Plan BayArea 2040

PERFORMANCE WORKING GROUP

Benefit-Cost Methodology Overview
June 18, 2015

Plan Bay Area developed a robust framework for evaluating the cost-effectiveness of major, uncommitted projects seeking inclusion in the Plan. The primary metric for evaluating cost-effectiveness was a ratio of the annual benefits afforded by the project divided by the annual costs to deliver and operate the project. Plan Bay Area 2040 will preserve the majority of this framework with minor improvements to methodology and processing. The Performance Working Group will inform methodology updates to the benefit-cost assessment at its July meeting. This memo provides an overview of the existing methodology and describes in detail each component of the benefit-cost ratio.

Benefits

All benefits are calculated and forecasted using MTC's travel demand model, Travel Model One, which is an activity-based model that simulates travel decisions over a typical workday for the entire Bay Area. Benefits (or dis-benefits) are evaluated for each project individually and compared to a baseline, no-project model run in the same horizon year. Benefits are then annualized and monetized for inclusion in the benefit-cost ratio.

Components of Benefits	
Travel Time	– Auto/Truck Free-flow Time + Recurring Delay – Non-Recurring Freeway Delay – Transit In-Vehicle – Transit Out-of-Vehicle – Walk/Bike
Travel Cost	– Operating Costs – Parking Costs – Vehicle Ownership (Modeled)
Air Pollutants	– PM2.5 – CO2 – Other: NOx, SO2, Acetaldehyde, Benzene, 1,3-Butadiene, Formaldehyde, Other volatile organic compounds
Collisions, Active Transportation, Noise	– Fatalities Due to Collisions – Injuries Due to Collisions – Property Damage Only Collisions – Active individuals – Noise

Costs

Project costs reflect total project cost over the lifetime of the project (e.g. lifecycle costs), converted to 2017 dollars. Capital costs are annualized based on the expected useful life of the corresponding transportation asset. Annualized capital costs are combined with annual operating and maintenance costs. The project cost is the denominator in the benefit-cost ratio.

The table on the following page further describes the methodology and rationale for each benefit along with details on calculating project costs. Staff will present updates to the benefit valuations (e.g. value of time, emissions, etc.) and methodology at the July meeting.

Benefit-Cost Component	Methodology	Reflects	Data Source	Likely update for PBA2040
Travel Time				
Auto/truck travel time + recurring delay (hours)	Sum of vehicle hours traveled across all roadways and transformed to person hours by using an assumption of occupancy for carpoolers	Discomfort to travelers of enduring transportation-related delay and the loss in regional productivity for on-the-clock travelers and commuters	Travel Model One	
Auto/truck non-recurring freeway delay (hours)	Sum of incident delay across all roadways; incident delay as a function of volume-to-capacity ratio and number of lanes on a roadway.	Additional traveler frustration of experiencing non-expected incident	Travel Model One/FHWA IDAS	**
Transit in-vehicle time (hours)	Sum of transit trips multiplied by the in-vehicle time for those trips, by transit mode (local bus, light rail/ferry, express bus, heavy rail, and commuter rail)	Discomfort to travelers of enduring transportation-related delay and the loss in regional productivity for on-the-clock travelers and commuters	Travel Model One	
Transit out-of-vehicle time (hours)	Sum of transit trips multiplied by out-of-vehicle time for those trips, by time spent walking to/from transit, driving to/from transit, waiting for transit to arrive, and an adjustment	Additional discomfort to travelers of experiencing uncertainty of transit travel arrival time, exposure to incident weather, and exposure to safety risk	Travel Model One	**
Walk/bike travel time (hours)	Sum of walk and bike trips multiplied by walk and bike times, converted from distance by assuming an average travel speed (3 mph for walk trips and 12 mph for bike trips)	Discomfort to travelers of enduring transportation-related delay and the loss in regional productivity for on-the-clock travelers and commuters	Travel Model One	
Travel Cost				
Auto/truck operating cost ($/mile)	Sum of roadway costs multiplied by the volume of autos and trucks that travel those roadways; do not include bridge or value tolls (HOT lanes)	Variable cost of owning a vehicle, including fuel, maintenance, depreciation and tires	Travel Model One	

Benefit-Cost Component	Methodology	Reflects	Data Source	Likely update for PBA2040
Parking cost ($/trip)	Number of work and non-work auto trips multiplied by an assumed parking cost incurred in each county	Additional cost of completing an auto trip	Travel Model One	**
Vehicle ownership ($/vehicle)	Predicted from Travel Model One vehicle ownership model, based on household demographics and accessibility estimates	Additional cost of owning vehicle to reflect purchase/lease cost, maintenance, and finance charges	Travel Model One	
Air Pollutants				
PM2.5 (tons/VMT)	Sum of vehicle miles travelled by time period, vehicle class and speed multiplied by an estimate of future PM2.5 emissions from EMFAC; calculated for gasoline and diesel vehicles	Negative health effects of PM2.5 emissions	Travel Model One/ EMFAC	
CO2 (metric tons/VMT)	Sum of vehicle miles travelled by time period, vehicle class and speed multiplied by an estimate of future CO2 emissions from EMFAC	Global social effects of CO2 emissions	Travel Model One/ EMFAC	
Other (tons/VMT)	Sum of vehicle miles travelled by time period, vehicle class and speed multiplied by an estimate of future volatile organic compound emissions from EMFAC	Negative health effects of volatile organic compounds	Travel Model One/ EMFAC	
Safety, Active Transportation, Noise				
Fatalities due to collisions (collisions/VMT)	Sum of vehicle miles travelled by area type, facility type, and number of lanes multiplied by an estimate of fatalities due to collisions	Costs of losing a life for the collision victim, family of the victim, and society	Travel Model One/SWITRS	
Injuries due to collisions (collisions/VMT)	Sum of vehicle miles travelled by area type, facility type, and number of lanes multiplied by an estimate of injuries due to collisions	Costs of pain, inconvenience, and loss of productivity to society	Travel Model One/SWITRS	

Benefit-Cost Component	Methodology	Reflects	Data Source	Likely update for PBA2040
Property damage due to collisions (collisions/VMT)	Sum of vehicle miles travelled by area type, facility type, and number of lanes multiplied by an estimate of property damage due to collisions	Costs of time loss resulting from the collision, inconvenience, and loss of productivity to society	Travel Model One/SWITRS	
Active individuals (minutes/person)	Sum of average minutes walking and biking multiplied by an estimate of number of inactive persons	Costs of an insufficiently active adult in terms of health care and productivity	Travel Model One	
Noise ($/VMT)	Sum of auto and truck vehicle miles travelled multiplied by a valuation	Cost of property value decreases and social cost of noise abatement	Travel Model One/FHWA	
Project Cost				
Capital cost	Capital cost is the total fixed cost of the project, expensed throughout all phases of the project. Capital costs include planning, design, environmental, right of way and rolling stock acquisition, and construction. Costs are collected by phase and inflated (or deflated) based on the mid-point of the phase to reflect 2017 dollars.		Sponsor	**
Operating and maintenance	Operating and maintenance costs reflect on-going costs of the transportation investment. For road projects, lane-mile maintenance costs are estimated using typical lane-mile costs by facility type. For transit projects, sponsors submit gross operating and maintenance costs. These are converted to net annual operating costs using the agencies' current farebox recovery ratios, thus rewarding agencies that recoup more of their operating costs through new farebox revenue.		Sponsor + MTC	**