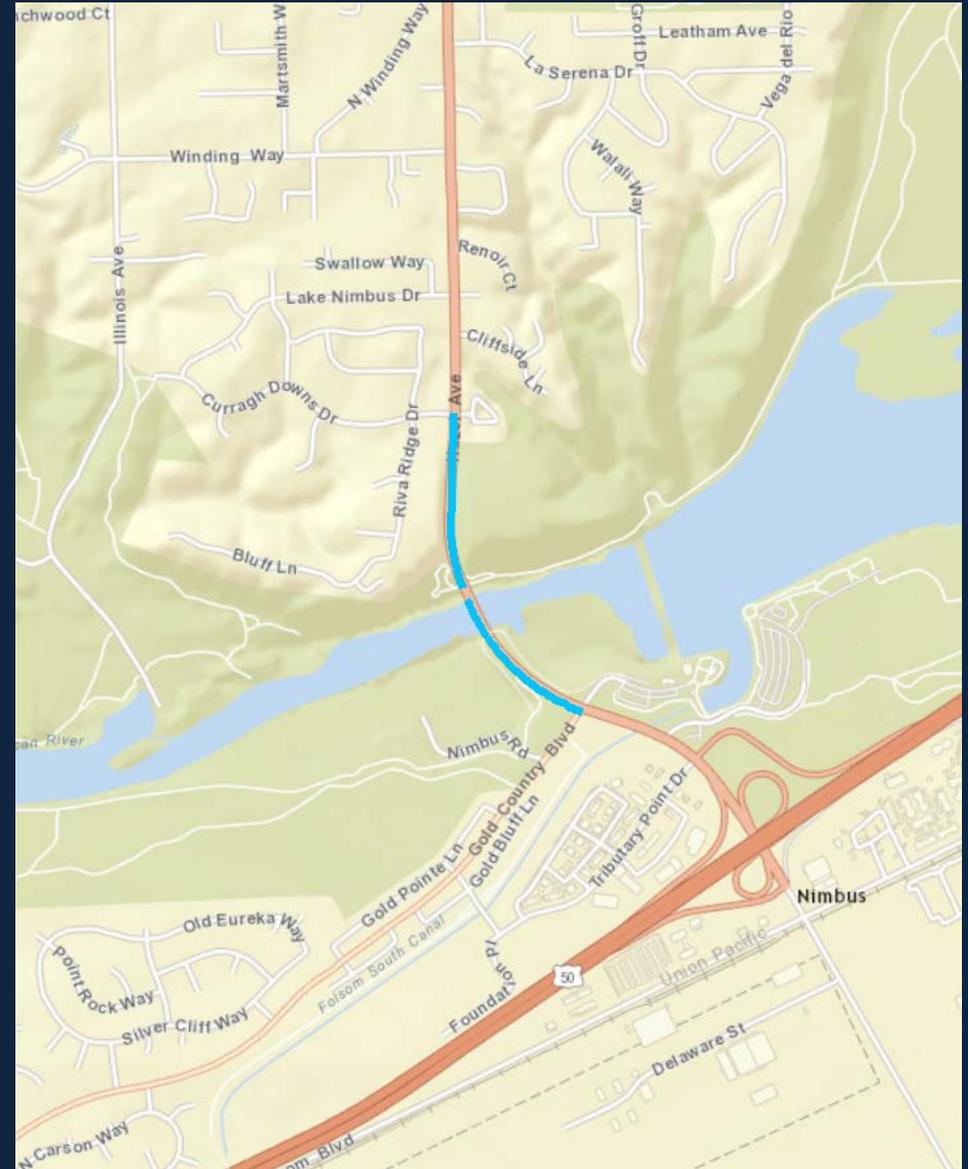
- Jurisdiction: Yolo County
- Project Description:
 - Widen to include 8 foot shoulder and bike lane, 12 feet recovery area and relocated utilities and drainage
 - Widen two bridges and added left turn lanes at 3 major intersections
 - 4.5 mile project extent from Woodland to near Davis (1,400 feet south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

Project cost: \$14,245,000



Test Projects: Hazel Ave Phase 1

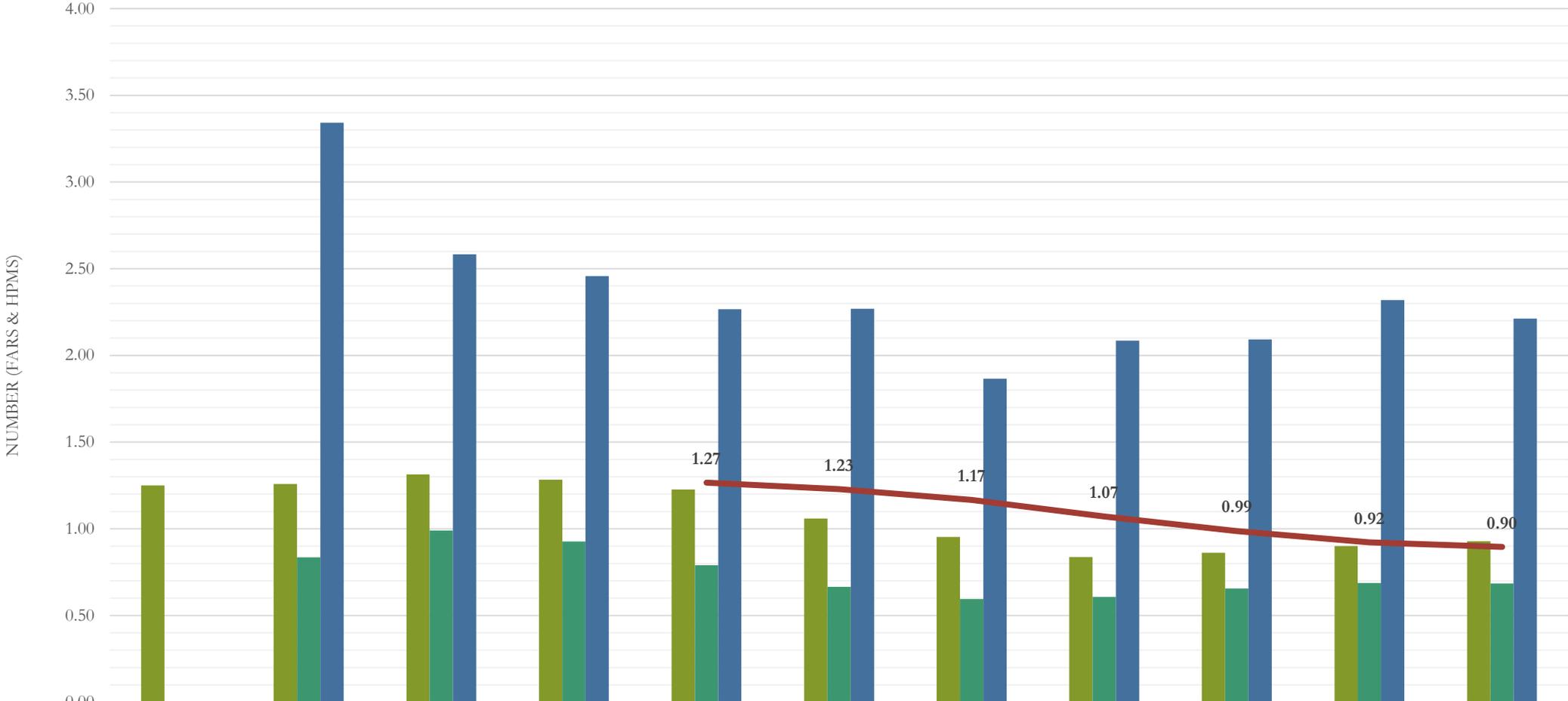
- Jurisdiction: Sacramento County
- Project Description:
 - Widened Hazel Avenue from four to six lanes over American River Bridge to Curragh Downs Drive
 - Constructed bike/ped/equestrian lane separated from vehicle traffic by barrier
 - Improved connections to American River bike trail
- Project cost: \$45,000,000



US50 HOV lanes	Benefits	Costs
Auto Time	1,083,000 hours	
Transit Time	7,800 hours	
Bike/Walk Time	0 hours	
Truck Time	166,000 hours	
Reliability	144,000 hours	
Safety		35 more collisions
User operating/owner		31 million VMT
Emissions (CO2)		6,900 metric tons
Public Health		
Construction/ Operating		\$4 million
TOTAL	\$14 million	\$4.75 million
B/C Ratio= 3.0		

CR98	Benefits	Costs
Auto Time	8,437 hours	
Transit Time	0 hours	
Bike/Walk Time	132 hours	
Truck Time	1,344 hours	
Reliability	8,255 hours	
Safety	2.3 property damage, 1.1 serious injury collisions avoided	
User operating/owner	600,000 decrease VMT	
Emissions (CO2)	382 ton reduction	
Construction/ Operating		\$356,163
TOTAL	\$599,368	\$356,163
B/C Ratio= 1.7		

Annual Fatality Rate (per 100 M VMT)



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total	1.25	1.26	1.31	1.28	1.23	1.06	0.95	0.84	0.86	0.90	0.93
Urban		0.83	0.99	0.93	0.79	0.67	0.59	0.61	0.66	0.69	0.69
Rural		3.34	2.58	2.46	2.27	2.27	1.87	2.08	2.09	2.32	2.21
5-Yr					1.27	1.23	1.17	1.07	0.99	0.92	0.90

Source: Caltrans Performance Monitoring Program

Hazel Ave Phase 1	Benefits	Costs
Auto Time	305,000 hours	
Transit Time	4,200 hours	
Bike/Walk Time	170 hours	
Truck Time	31,325 hours	
Reliability	61,862 hours	
Safety	12 fewer collisions	
User operating		4 million VMT
User ownership		
Emissions (CO2)		465 metric tons
Public Health		
Construction/ Operating		\$2 million
TOTAL	\$6 million	\$2.3 million

B/C Ratio= 2.64

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

		Travel Summary								
	Project Length (Mi)	VMT, all vehicles			CVMT, all vehicles			VMT per Resident		
		2012	2036	Chg.	2012	2036	Chg.	2012	2036	Pct Chg
County Road 98	5.50	11,332	10,929	-4%	0	0	0%	21.4	20.5	-4%
US 50 HOV	12.78	495,753	487,459	-2%	43,372	36,103	-17%	23.7	21.3	-10%
Hazel Avenue	0.51	66,394	94,082	42%	0	11,804	NA	21.1	18.9	-10%

Increase Multi-Modal Travel / Create Transportation Options

	Project Area Travel Trends											
	Resident SOV Trip Share			Resident Transit Trip Share			Resident Walk Trip Share			Resident Bike Trip Share		
	2012	2036	Pct Chg	2012	2036	Pct Chg	2012	2036	Pct Chg	2012	2036	Pct Chg
County Road 98	49.6%	47.2%	-5%	0.4%	1.2%	229%	5.6%	7.1%	27%	1.1%	1.5%	28%
US 50 HOV	47.5%	46.1%	-3%	0.2%	0.7%	325%	4.4%	5.2%	18%	0.5%	0.6%	7%
Hazel Avenue	51.1%	48.6%	-5%	0.5%	1.2%	147%	2.8%	3.6%	26%	0.3%	0.3%	36%

Improve Safety and Security

	Safety (2014 Transportation Injury Mapping System)					
	Collisions		Per Project Mile		Per 1,000 VMT	
	Total	Bike/ Ped	Total	Bike/ Ped	Total	Bike/ Ped
County Road 98	7	1	1.3	0.2	0.6	0.1
US 50 HOV	57	2	4.5	0.2	0.1	0.0
Hazel Avenue	25	0	48.7	0.0	0.4	0.0

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**