Defining Methodologies and Data Sources for Project-Level Performance Measurement

Requested by
Angel Pyle, SB 1 Program

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List of Abbreviations and Acronyms

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AB	assembly bill
ABAG	Association of Bay Area Governments
ABM	Activity-Based Model
ACS	American Community Survey
ADA	Americans With Disabilities Act
ADT	average daily traffic
AVMT	annual vehicle miles of travel
BRT	Bus Rapid Transit
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CARE	Community Air Risk Evaluation
CMAQ	Congestion Mitigation and Air Quality
CTC	California Transportation Commission

CTP	Consolidated Transportation Program
DAC	disadvantaged communities
DOT	department of transportation
EA	environmental assessment
EIR	environmental impact report
EIS	environmental impact statement
EJ	environmental justice
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
GHG	greenhouse gas
GIS	geographic information system
HPMS	Highway Performance Monitoring System
HQTA	High Quality Transit Area
Kern COG	Kern Council of Governments
LA County Metro	Los Angeles County Metropolitan Transportation Authority
LEHD	Longitudinal Employer-Household Dynamics
MAP-21	Moving Ahead for Progress in the 21st Century Act
MAPC	Metropolitan Area Planning Council (Boston)
Maryland SHA	Maryland State Highway Administration
MPO	metropolitan planning organization
MSTM	Maryland Statewide Transportation Model
MTC	Metropolitan Transportation Commission
NHFN	National Highway Freight Network
NOAA	National Oceanic and Atmospheric Administration
NPMRDS	National Performance Measurement Research Data Set
PDA	Priority Development Area
PeMS	Performance Measurement System
RCTC	Riverside County Transportation Commission
RITIS	Regional Integrated Transportation Information System
RSTP	Regional Surface Transportation Program
RTP	Regional Transportation Plan
RTPA	regional transportation planning agency
SACOG	Sacramento Area Council of Governments
SACSIM	Sacramento Activity-Based Travel Simulation Model
SANDAG	San Diego Association of Governments
SB	senate bill
SBCAG	Santa Barbara County Association of Governments
SBCTA	San Bernardino County Transportation Authority
SBTAM	San Bernardino Transportation Analysis Model

SCAG	Southern California Association of Governments
SCCP	Solutions for Congested Corridors Program
SCCRTC	Santa Cruz County Regional Transportation Commission
SCS	Sustainable Communities Strategy
SHOPP	State Highway Operation and Protection Program
StanCOG	Stanislaus Council of Governments
STIP	Statewide Transportation Improvement Program
STP	Surface Transportation Program
SWITRS	Statewide Integrated Traffic Records System
TASAS	Traffic Accident Surveillance and Analysis System
TAZ	Traffic Analysis Zone
TCEP	Trade Corridor Enhancement Program
TERM	Transit Economic Requirements Model
TIMS	Traffic Injury Mapping System
TIP	transportation improvement program
TIRCP	Transit and Intercity Rail Capital Program
TMC	Traffic Message Channel
TRAC	Transportation Review Advisory Council
VHD	vehicle hours of delay
VHT	vehicle hours traveled
VMT	vehicle miles traveled

Executive Summary

Background

California Department of Transportation (Caltrans) and the California Transportation Commission (CTC) have defined performance measures for use with four competitive transportation project funding programs established in response to Senate Bill 1, Road Repair and Accountability Act of 2017 (SB 1):

- Active Transportation Program.
- Local Partnership Program.
- Solutions for Congested Corridors Program.
- Trade Corridor Enhancement Program.

Many of these measures are included in program guidelines and are required to be reported in transportation project applications. Caltrans is seeking information about the practices that other state departments of transportation (DOTs) and California agencies have instituted and implemented (or plan to implement) to measure the impacts of proposed transportation policies, programs and projects, and to ensure transportation equity for disadvantaged communities. This information will be used to develop a guidebook for applicant agencies that will standardize applicants' use of the performance measures in project applications.

Summary of Findings

Survey of Practice

An online survey was distributed to members of the American Association of State Highway and Transportation Officials (AASHTO) Committee on Performance-Based Management. This committee's membership is national in scope and includes representatives from state DOTs in all 50 states and the District of Columbia. The survey was also distributed to a select group of California metropolitan planning organizations (MPOs), regional transportation planning agencies (RTPAs) and other regional MPOs outside of California.

Thirty agencies responded to the survey. Of these, 17 respondents from 16 agencies described project-level performance measures used to evaluate proposals submitted by applicant agencies:

State DOTs

Illinois DOT
Maryland DOT
Minnesota DOT
Ohio DOT

California MPOs

Kern Council of Governments (Kern COG)
Metropolitan Transportation Commission (MTC)
Sacramento Area Council of Governments (SACOG)
San Diego Association of Governments (SANDAG)
Southern California Association of Governments (SCAG)
Stanislaus Council of Governments (StanCOG)

California RTPAs

Los Angeles County Metropolitan Transportation Authority (LA County Metro)
Riverside County Transportation Commission (RCTC) (two responses)
San Bernardino County Transportation Authority (SBCTA)
Santa Cruz County Regional Transportation Commission (SCCRTC)

California Consultants

Mark Thomas, an engineering consultant

Other Regional MPO

Boston Region Metropolitan Planning Organization (Boston Region MPO)

Respondents from three agencies—Indiana DOT, Michigan DOT and Puget Sound Regional Council—reported that their agencies have developed project-level performance measures, however, the respondents did not provide details about these measures or related practices. Twelve respondents from 11 agencies reported that their agencies have not developed project-level performance measures.

Performance Measures

Below is a summary of responding agencies' experience with project-level performance measures in the following categories:

Accessibility

Accessibility performance measures were primarily related to access to destinations (jobs, schools and services) by various modes, highway delays and Americans With Disabilities Act (ADA) compliance.

Climate

Climate performance measures were primarily related to greenhouse gas (GHG) emissions and flooding risk. Other metrics addressed air quality, vehicle miles traveled (VMT) reduction, use of green infrastructure and project impact on jobs and housing.

Boston Region MPO and SCCRTC described indicators that specifically address emergency incidents and repairs. These agencies along with Minnesota DOT and RCTC 1 provided resources related to vulnerability studies used to define climate performance indicators.

Congestion

Measures related to travel time and travel time reliability, speeds, VMT and congestion "hot spots" were commonly reported by respondents.

Economy and Cost-Effectiveness

In addition to benefit–cost ratios and cost-effectiveness calculations, survey respondents considered other cost measures, including cost per mile and life cycle cost, and additional funding sources, such as the portion of the cost borne by project proponents and funding from federal, state, local and private sectors. Other performance measures focus on job creation (both direct and indirect), job retention and annual household costs.

Efficient Land Use

Performance measures were primarily related to land consumption and prioritization plans, but also included metrics for proximity to transit, jobs and affordable housing; active transportation; and congestion.

Environment—Short-Term Assessment

Short-term environmental performance metrics included criteria air pollutant and GHG air quality impacts, projects that avoided impacts to sensitive natural areas and state resources, anticipated improvements to water quality and the project's potential to reduce an urban heat island effect or increase tree canopy coverage. Noise impacts are also considered.

Environment—Long-Term Goals and Objectives

Emissions reduction measures were most frequently cited by agencies responding to the survey. Advancing state environmental goals and natural resource preservation were also reported.

Equity

Benefits to equity populations is the primary focus of equity performance measures. Boston Region MPO, Mark Thomas (consultant), Minnesota DOT, MTC and SBCTA assess the extent to which projects deliver benefits to people of color, tribal communities, low-income people, people with disabilities, people with limited English proficiency, youth, older adults and other disadvantaged communities. Other focus areas include environmental justice and access to affordable housing, jobs, schools and services.

Innovation

Three agencies provided recommendations instead of metrics currently used: RCTC 2 suggested a metric focused specifically on climate change innovation that could be used in conjunction with climate metrics; SBCTA recommended an overall commitment to innovative approaches; and SCCRTC suggested a qualitative discussion explaining why the project is innovative.

Partnership

Partnership performance measures include metrics that encourage participation and collaboration from the public and private sectors. In the Boston Region MPO, projects with more co-sponsors are expected to have a higher likelihood of long-term success. Other agencies encourage local agencies to prioritize projects to obtain local agency buy-in.

Quality of Life and Public Health

Several agencies use air quality impacts as a measure of quality of life. Metrics in Boston Region MPO include NOx reductions in parts of the region with existing high concentrations. SANDAG evaluates air quality based on PM 2.5, PM 10, CO_2, VOC, SO_X, CO and NO_X. SCCRTC assesses six standard criteria plus GHG. Additional measures assess acres of parks per 1,000 residents; the percent of residents living within a 0.5-mile walk to parks or open space; and enhancements to community assets, such as schools and community centers.

Reliability

- *Freight*: Truck travel time reliability and freight travel time reliability performance measures are commonly used among responding agencies to assess freight reliability. Illinois DOT prioritizes projects on routes on the National Highway Freight Network (NHFN). SCCRTC uses 80% reliability, however, the respondent added that it is "very hard to forecast based on project improvements." Additional measures include vehicle hours traveled time reduction and vehicle hours of buffer time.
- *Nonfreight*: Travel time reliability was also frequently cited as a measure of nonfreight reliability. Boston Region MPO uses a level of travel time reliability based on data from the Regional Integrated Transportation Information System (RITIS), which is obtained from the Center for Advanced Transportation Technology Lab at the University of Maryland. SACOG's travel time reliability ratio is based on the MAP-21 (Moving Ahead for Progress in the 21st Century Act) level of travel time reliability definition of reliability measurement as 80th percentile travel time divided by 50th percentile travel time.

Safety

Most safety performance measures were related to crash rates, the number of fatalities and the number of serious injuries. Additional metrics were reported for reduction in crashes, fatalities and severe injuries; bicycle and pedestrian incidents; presence of bicycle/pedestrian facilities; pavement condition; property damage; and impact on the implementation of Complete Streets policies.

Throughput

Truck volume performance measures included daily and peak period volume, percent of traffic volume that is trucks and change in annual truck volume as a result of the project. Additional measures assess the project's alignment with a state freight plan and share of jobs near projects in industrial sectors, which indicates the volume of freight traffic that will travel on the project segment.

Velocity—Freight

Respondents from RCTC 2, SANDAG and SBCTA provided performance measures in the velocity (freight) category. SANDAG uses travel time or total cargo transport time, including dwell time in a logistics facility such as a port or railyard if applicable to the project. SBCTA uses peak and off-peak period speeds for all traffic, with the understanding that trucks travel with all traffic under congested conditions and at the speed limit for uncongested conditions. The agency anticipates that the improvement will not increase speeds for trucks as much as it will for automobiles. The RCTC 2 respondent noted that the CTC metrics of travel time per trip and change in average peak speed are sufficient to measure this outcome.

Several respondents provided information about performance measures in other categories, including economic development, social benefit–cost ratios, resiliency and system preservation/asset management. Table ES1 summarizes agency use of performance measures.

Tools and Models

Ten responding agencies reported using ArcGIS, ArcMap and other Esri tools to gather and map data needed to support the project-level performance measures. Additional tools used by agencies included in-house and vendor products, Google Maps and CalEnviroScreen.

Agencies also reported using a range of vendor, in-house and other tools and models to manage the data needed to support the project-level performance measures. SACOG uses the select link analysis in its travel model in performance assessment. SANDAG's Activity-Based Model is useful for horizon year data; however, because operating the model takes significant resources, the agency typically uses Cal-B/C for grant applications.

Assessment and Recommendations

Successes and Challenges

Successes using project-level performance measures in transportation project applications were reported in the following areas:

- Ensuring equitable access to funding.
- Modeling project elements and cost-effectiveness.
- Using performance and equity assessment results to identify project deficiencies.
- Obtaining required design and other documentation.
- Maintaining flexibility with performance measures.
- Building interagency relationships.

Challenges that agencies reported included:

- Incomplete information from applicants.
- Applicants' ability to access data.
- Accommodating projects of all sizes.
- Issues with tools and access to tools.
- Understanding how projects will perform in an uncertain future.
- Maintaining flexibility with performance measures.

Implementation Recommendations

Respondents offered recommendations for other agencies beginning to implement project-level performance measures to evaluate the effectiveness and/or competitiveness of transportation project applications. Below is a sampling of respondents' suggestions:

- Allow performance measures to vary by project type (Boston Region MPO).
- Ensure a transparent development and education process for new programs (Maryland DOT, Minnesota DOT).
- Try some new criteria and then reflect and update measures (Minnesota DOT).
- Base equity assessments on modeled utilization of a project instead of simply on a project location (MTC).
- Use templates within the application to request essential project information and data (RCTC).
- Start with observed data to demonstrate an existing need (SACOG).
- Develop a process for tracking the performance measures since the awarded agency will need to revisit these performance measures often for annual reporting and audits (SANDAG).

- Provide the best information for evaluation instead of following the exact wording of the performance measure requirement since measures are not always applicable for all situations (SCCRTC).
- Once performance measures are developed, work with the agencies to help generate projects with the ability to meet the performance goals (StanCOG).

Related Research and Resources

Included throughout the Preliminary Investigation is documentation provided by survey respondents about using project-level performance measures with competitive transportation project funding programs. Also included is contact information for survey respondents and others who are available to provide additional information about an agency's project-level performance measurement practices.

Table ES1. State/Agency Performance Measures

State/Agency	Accessibility	Climate	Congestion	Economy	Land Use	Environment Short Term	Environment Long Term	Equity	Innovation
Boston Region MPO	X	X	X	X	X	X	X	X	
Illinois DOT	X		X	X		X		X	
LA County Metro	X			X				X	
Mark Thomas								X	
Maryland DOT	X	X	X	X	X	X	X	X	
Minnesota DOT	X	X	X	X				X	
MTC	X				X			X	
Ohio DOT									
RCTC 1	X	X	X	X	X	X	X	X	
RCTC 2	X	X	X		X	X		X	
SACOG	X	X	X	X	X		X	X	X
SANDAG				X					
SBCTA	X	X	X	X	X	X	X	X	X
SCAG	X	X	X	X	X				
SCCRTC	X	X	X	X				X	X
StanCOG				X					

Table ES1. State/Agency Performance Measures, Continued

State/Agency	Partnership	Quality of Life	Reliability: Freight	Reliability: Nonfreight	Safety	Throughput (Freight)	Velocity: Freight	Other
Boston Region MPO	X	X		X	X			X
Illinois DOT	X		X		X			
LA County Metro					X			
Mark Thomas								
Maryland DOT	X	X		X	X	X		X
Minnesota DOT		X	X		X			

State/Agency	Partnership	Quality of Life	Reliability: Freight	Reliability: Nonfreight	Safety	Throughput (Freight)	Velocity: Freight	Other
MTC								X
Ohio DOT					X			
RCTC 1	X	X			X			
RCTC 2	X		X	X	X	X	X	
SACOG				X	X	X		
SANDAG		X	X			X	X	
SBCTA	X	X	X	X	X	X	X	
SCAG		X	X	X	X			
SCCRTC	X	X	X	X	X	X		
StanCOG								

Agencies Not Using Project-Level Performance Measures

Twelve respondents from 11 agencies reported that their agencies have not developed project-level performance measures:

State DOTs

Florida DOT
New Mexico DOT
Wyoming DOT

California MPOs

SANDAG (two responses: Planning, and Grants and Contracts)
San Luis Obispo Council of Governments
Santa Barbara County Association of Governments (SBCAG)

California RTPAs

Madera County Transportation Commission
Modoc County Transportation Commission
Shasta Regional Transportation Planning Agency
Tehama County Transportation Commission
Trinity County DOT

Five agencies—Modoc County Transportation Commission, SANDAG/Planning, SBCAG, Shasta Regional Transportation Planning Agency and Wyoming DOT—provided information about their agencies' current circumstances related to competitive transportation project funding, which is primarily related to the limited number of funded projects (see page 84).

Gaps in Findings

While the survey received a good response and respondents provided a significant level of detail, other state transportation agencies and planning agencies from within California and outside of the state may have information and experience to share related to their use of performance measures. Contacting agencies that did not respond to the survey may produce additional information of value to Caltrans. In addition, follow-up inquiries with survey respondents could generate other information of value to Caltrans, particularly related to methodologies.

Next Steps

Moving forward, Caltrans could consider:

- Examining the tables in this report to review in detail the performance measures used by respondents.
- Engaging with survey respondents to learn more about their use of performance measures, including data sources and methodologies.
- Reviewing the publications and other resources provided by respondents related to their agencies' practices and to studies conducted by these agencies.
- Contacting the respondents from Indiana DOT, Michigan DOT and Puget Sound Regional Council for details about the project-level performance measures or related practices used by these agencies.
- Reaching out to nonresponding transportation and planning agencies to potentially uncover additional information of value to Caltrans.

Detailed Findings

Background

California Department of Transportation (Caltrans) and the California Transportation Commission (CTC) have defined performance measures for use with four competitive transportation project funding programs established in response to Senate Bill 1, Road Repair and Accountability Act of 2017 (SB 1):

- Active Transportation Program.
- Local Partnership Program.
- Solutions for Congested Corridors Program (SCCP).
- Trade Corridor Enhancement Program (TCEP).

Many of these measures are included in program guidelines and are required to be reported in transportation project applications. They also appear in the California Transportation Plan 2050 and are organized into eight goal areas with related objectives. In addition to the measures that were included in cycles 1 and 2 of the SB 1 programs listed above, Caltrans and CTC are interested in other measures that will help quantify the benefits of potential projects in the following categories:

- Accessibility.
- Climate.
- Congestion.
- Economy and cost-effectiveness.
- Efficient land use.
- Environment (short-term assessment and long-term goals and objectives).
- Equity.
- Innovation.
- Partnership.
- Quality of life and public health.
- Reliability (freight and nonfreight).
- Safety.
- Throughput (freight).
- Velocity (freight).

Caltrans is seeking information from state departments of transportation (DOTs) and local and regional agencies about their experience with project-level performance measures and methodologies. This information will be used to inform the development of a guidebook for applicant agencies that provides the methodologies—including data sources, assumptions, standards and calculations—that will standardize applicants' use of the performance measures in project applications.

Survey of Practice

An online survey was distributed to members of the American Association of State Highway and Transportation Officials (AASHTO) Committee on Performance-Based Management. This committee's membership is national in scope and includes representatives from state DOTs in all 50 states and the District of Columbia. The survey distribution list also included a select group of California metropolitan planning organizations (MPOs), regional transportation planning agencies (RTPAs) and other regional MPOs outside of California.

Survey questions are provided in Appendix A. The full text of survey responses is presented in a supplement to this report.

Summary of Survey Results

Thirty agencies responded to the survey. Of these, 17 respondents from 16 agencies described project-level performance measures used to evaluate proposals submitted by applicant agencies:

State DOTs

Illinois DOT.
Maryland DOT.
Minnesota DOT.
Ohio DOT.

California MPOs

Kern Council of Governments (Kern COG).
Metropolitan Transportation Commission (MTC).
Sacramento Area Council of Governments (SACOG).
San Diego Association of Governments (SANDAG).
Southern California Association of Governments (SCAG).
Stanislaus Council of Governments (StanCOG).

California RTPAs

Los Angeles County Metropolitan Transportation Authority (LA County Metro).
Riverside County Transportation Commission (RCTC) (two responses).
San Bernardino County Transportation Authority (SBCTA).
Santa Cruz County Regional Transportation Commission (SCCRTC).

California Consultants

Mark Thomas, a consultant that provides "civil and structural engineering, land surveying, planning and urban design, and landscape architectural services for California roadways, structures, bicycle/pedestrian facilities, parks, communities, and infrastructure and utility systems."

Other Regional MPO

Boston Region Metropolitan Planning Organization (Boston Region MPO).

Respondents from three agencies—Indiana DOT, Michigan DOT and Puget Sound Regional Council—reported that their agencies have developed project-level performance measures, however, the respondents did not provide details about these measures or related practices.

Twelve respondents from 11 agencies reported that their agencies have not developed project-level performance measures:

State DOTs

Florida DOT.
New Mexico DOT.
Wyoming DOT.

California MPOs

SANDAG (two responses).
San Luis Obispo Council of Governments.
Santa Barbara County Association of Governments (SBCAG).

California RTPAs

Madera County Transportation Commission.
Modoc County Transportation Commission.
Shasta Regional Transportation Planning Agency.
Tehama County Transportation Commission.
Trinity County DOT.

Information provided by these agencies begins on page 84.

Below are survey results from the 16 agencies reporting on project-level performance measures used to evaluate applicant agency proposals. Two agencies, Kern COG and Ohio DOT, provided the following responses instead of completing the survey:

- The Kern COG respondent recommended consolidating the required technical data in reference to all of the state-managed programs, including State Highway Operation and Protection Program (SHOPP), Statewide Transportation Improvement Program (STIP), all SB 1 programs, Congestion Mitigation and Air Quality (CMAQ) and Regional Surface Transportation Program (RSTP). The respondent noted that equity is the only measure that stands out as a challenge for regions and the state, including weighting the various output elements. Most of the transportation programs now are discretionary, he said, and are not all equal in how they should be valued. He also suggested examining all of the applications for existing project programs to determine what agencies are using. He added that regions are "trying to please the state and federal guidelines [but the] challenge is the weighting of all these considerations because it's political." He recommended a focus on consistency, using the same formulas and calculations whenever possible since review "gets extremely technical very quickly." Once the data is gathered, agencies should work with the benefits–cost analysis staff to integrate that data into the other performance measures. Kern COG recently completed an SB 1 TCEP application that included a working spreadsheet to support its output calculations.
- According to the Ohio DOT respondent, the agency has "many, many project-level performance measures across dozens of programs." The respondent referred to two publications: Ohio DOT Program Resource Guide: Fiscal Year 2020, which lists many of its programs and high-level metrics used in some of them, and the Transportation Review Advisory Council (TRAC) Policy and Procedures, one of the agency's most detailed explanations of project scoring practices for its TRAC program (see page 60 for more information about these resources). He added that many of the agency's programs have a similar level of project scoring.

Results from the remaining agencies are summarized in the following topic areas:

- Performance measures.
- Tools and documentation.
- Assessment and recommendations.

Publications and resources provided by survey respondents are included as supporting documents throughout this report. Additional documentation related to the use of project-level performance measures in connection with competitive transportation project funding programs can be found in Related Research and Resources beginning on page 81.

Below is supplemental information related to other survey responses:

- Illinois DOT's project-level performance measures are still in development and have not yet been implemented.
- MTC's responses are related to two distinct processes: its current Surface Transportation Program (STP)/CMAQ funding program and its Regional Transportation Program (RTP) project performance assessment. The respondent noted that although the RTP is not technically a competitive funding process (there are no actual funds awarded to projects during RTP development), the project performance assessment work that was completed for the RTP could be useful in developing innovative methodologies that could be applied to project prioritization processes for funding programs.
- Many of the measures reported by the RCTC 2 respondent are suggested practices and are not currently used by RCTC.
- The SANDAG comments are specific to the SB 1 TCEP for its land port of entry project.
- Much of the SCCRTC data is provided in more detail in its SCCP grant application.

Performance Measures

Below is a summary of responding agencies' experience with project-level performance measures in the following categories:

- Accessibility.
- Climate.
- Congestion.
- Economy and cost-effectiveness.
- Efficient land use.
- Environment—short-term assessment.
- Environment—long-term goals and objectives.
- Equity.
- Innovation.
- Partnership.
- Quality of life and public health.
- Reliability—freight.
- Reliability—nonfreight.
- Safety.
- Throughput.
- Velocity—freight.

Additional performance measures reported by respondents are also presented. When available, data sources and methodologies used with each measure are provided.

Accessibility

Accessibility performance measures were primarily related to access to destinations (jobs, schools and services) by various modes, highway delays and Americans With Disabilities Act (ADA) compliance. The RCTC 2 respondent noted that accessibility measures currently used by CTC are sufficient to measure project impact. These measures include the number of jobs accessible by mode and access to key destinations by mode, and percent of the population defined as low-income or disadvantaged communities (DAC) within the project area.

Table 1 summarizes survey responses.

Table 1. Accessibility Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Highway Nonrecurrent Delay	SCAG	Caltrans Performance Measurement System (PeMS)	Delay caused by atypical traffic patterns, including accidents, weather, planned lane closure or special events
Improved Transportation Choices	MTC	N/R	Projects that improve transportation choices for all income levels (specifically, those that reduce vehicle miles traveled (VMT)), improve access to transit, and/or emphasize connectivity are given additional weight in STP/CMAQ project prioritization.
Intermodal Accessibility	Illinois DOT	Illinois DOT GIS data	Projects are scored on whether intermodal facilities (ports, airports or rail/truck facilities) are within 1 mile or 3 miles.
Proximity to Key Destinations	SCCRTC	• Regional travel demand model job data sets • OnTheMap • Parcel data	GIS mapping
Average Number of Destinations (Jobs, Schools) Accessible Near Project by Mode (Walk, Bike, Drive, Transit)	RCTC 2, SACOG	*SACOG*: • CUBE Access by Bentley Systems • General Transit Feed data • Commercially available congestion data • Routable all-streets GIS network • U.S. Census population data • Longitudinal Employer-Household Dynamics (LEHD) data.	*RCTC 2*: CTC metrics (number of jobs accessible by mode and access to key destinations by mode). *SACOG*: • CUBE Access software calculates accessibility at a user-specified geography (e.g., accessibility to jobs from each block group, census tract or Traffic Analysis Zone (TAZ)). • Project Performance Assessment goes one step further and gets "project average" accessibility (the average accessibility for an entire project based on the accessibility of the census blocks in the project).
Jobs Within a Median Work Trip Length of the Corridor (Freight/ Express Lane Project)	SBCTA	TAZ data	GIS analysis of number of jobs within corridor (for highway)
Jobs Within 0.5 Mile of Transit Station (Bus Rapid Transit (BRT) Project)	SBCTA	TAZ data	Geographic information system (GIS) analysis of number of jobs within 0.5-mile radius of transit stations (for transit, BRT or rail)

Performance Measure	State/Agency	Data Sources	Methodologies
Jobs Within X Distance of Project (or Transit Stop)	SCCRTC	• Regional travel demand model job data sets • OnTheMap • Parcel data	GIS mapping
Projected Increase in Job Accessibility Within 60-Minute Commute	Maryland DOT	Maryland Statewide Transportation Model (MSTM)	1. Define study area based on change in travel time on links. 2. Model jobs access with no build. a. Use model to estimate the number of jobs that can be accessed from that zone using a decay function (jobs farther away valued less because people are less likely to access them). b. Multiply job access by zone by population. c. Aggregate across study area. 3. Repeat above with build. 4. Difference between build and no build are results.
Mode Share for Work Trips	SCAG	• U.S. Census • American Community Survey (ACS)	Share of work trips by various travel modes
Travel Time to Work	SCAG	• U.S. Census • ACS	Average travel time to work by mode
Percent of Population Defined as Low-Income Communities or DACs Within Project Area	RCTC 2	N/R	CTC metric
Transit Boardings Per Capita	SCAG	National Transit Database.	Average annual number of transit boardings per person.
ADA Accessibility	Minnesota DOT	ADA Transition Plan	N/R
Ability to Make Noncompliant Infrastructure ADA-Compliant	Boston Region MPO	Project design documents	Analysis of current and proposed future conditions to understand where accessibility improvements are being made.

Performance Measure	State/Agency	Data Sources	Methodologies
Accessibility Coordinator to Manage ADA Conformance	RCTC 1	Project-level accessibility requirements determined as a function of specific project objectives. In construction-related projects, this is conformance to ADA requirements.	Qualitative measure. RCTC has published an ADA nondiscrimination notice, ADA grievance procedure and ADA discrimination complaint form on its web site.
All Build Vs. No Build (Unless Otherwise Specified)	SBCTA	TAZ employment data	GIS analysis of number of jobs within corridor (for highway)
Freight Facility Access	Minnesota DOT	Applicant information	N/R
Percentage Elevation Gain Over Route	LA County Metro	• mapmyride.com • Google Maps	N/R

N/R No response.

Climate

Climate performance measures were primarily related to greenhouse gas (GHG) emissions and flooding risk. Other metrics addressed air quality, reduction in vehicle miles traveled (VMT), use of green infrastructure, and project impact on jobs and housing. The RCTC 2 respondent suggested that in addition to the air quality and GHG emissions performance metrics used by the CTC, agencies could consider the reduction in GHG emissions that would result if a project includes a scope to build an alternative energy source such as wind, solar or other installations. Project documentation could provide the needed data, and Cal-B./C could be used to evaluate the measure.

Table 2 summarizes survey responses.

Indicators Specifically Addressing Emergency Incidents and Repairs

Two agency respondents—Boston Region MPO and SCCRTC—described indicators that specifically address emergency incidents and repairs:

- *Boston Region MPO*: Projects are awarded points for making multimodal improvements to hurricane evacuation routes (for those projects located in areas that the Massachusetts Emergency Management Agency has identified as hurricane evacuation zones).
- *SCCRTC*: The respondent noted that one quantitative performance measure may not address all types of emergency scenarios. She added that emergency response metrics should be "open-ended discussions" that explain how a project will improve any type of emergency response, such as alternative options for travel through transit or improved highway shoulders for breakdowns or collision removal.

Vulnerability Studies Used to Define Climate Performance Indicators

Four agency respondents—Boston Region MPO, Minnesota DOT, RCTC 1 and SCCRTC—provided resources related to vulnerability studies used to define climate performance indicators:

- *Boston Region MPO*: The agency uses municipal vulnerability, climate adaptation and hazard mitigation plans.
- *Minnesota DOT*: The agency's climate resilience web page (see Supporting Documents below) provides access to ongoing research and completed vulnerability analyses.
- *RCTC 1*: Many project-level air quality analyses conducted by RCTC consider any disproportionate impact on DACs.
- *SCCRTC*: The agency uses The Nature Conservancy's Coastal Resilience mapping portal and NOAA's Sea Level Rise Viewer to evaluate potential coastal flooding impact areas and relative depth (see Supporting Documents below).

Supporting Documents

Minnesota

Cost-Effectiveness and Benefit–Cost Analysis for Transportation Projects: Standard Value Tables, Appendix A, Office of Transportation System Management, Minnesota Department of Transportation, July 2020.
https://www.dot.state.mn.us/planning/program/appendix_a.html
Standard values for use in benefit–cost analysis are available on this web page.

Climate Resilience, Minnesota Department of Transportation, undated.
https://www.dot.state.mn.us/sustainability/climate-resilience.html
Access to ongoing climate research and completed vulnerability analyses is provided at this web site.

Santa Cruz County Regional Transportation Commission

Coastal Resilience Mapping Portal, The Nature Conservancy, undated.
https://maps.coastalresilience.org/
From the web page: Coastal Resilience is a program led by The Nature Conservancy to examine nature's role in reducing coastal flood risk. The program consists of an approach, a web mapping tool, and a network of practitioners around the world supporting hazard mitigation and climate adaptation planning.

Sea Level Rise Viewer, National Oceanic and Atmospheric Administration (NOAA), undated.
https://coast.noaa.gov/slr/
This tool allows users to view sea level rise and potential coastal flooding impact areas and relative depth.

Table 2. Climate Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Anticipated Flooding or Sea Level Rise Issues Based on Future Climate Projections	Boston Region MPO	• Project design documents • State data on flooding and sea level rise	Analyze project documents and climate projections to understand the relationship of the project to anticipated issues with flooding or rises in sea level.
Coastal Resiliency (Length of Project With Potential Impact From Climate Change)	SCCRTC	NOAA and other tools for assessing coastal erosion, coastal storm surge and flooding impacts from sea level rise (see Supporting Documents).	Use NOAA and other tools to assess coastal erosion, coastal storm surge and flooding impacts from sea level rise (see Supporting Documents).
Proportion of Project Area Vulnerable to Flooding	Maryland DOT, Minnesota DOT	*Maryland DOT*: • MSTM • Federal Emergency Management Agency (FEMA) 100-year floodplain *Minnesota DOT*: Flood risk based on vulnerability assessment	*Maryland DOT*: 1. Determine the area (in acres) within the 100-year floodplain impacted by the project**.** Using geospatial data, layer project acres over 100-year floodplain areas to determine the acres impacted within the 100-year floodplain. 2. Divide the number of impacted acres within the 100-year floodplain by the total project acres. 3. Subtract this number from 1 (i.e., score = 1 - impacted acres/total project acres). Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database.
Use of Green Infrastructure or Other Climate-Resilient Materials	Boston Region MPO	• Project design documents • State data on flooding and sea level rise	Analyze project documents and climate projections to understand the relationship of the project to planned use of green infrastructure or other climate-resilient materials.
Support for Regional Resiliency Plan/Study Goals	Boston Region MPO	• Project design documents • State data on flooding and sea level rise	Analyze project documents and climate projections to understand the relationship of the project to regional resiliency goals.
Potential to Reduce GHG Emissions	Maryland DOT, Minnesota DOT, SBCTA, SCCRTC	*Maryland DOT*: MSTM *Minnesota DOT*: Emissions based on change in VMT and truck VMT	*Maryland DOT*: **Highway Projects** 1. Identify zones in the project study area. 2. Use the MSTM multi-resolution framework to assign traffic at the higher-resolution (Level 2) zone structure.

Performance Measure	State/Agency	Data Sources	Methodologies
		SBCTA: GHG emission factors in Cal-B/C *SCCRTC*: EMFAC or Cal-B/C	3. Calculate the daily fuel consumption from each period based on congested travel times for the baseline or no-build condition within the study area. 4. Calculate the daily fuel consumption from each period based on congested travel times for the build condition within the study area. 5. Subtract the daily fuel consumed under the no-build condition from the build condition to estimate daily fuel savings due to operating speed improvements. 6. Annualize fuel savings. 7. Divide by 1000 to convert value into thousands of gallons. **Transit Projects** 1. Obtain the number of daily new transit passengers. 2. Compute reduced fuel consumption as a result of new transit riders: a. Convert new daily transit passengers to annual passengers. b. Multiply by average transit trip length in miles (constant value). This value represents annual miles of new transit trips. c. Divide by fuel economy average in miles per gallon (constant value). This value represents the gallons of fuel saved by shifting passengers from highway to transit travel. d. Divide by 1000 to convert value into thousands of gallons. 3. Add the values for fuel savings for highway and transit. 4. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database. For projecting fuel savings, the agency estimates that each new trip reduced fuel consumption by 0.2 gallon based on an average auto trip in DMV of 5 miles divided by the average fuel efficiency of vehicles at 27 miles per gallon. This equates to a 0.2 gallon fuel savings per new transit passengers off the roadway. *Minnesota DOT*: Part of the agency's benefit–cost analysis (see Supporting Documents). *SBCTA*: Use Cal-B/C Sketch version 7.2. Post-implementation estimates not feasible. *SCCRTC*: Use EMFAC or Cal-B/C.

Performance Measure	State/Agency	Data Sources	Methodologies
Life Cycle GHG Emissions	RCTC 1	• Traffic engineering studies • Environmental impact studies and EIRs • Project-level analyses	• California Air Resources Board (CARB) GHG quantification methodologies • Cal-B/C suite of tools • ICF Infrastructure Carbon Estimator
Project-Level GHG Emissions	RCTC 1	• Traffic engineering studies • Environmental impact studies and EIRs • Project-level analyses	• CARB GHG quantification methodologies • Cal-B/C suite of tools • ICF Infrastructure Carbon Estimator
Construction-Related GHG Emissions	RCTC 1	• Traffic engineering studies • Environmental impact studies and EIRs • Project-level analyses	• CARB GHG quantification methodologies • Cal-B/C suite of tools • ICF Infrastructure Carbon Estimator
GHG Reduction From Alternative Energy (e.g., Wind, Solar)*	RCTC 2*	Project documentation*	Calculate in Cal-B/C*.
Ambient Air Quality Conditions	SCAG	CARB	Existing air quality condition by air basin
VMT	SCAG	Highway Performance Monitoring System (HPMS)	Average annual VMT per person (autos and light trucks)
VMT Reduction	SCCRTC	• Travel demand model • Off model analysis for countywide VMT	• Travel demand model • Off model analysis for countywide VMT
Build, No-Build Conditions	SBCTA	GHG emission factors in Cal-B/C	Use Cal-B/C Sketch version 7.2. Post-implementation estimates not feasible.

Performance Measure	State/Agency	Data Sources	Methodologies

Land Use Mix Index**	SACOG	• SACSIM (Sacramento Activity-Based Travel Simulation Model) outputs for parcel-level:
		  ○ VMT estimates
		  ○ Mode-split estimates
			Land use mix index compares ratios of various job types that are proxies for typical daily needs like schools and retail to the number of households that are within a given area. For Project Performance Assessment, this area is within 0.5 mile of a proposed transportation project.

Accessibility to Services by Walking/Short Drive	SACOG	CUBE Access software	N/R
Share of Total Centerline Miles That are Bike Paths/Bike Lanes	SACOG	GIS line file of regional bike facilities	N/R
Total Jobs and Housing Within 0.5 Mile of Project	SACOG	• SACOG Employment Inventory • ACS • Local agency general and specific plans and parcel data	N/R
Transit Vehicle Stops Per Acre Per Day	SACOG	GTFS transit service data for levels of service down to the transit stop	N/R
Transit Person-Trips on Segment	SACOG	SACSIM travel demand model estimates of transit person-trips on road segments	N/R
Share of Household Growth in High Quality Transit Areas (HQTAs)	SCAG	• ACS • SCAG data	Share of total regional household growth occurring in HQTAs
Share of Employment Growth in HQTAs	SCAG	• ACS • SCAG data	Share of total regional employment growth

Performance Measure	State/Agency	Data Sources	Methodologies
GHG Reduction From Alternative Energy Source (e.g., Wind, Solar)*	RCTC 2*	Project documentation*	Calculate in Cal-B/C.*

N/R No response.

* Potential performance measure. RCTC does not use this practice.

** Land use mix index: Mix of houses and businesses accessible to residents through nondriving modes or by short (less than 1 mile) driving trips.

Congestion

Measures related to travel time and travel time reliability, speeds, VMT and congestion "hot spots" were commonly reported by respondents. Minnesota DOT uses a benefit–cost ratio, and Maryland DOT assesses the positive impact on travel time. Data sources ranged from national and state modeling to traffic engineering analyses and environmental impact reports (EIRs).

Table 3 summarizes survey responses.

Supporting Document

Minnesota

Cost-Effectiveness and Benefit–Cost Analysis for Transportation Projects: Standard Value Tables, Appendix A, Office of Transportation System Management, Minnesota Department of Transportation, July 2020.
https://www.dot.state.mn.us/planning/program/appendix_a.html
Standard values for use in benefit–cost analysis are available on this web page.

Table 3. Congestion Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Positive Impact on Travel Time	Maryland DOT	MSTM	**Highway Projects** 1. Identify zones that comprise the study area for each project. 2. Use the MSTM multi-resolution framework to assign traffic at the higher-resolution (Level 2) zone structure. 3. Combine vehicle hours traveled (VHT) for each time of day to develop daily VHT under free-flow conditions. 4. Combine VHT for each time of day to develop daily VHT under congested conditions. 5. Subtract congested VHT from free-flow VHT to calculate vehicle hours of delay (VHD). 6. Annualize daily VHT and divide by 1000 to report in thousands. **Transit Projects** 1. Obtain the number of daily new transit passengers. 2. Calculate the travel time savings for transit users through the Renaissance Planning Multimodal Accessibility Tool: a. Compute a comparison of the matrix of zone-to-zone transit travel time savings against the highway trip table from the MSTM to compute a weighted average of travel time savings multiplied by transit ridership, and annualized. 3. Compute travel time savings for highway users as a result of the transit project. a. Multiply daily new transit passengers by travel time savings for new transit passenger (constant value expressed in minutes/trip). b. Convert from daily to annual travel time savings. This value represents the annual minutes of travel time saved by new transit passengers produced by the project. c. Divide by 60 to convert minutes of travel time savings to hours of travel time savings. Then divide by 1000 to convert value to align with the thousands of hours scale. 4. Add the values for annual travel time savings for highway and transit users. 5. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database.

Performance Measure	State/Agency	Data Sources	Methodologies
Benefit–Cost Ratio	Minnesota DOT	N/R	See Supporting Documents.
Bottleneck/ Congestion Hot Spots	RCTC 1	• Traffic engineering analyses • EIRs • Signal coordination timing analyses	Methodologies included in analytic tools (including but not limited to Synchro Trafficware and SimTraffic)
Change in Level of Service	RCTC 1, RCTC 2	• Traffic engineering analyses • EIRs • Signal coordination timing analyses	• Methodologies included in analytic tools (including but not limited to Synchro Trafficware and SimTraffic) • Highway Capacity Manual
Average Peak Hour and Peak Period Speeds	SBCTA	Probe-based data analyzed with ClearGuide (Iteris)	Generally use speed/distance speed contour diagrams to illustrate extent and time of congestion. *Note*: Selection of analysis area/study area and facilities included is critically important for VHT, PHT and VMT. Study area should capture all the effects of the project, and scope of impact can vary significantly from project to project.
Peak and Off-Peak Speed and Volumes	SACOG:	• National Performance Measurement Research Data Set (NPMRDS) • SACSIM travel demand model	• Calculate congestion and reliability. These values are initially calculated for each Traffic Message Channel (TMC) segment, provided in the NPMRDS data set; project-level analyses are then aggregated to get average speed and reliability values for a given project's extent. • Select link analysis in travel model.
Comparison of Free-Flow Speed to Congested Speed*	SACOG:	• NPMRDS • SACSIM travel demand model	• Calculate congestion and reliability. These values are initially calculated for each TMC segment, provided in the NPMRDS data set; project-level analyses are then aggregated to get average speed and reliability values for a given project's extent. • Select link analysis in travel model.
Annual Average Daily Traffic (AADT) Travel Time Index	Illinois DOT	Illinois DOT data	• Project AADT = SUM(segment AADT x (segment length/project length)) • TTI calculated using Regional Integrated Transportation Information System (RITIS) platform
Travel Time Reliability for Automobiles	SCAG	Caltrans PeMS	Day-to-day variation in travel times of automobile travelers along a specified roadway.

Performance Measure	State/Agency	Data Sources	Methodologies
Travel Time Reliability for Trucks	SCAG	Caltrans PeMS	Day-to-day variation in travel times of trucks along a specified roadway
Vehicle Hours of Delay	SCCRTC	• Caltrans HPMS • Travel demand model • U.S. Census data • California Household Travel Survey • Traffic count data • Origin/destination data from cellphone	Mode shift projections from vehicles to other modes based on bike or transit ridership projections with new facility. Transit ridership projections can include many types of data for assessment.
Vehicle Hours of Travel Time Saved	SBCTA	Subregional travel demand model	Generally use speed/distance speed contour diagrams to illustrate extent and time of congestion. *Note*: Selection of analysis area/study area and facilities included is critically important for VHT, PHT and VMT. Study area should capture all the effects of the project, and scope of impact can vary significantly from project to project.
Person Hours of Travel Time Saved	SBCTA	Subregional travel demand model	Generally use speed/distance speed contour diagrams to illustrate extent and time of congestion. *Note*: Selection of analysis area/study area and facilities included is critically important for VHT, PHT and VMT. Study area should capture all the effects of the project, and scope of impact can vary significantly from project to project.
Transit: Daily Hours of Passenger Delay	Boston Region MPO	RTA ridership/route data	• Change in traffic signal delay resulting from the project is calculated. • Result is translated into transit passenger hours of delay (for bus and light rail) based on ridership.
VMT	SBCTA	Probe-based data analyzed with ClearGuide (Iteris)	Generally use speed/distance speed contour diagrams to illustrate extent and time of congestion. *Note*: Selection of analysis area/study area and facilities included is critically important for VHT, PHT and VMT. Study area should capture all the effects of the project, and scope of impact can vary significantly from project to project.

Performance Measure	State/Agency	Data Sources	Methodologies
Countywide VMT	SCCRTC	• Caltrans HPMS • Travel demand model • U.S. Census data • California Household Travel Survey • Traffic count data • Origin/destination data from cellphone	Mode shift projections from vehicles to other modes based on bike or transit ridership projections with new facility. Transit ridership projections can include many types of data for assessment.
Countywide VMT Per Capita	SCCRTC	• Caltrans HPMS • Travel demand model • U.S. Census data • California Household Travel Survey • Traffic count data • Origin/destination data from cellphone	Mode shift projections from vehicles to other modes based on bike or transit ridership projections with new facility. Transit ridership projections can include many types of data for assessment.
Change in VMT	RCTC 1	• Traffic engineering analyses • EIRs • Signal coordination timing analyses	Methodologies included in analytic tools (including but not limited to Synchro Trafficware and SimTraffic)
Projected Change in Annual Vehicle Miles of Travel (AVMT)	Illinois DOT	Illinois DOT statistics	Change in AVMT = 1 - e^rt where: e = mathematical constant r = county growth rate t = # of years (plan to use 20 years)

N/R No response.

* Congested speed is the average speed during the four slowest weekday hours.

Economy and Cost-Effectiveness

In addition to benefit–cost ratios and cost-effectiveness calculations, survey respondents considered other cost measures, including cost per mile and life cycle cost, and additional funding sources, such as the portion of the cost borne by project proponents and funding from federal, state, local and private sectors. Other performance measures focus on job creation (both direct and indirect), job retention and annual household costs.

StanCOG uses dollars per pound as a metric. The respondent noted that beginning in fiscal year 2011, all San Joaquin Valley MPOs adopted policies for distributing at least 20% of CMAQ funds to projects that meet a cost-effectiveness threshold for emission reductions. The policies indicate that before allocating CMAQ funds with each new Federal Transportation Improvement Program, the San Joaquin Valley MPOs in consultation with the interagency consultation partners will develop the cost-effectiveness threshold. The current threshold is $45 per pound ($90,000 per ton).

Table 4 summarizes survey responses.

Supporting Documents

Minnesota

Cost-Effectiveness and Benefit–Cost Analysis for Transportation Projects: Standard Value Tables, Appendix A, Office of Transportation System Management, Minnesota Department of Transportation, July 2020.
https://www.dot.state.mn.us/planning/program/appendix_a.html
Standard values for use in benefit–cost analysis are available on this web page.

Stanislaus Council of Governments

Congestion Mitigation and Air Quality Improvement (CMAQ) Program, California Air Resources Board, undated.
http://www.arb.ca.gov/planning/tsaq/eval/eval.htm
This web page offers access to the automated tool for determining the cost-effectiveness of funding air quality projects.

Methods to Find the Cost-Effectiveness of Funding Air Quality Projects: Emission Factor Tables, California Air Resources Board, March 2018.
https://myairdistrict.com/wp-content/uploads/2018/09/Emission-Factor-Tables-March-2018.pdf
This methodology is used by StanCOG for calculating cost-effectiveness.

Table 4. Economy and Cost-Effectiveness Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Air Quality Cost Effectiveness	RCTC 1	• Project design documentation • Cost estimates.	CARB cost-effectiveness methodologies.
Benefit–Cost Ratio	Minnesota DOT, RCTC 1, SBCTA	*Minnesota DOT*: Usually project applicants *RCTC 1*: • Project design documentation • Cost estimates *SBCTA*: All inputs required for Cal-B/C	*Minnesota DOT* : Benefits/cost ratio (see Supporting Documents) *RCTC 1*: Cal-B/C *SBCTA*: Cal-B/C 7.2 Sketch
Cost-Effectiveness	Minnesota DOT, SACOG, SCCRTC	*Minnesota DOT* Applicants *SACOG*: • Average daily traffic (ADT) • Cost • Useful life estimate • Length *SCCRTC*: Cal-B/C	*Minnesota DOT*: Usually a points/cost calculation. *SACOG*: Simple cost–effect calculation based on sponsor-provided inputs. Not meant to imply precision. *SCCRTC*: Cal-B/C for various modes.
Percent of Project Cost Borne by Proponent	Boston Region MPO	Project documentation	Projects are awarded more points for supplementing transportation improvement program (TIP) funding with other public or private funding sources in support of capital costs
Leverage Additional Funding (Federal, State, Local and Private Sectors)	Maryland DOT	MSTM	1. Determine total value of funds from other sources, defined as: a. Anticipated commitments from local governments/private entities; or b. Committed discretionary funds awarded through federal grant applications. 2. Divide by the total project cost. 3. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database.

Performance Measure	State/Agency	Data Sources	Methodologies
Cost Per Mile	LA County Metro	Applicant data on total project cost and project limits	N/R
Life Cycle Cost	RCTC 1	• Project design documentation • Cost estimates	Cal-B/C
Estimated Travel Time Savings Divided by Project Cost	Maryland DOT	MSTM	1. Obtain the scaled annual hours of travel time savings for the project. This value is the output from the calculation for Goal 3 Measure 2, Travel Time Reliability. 2. Divide by project cost from the Maryland Consolidated Transportation Program (CTP). If the project is not in the CTP, use the combined value of state money plus federal formula money. 3. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database.
Dollars Per Pound	StanCOG	CARB (see Supporting Documents)	• Methodology taken from the March 2018 CARB Methods to Find the Cost-Effectiveness of Funding Air Quality Projects (see Supporting Documents). • Cost-effectiveness for CMAQ projects should be expressed as dollars spent per pound of pollutant reduced (ROG + NOx + PM2.5 + PM10). • CO emissions are not included in the formula. CO is several orders of magnitude larger than ozone precursors and overwhelms cost-effectiveness ratios unless CO emission reductions are scaled back significantly, typically by a factor of seven. • As indicated in the policy, cost-effectiveness is based on CMAQ dollars only (versus total project costs, which include capital investments and operating costs). The funding dollars are amortized over the expected project life using a discount rate. The amortization formula yields a capital recovery factor, which, when multiplied by the funding, gives the annual funding for the project over its expected lifetime. • Cost-effectiveness is determined by dividing annualized funds by annual emission reductions (VOC + NOx + PM10).
Major Development	Illinois DOT	Illinois DOT district information	A project is evaluated on whether any major industrial, commercial or residential development has recently occurred or is being planned along the project corridor.

Performance Measure	State/Agency	Data Sources	Methodologies
Job Creation/ Retention	Minnesota DOT, SANDAG, SBCTA, SCCRTC	*Minnesota DOT*: Usually project applicants *SANDAG*: • Applicable capital cost and annual operation and maintenance cost estimates • Regional economic multipliers from IMPLAN *SBCTA*: All inputs required for Cal-B/C *SCCRTC*: Cal-B/C	*Minnesota DOT*: Number of jobs created per million of construction costs and income created (number of jobs x average wages) *SANDAG*: Direct and indirect jobs. Input-output analysis with IMPLAN tool *SBCTA*: Cal-B/C 7.2 Sketch *SCCRTC*: Caltrans provides an estimate of 11 direct and indirect jobs for every $1 million spent.
Annual Household Transportation Cost	SCAG	Center for Neighborhood Technology	Annual household spending on transportation, including vehicle ownership, operation and maintenance, and transit costs
Share of Annual Household Income Spent on Housing	SCAG	• U.S. Bureau of Labor Statistics • ACS	Share of annual household income spent on housing-related expenses.

N/R No response.

Efficient Land Use

Performance measures were primarily related to land consumption and prioritization plans, but also included metrics for proximity to transit, jobs and affordable housing; active transportation; and congestion. The SCCRTC respondent noted that this measure is difficult to assess quantitatively, adding that discussions similar to the SCCP analysis worked, but agencies “need space to provide this level of detail.”

The RCTC 2 respondent suggested a potential metric could focus on supplying needed transportation and housing for future population demand; for example, the measure could evaluate the amount of housing within a specified proximity of the project area that will be available to an estimated additional population in the area by a specific year.

Table 5 summarizes survey responses.

Table 5. Efficient Land Use Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Land Consumption	SCAG	California Farmland Mapping and Monitoring Program	Number of acres of previously agricultural or otherwise rural land changed to urban uses.
Proximity to Areas Identified for Future Regional Growth	Boston Metro Region	• Project design documents • State policies on priority growth area • ACS	Points awarded to projects that are within 0.5 mile of area that improves multimodal access (transit, bicycle, pedestrian).
Support for Affected Community/ State Revitalization Plans	Maryland DOT	Maryland Sustainable Communities map various revitalization plans	1. Obtain total project cost. 2. Use scoring guide below to determine number of points to assign to project. 3. Multiply project cost by assigned number of points. 4. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database. Scoring: • Improving indirect access to a state-designated Sustainable Community: 0.5 point • Direct access: 1 point • Consistency with a published revitalization plan: 0.5 point • Listing in revitalization plan: 2 points
Land Use Mix Index*	SACOG	• SACOG-maintained parcel-level land use data based on employment Inventory • ACS • Local agency general and specific plans	Described in Project Performance Assessment documentation.

Performance Measure	State/Agency	Data Sources	Methodologies
Priority Development Area (PDA) Investment Minimums Per County	MTC	• ArcGIS for PDA boundary delineation • PDAs adopted by MTC and Association of Bay Area Governments (ABAG)	• In the agency's current STP/CMAQ program, larger counties must invest 70% of their funding targets into PDAs. The target for more rural/suburban counties is 50%. • To qualify, projects must be located within a PDA or provide or improve access to a PDA. Each county developed its own definition of how a project not within a PDA could qualify for providing or improving access.
Priority to Projects in High-Impact Areas	MTC	• Regional housing needs allocations for number of housing units accepted by jurisdiction • Housing element annual progress reports submitted by jurisdictions to HCD for number of units built in a given year	Projects located in high-impact areas are given additional weighting in project prioritization (areas planning for future growth, delivering on building new housing, dense job centers in proximity to housing and transit).
Proximity of Land Amenable to Transit-Oriented Development	SBCTA	Mapping of existing and planned land uses	Map/GIS analysis
Access to Public Transit	RCTC 1	• SCAG data • Project-level design studies	N/R
Access to Services by Walking or Short Drive	SACOG	• CUBE Access software	Described in Project Performance Assessment documentation.
Active Transportation (Pedestrian/ Biking)	RCTC 1	• SCAG data • Project level design studies	N/R
Proximity to Existing Areas of High Population and Employment	Boston Metro Region	• Project design documents • State policies on priority growth areas • ACS	Points awarded to projects that are within 0.5 mile of area that improves multimodal access (transit, bicycle, pedestrian).

Performance Measure	State/Agency	Data Sources	Methodologies
Total Jobs and Housing Within 0.5 Mile of Project	SACOG	• SACOG Employment Inventory • ACS • Local agency general and specific plans • Parcel data	Described in Project Performance Assessment documentation.
Share of Regional Household Growth in HQTAs	SCAG	• ACS • SCAG data	N/R
Share of Regional Employment Growth in HQTAs	SCAG	• ACS • SCAG data	N/R
Amount of Housing Within X of Project Area Available to X More Expected Population in the Area by Year XXXX**	RCTC 2**	N/R**	N/R**
Dwelling Density	RCTC 1	• SCAG data • Project-level design studies	N/R
Congestion	RCTC 1	• SCAG data • Project-level design studies	N/R
Traffic Circulation	RCTC 1	• SCAG data • Project-level design studies	N/R

HCD California Department of Housing and Community Development.

N/R No response.

* Land use mix index: Mix of houses and businesses accessible to residents through nondriving modes or by short (less than 1 mile) driving trips.

** Potential performance measure. RCTC does not currently use this practice.

Environment

Short-Term Assessment

Short-term environmental performance metrics included criteria air pollutant and GHG air quality impacts, projects that avoided impacts to sensitive natural areas and state resources, anticipated improvements to water quality and the project's potential to reduce an urban heat island effect or increase tree canopy coverage. Noise impacts are also considered; for example, SBCTA measures the increase in noise based on Federal Highway Administration (FHWA) guidelines.

The SCCRTC respondent suggested asking for the results of the environmental review instead of developing new measures to assess performance. The RCTC 2 respondent suggested developing a metric that would measure a project's potential benefit to an ecosystem such as a wetland or prairie. Data could be gathered from environmental documentation related to the project, and performance could be assessed qualitatively.

Table 6 summarizes survey responses.

Long-Term Goals and Objectives

Emissions reduction measures were most frequently cited by agencies responding to the survey. Advancing state environmental goals and natural resource preservation were also reported. As with short-term environmental assessment, the SCCRTC respondent suggested asking for the results of the environmental review instead of developing new measures to assess long-term environmental goals and objectives.

Table 7 summarizes survey responses.

Table 6. Environment: Short-Term Assessment Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Environmental Impact	Illinois DOT	• Environmental impact statement (EIS) • Environmental assessment (EA) • Categorical exclusion	Qualitative measure that uses the type of environmental documentation attached to a project as an indicator of the environmental impacts a project would likely have.
Criteria Air Pollutant and GHG Air Quality Impacts	RCTC 1	• Short-range transit plans • EIS and environmental studies • EIRs • Project-level analyses	N/R
Congestion and Traffic Circulation Impacts	RCTC 1	• Short-range transit plans • EIS and environmental studies • EIRs • Project-level analyses	N/R
Anticipated Improvements to Water Quality	Boston Metro Region	Project design documents	Project design documents reviewed to understand measures project is taking to improve water quality
Potential to Reduce Urban Heat Island Effect/Increase Tree Canopy Coverage	Boston Metro Region	Project design documents	Project design documents reviewed to understand measures project is taking to reduce urban heat island effect/increase tree canopy coverage
Acres of Habitat Taken	SBCTA	• Right of way maps • Habitat maps	Analysis of right of way maps and mitigation
Avoidance of Impacts to Sensitive Natural Areas	Boston Metro Region	Project design documents	Project design documents reviewed to understand measures project is taking to avoid impacts to sensitive natural areas
Potential Benefit to Ecosystem (Wetland, Prairie)*	RCTC 2*	Project environmental documentation*	Qualitative measure*
Avoidance of Impacts to State Resources	Maryland DOT	GIS database of state historic resources and state parks	1. Determine the area of state resources (in acres) impacted by the project. State-controlled resources are limited to historic properties and state parks. Geospatial data is used

Performance Measure	State/Agency	Data Sources	Methodologies
			to layer the project acres over historic and state park land to determine the acres of state resources impacted. 2. Divide the number of impacted state resources acres by the total project acres. Subtract this number from 1 (i.e., score = 1 - impacted acres/total project acres). 3. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database.
Residences/Businesses Impacted or Taken	SBCTA	Right of way maps	Analysis of right of way maps and mitigation
Increase in Noise	RCTC 1, SBCTA	*RCTC 1*: • Short-range transit plans • EIS and environmental studies • EIRs • Project-level analyses *SBCTA*: • Traffic volumes and speeds for noise analysis	*SBCTA*: Noise modeling

N/R No response.

* Potential performance measure. RCTC does not currently use this practice.

Table 7. Environment: Long-Term Goals and Objectives Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Advancing State Environmental Goals	Maryland DOT	N/R	1. Obtain total project cost. 2. Determine number of points to assign to the project using the list below. 3. Multiply project cost by the assigned number of points. 4. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database. For advancing each of the following environmental goals, projects receive 1 point: • Increases jobs in green industries. • Reduces GHG emissions. • Promotes the use of electric vehicles. • Reduces sediment and nutrient pollution in the Chesapeake Bay. • Promotes land conservation and preserves green spaces. • Furthers renewable energy innovation and investment. • Promotes effective and sustainable management of materials throughout the life cycle of the facility.
Emissions for CO_2, NOx, CO and VOCs	Boston Region MPO	• Massachusetts DOT CMAQ worksheets • Project design documents	Predictions for the change in emissions resulting from a project are calculated using worksheets developed by Massachusetts DOT that take into account changes in signal delay and potential for mode shift to non-auto modes.
Tons of Emissions for GHGs	SBCTA	Emission factors	EMFAC emission model or Cal-B/C
GHG Reduction Goals	RCTC 1	Long-range transportation planning studies	N/R
Tons of Emissions for All Criteria Pollutants	SBCTA	Traffic volumes and speeds from model	EMFAC emission model or Cal-B/C
Criteria Air Pollutant Attainment Goals	RCTC 1	Long-range transportation planning studies.	N/R
Natural Resource Preservation	SACOG	RTP/SCS	Compares acres of agricultural and open space in project travel shed in current year to horizon year of RTP/SCS

N/R No response.

Equity

The primary focus of equity performance measures is on benefits to equity populations. Boston Region MPO, Mark Thomas (consultant), Minnesota DOT, MTC and SBCTA assess the extent to which projects deliver benefits to people of color, tribal communities, low-income people, people with disabilities, people with limited English proficiency, youth, older adults and other DACs. Other focus areas include environmental justice and access to affordable housing, jobs, schools and services.

Although LA County Metro did not provide a performance metric, the agency uses percentile scores from CalEnviroScreen, Healthy Places Index and SCAG communities of concern data. The RCTC 2 respondent suggested measuring whether the project provided access to higher-wage jobs to low-income, disadvantaged, rural or tribal communities in the project area or region. Data sources could include travel time savings from the project and household income from U.S. Census data.

Table 8 summarizes survey responses.

Table 8. Equity Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Benefits to Equity Populations	Boston Region MPO, Mark Thomas (consultant), Minnesota DOT, MTC, SBCTA	*Boston Region MPO*: • U.S. Census • ACS *Minnesota DOT*: • Qualitative information from applicants • U.S. Census data *Mark Thomas*: • CalEnviroScreen • Median Household Income *MTC*: ArcGIS for community of concern boundaries *SBCTA*: DAC maps	*Boston Region MPO*: Layered approach to equity scoring: 1. Calculate the concentration of the six equity populations above within 0.5 mile of the project, relative to regional averages. 2. Assign each project a point multiplier based on these relative concentrations. 3. Apply this multiplier to other base criteria scores (e.g., scores for improvements to safety, transit access, air quality) that have been specifically identified as important to equity populations in the region through public outreach *Mark Thomas:* SB 535 and Assembly Bill (AB) 1550 *Minnesota DOT*: Generally a qualitative assessment for bonus points *MTC*: STP/CMAQ projects located within or benefiting communities of concern are given additional weight in prioritizing projects. *SBCTA*: Map/GIS analysis
Environmental Justice (EJ)/Equity	Illinois DOT, SACOG	*Illinois DOT*: Shapefile of U.S. Census block group-level Community Survey Estimates for Minority and Low Income (obtained from Illinois EPA) *SACOG*: • SACOG-maintained GIS file of designated EJ areas within region • SACOG-maintained parcel-level land use data: ○ SACOG Employment Inventory ○ ACS ○ Local agency general and specific plans and parcel data	*Illinois DOT*: Qualitative measure that prioritizes projects in or adjacent to a predominately low income (≤64.8%) or minority (>74.8%). The minority and low-income thresholds were determined by doubling the statewide averages. The measure assumes that improvements to a roadway benefit the local community. *SACOG*: Same accessibility approach: • CUBE Access software calculates accessibility at a user-specified geography (e.g., accessibility to jobs from each block group, census tract or TAZ). • Project Performance Assessment obtains the project average accessibility (the average accessibility for an entire project based on the accessibility of the census blocks in the project).

Performance Measure	State/Agency	Data Sources	Methodologies
Total Population Within 0.5 Mile of Project Living Within Designated EJ Area*	SACOG	• SACOG-maintained GIS file of designated EJ areas within region • SACOG-maintained parcel-level land use data based on: ○ SACOG Employment Inventory ○ ACS ○ Local agency general and specific plans and parcel	Described in Project Performance Assessment documentation.
Share of Population Within 0.5 Mile of Project Living Within EJ Area	SACOG	• SACOG-maintained GIS file of designated EJ areas within region • SACOG-maintained parcel-level land use data based on: ○ SACOG Employment Inventory ○ ACS ○ Local agency general and specific plans and parcel	Described in Project Performance Assessment documentation.
Affordable Housing Preservation/ Creation Strategies	MTC	Survey of local jurisdictions' housing staff to identify adopted strategies that support affordable housing	STP/CMAQ projects located within jurisdictions that have adopted policies to support affordable housing are given additional weight in prioritizing projects
Accessibility/ Increase in Accessibility to Jobs, Schools and Services	Maryland DOT, SACOG	*Maryland DOT*: • MSTM • Census employment data *SACOG*: Accessibility data from CUBE Access software	*Maryland DOT*: 1. Define study area based on change in travel time on links. 2. Model jobs access with no build. a. Evaluate the number of jobs in each zone that can be accessed from that zone, using a decay function (jobs farther away valued less because people are less

Performance Measure	State/Agency	Data Sources	Methodologies
			likely to access them). b. Multiply job access by zone by population. c. Aggregate across study area. 3. Repeat above with build data. 4. Difference between build and no build are results. Disadvantaged populations are defined as Census Block Groups with 50% or more of households having low incomes, defined as less or equal than twice the federal poverty level. *SACOG*: Same accessibility approach: • CUBE Access software calculates accessibility at a user-specified geography (e.g., accessibility to jobs from each block group, census tract or TAZ). • Project Performance Assessment obtains the project average accessibility (the average accessibility for an entire project based on the accessibility of the census blocks in the project).
Access to Higher-Wage Jobs for Low-Income, Disadvantaged, Rural or Tribal Communities**	RCTC 2**	Travel time savings from project and household income (census)**	N/R**
% of Population Transportation Disadvantaged Within X Distance of Project	SCCRTC	County-defined transportation-disadvantaged U.S. Census tracts due to low income and minority	N/R
Transit Service Equity	RCTC 1	N/R	N/R
Fare Equity	RCTC 1	N/R	N/R
ADA	RCTC 1	N/R	N/R
Community Air Risk Evaluation (CARE)	MTC	ArcGIS for CARE boundaries	STP/CMAQ projects located within or benefiting CARE communities are given additional weight in prioritizing projects.

Performance Measure	State/Agency	Data Sources	Methodologies
Other	LA County Metro	• CalEnviroScreen • Healthy Places Index • SCAG Communities of Concern	Use percentile scores.

N/R No response.

* Based on large shares or populations with one or more of the following identified characteristics: majority, minority, high poverty, significant senior population or youth population, or high share of people with limited English proficiency.

** Potential performance measure. RCTC does not currently use this practice.

Innovation

Three agencies provided information in the innovation category, primarily in the form of recommendations instead of metrics currently used. Details about data sources or methodologies were not provided. Below are suggestions from these agencies:

- RCTC 2 suggested a metric focused specifically on climate change innovation that could be used in conjunction with climate metrics.
- SBCTA recommended an overall commitment to innovative approaches.
- SCCRTC suggested a qualitative discussion explaining why the project is innovative. Performance measures identified in other categories could be used.

Partnership

Partnership performance measures include metrics that encourage participation and collaboration from the public and private sectors. In the Boston Region MPO, projects with more co-sponsors are expected to have a higher likelihood of long-term success. Other agencies encourage local agencies to prioritize projects to obtain local agency buy-in. The RCTC 2 respondent noted that a metric could be developed based on the amount of funding from both public and private partners.

Table 9 summarizes survey responses.

Table 9. Partnership Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Number of Project Collaborators	Boston Region MPO	Project documents	• This criterion is used specifically for projects funded through the agency's first- and last-mile funding program, including new shuttle services, transit signal priority, bus lanes and transportation network company partnerships. • Projects receive points for having more collaborators in the public, private and nonprofit sectors.
Priority Ranking by County/Region/District	Illinois DOT	Illinois DOT district information	Districts rank projects based on their importance to the district.
Support of Local Governments' Transportation Priorities	Maryland DOT	N/R	• Within the Chapter 30 methodology, local priorities are determined at the county jurisdiction level. • Each county has 100 points to distribute across project applications. Counties can assign all points to one project application or distribute points across multiple projects. • Municipalities and counties should coordinate on applicable project priorities, and any municipality-requested projects should be submitted by the county as one of its project applications. To encourage coordination, any project with joint support from the county and municipality (based on letters of support accompanying the project application) receives an additional 30 local priority points in addition to the points allocated by the county.
Leveraging of Public Funding, Other Co-Funding, In-Kind Contributions, Other Project Co-Benefits	RCTC 1, RCTC 2*	*RCTC 2*: Funding allocations*	N/R
Statement of Working Relationships for Project Implementation	SBCTA	Cross-agency agreements	N/R
Qualitative Discussion on Project Partnerships	SCCRTC	N/R	N/R

N/R No response.

* Potential performance measure. RCTC does not currently use this practice

Quality of Life and Public Health

Several agencies use air quality impacts as a measure of quality of life. Metrics in Boston Region MPO include NOx reductions in parts of the region with existing high concentrations. Regional NOx concentration data is obtained from the Metropolitan Area Planning Council (MAPC), the regional planning agency serving the Boston area. SANDAG evaluates air quality based on PM 2.5, PM 10, CO_2, VOC, SO_X, CO and NO_X. SCCRTC assesses six standard criteria plus GHG.

Additional measures assess acres of parks per 1,000 residents; the percentage of residents living within a 0.5-mile walk to parks or open space; and enhancements to community assets, such as schools and community centers.

Table 10 summarizes survey responses.

Table 10. Quality of Life and Public Health Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Air Quality Impacts	RCTC 1, SANDAG*, SCCRTC**	*RCTC 1*: Congestion management and traffic engineering studies *SANDAG*: • For TCEP cycle 2: ○ Otay Mesa East Level II traffic and revenue Model (vehicle wait time simulation) ○ Cal-B/C emission rates ○ Grams to short ton conversion • For TCEP cycle 1: Previous traffic studies *SCCRTC*: EMFAC or Cal-B/C	*SANDAG*: • For TCEP cycle 2: Using Cal-B/C, calculate based on: ○ Reduced delay at border ○ Emission rates from idling vehicles (2025-2044) • For TCEP cycle 1: Use Cal-B/C. *SCCRTC*: Use EMFAC or Cal-B/C.
NOx Reductions in High-Concentration Areas	Boston Region MPO	Regional NOx concentrations from MAPC	Projects are awarded points for reducing NOx emissions in high-concentration areas (relative to regional concentrations).
Traffic Congestion and Circulation Impacts	RCTC 1	Congestion management and traffic engineering studies	N/R
Concentration of Affordable Housing	Boston Region MPO	Massachusetts Executive Office of Housing and Economic Development	Projects are awarded points for making multimodal improvements within 0.5 mile of higher concentrations of affordable housing options (relative to regional concentrations).
Percent of Residents Within 0.5-Mile Walk to Parks and Open Space	SCAG	SCAG data	Share of regional population living within walking distance to open space.
Acres of Parks Per 1,000 Residents	SCAG	SCAG data	Acres of parks (including local, regional and beach parks) for every 1,000 residents.
Projects That Improve Walking/Bicycling/ Transit	Minnesota DOT	Applicant information (qualitative)	N/R

Performance Measure	State/Agency	Data Sources	Methodologies
Enhancements to Community Assets	Maryland DOT	N/R	1. Obtain the total project cost. 2. Determine the points to assign to the project using the list below. 3. Multiply the project cost by the assigned points. 4. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database. Points awarded based on the number of community assets accessed through the proposed project. Multiples of the same community asset can apply (i.e., two schools): • Public and private grade schools: 1 • Accredited higher education facilities: 1 • Military base/government facility: 1 • Community center: 1 • Parks and community recreation facilities: 1 • Hospitals: 1 • State-designated sustainable communities: 1
Health Effects Impacts	RCTC 1	Health effects studies	N/R
General Statements of Benefit	SBCTA	N/R	N/R

N/R No response.

* Air quality: PM 2.5, PM 10, CO_2, VOC, SO_X, CO, NO_X.

** Air quality: Six standard criteria plus GHG.

Reliability (Freight and Nonfreight)

Freight

Truck travel time reliability and freight travel time reliability performance measures are commonly used among responding agencies to assess freight reliability. Illinois DOT prioritizes projects on routes on the National Highway Freight Network (NHFN). SCCRTC uses 80% reliability, however, the respondent added that it is “very hard to forecast based on project improvements.” Additional measures include VHT time reduction and vehicle hours of buffer time. The RCTC 2 respondent noted that the CTC-required metrics of truck travel time reliability index and VHT time reduction are sufficient to measure this outcome.

Table 11 summarizes survey responses.

Nonfreight

Travel time reliability was also frequently cited as a measure of nonfreight reliability. Boston Region MPO uses a level of travel time reliability based on RITIS data, which is obtained from the Center for Advanced Transportation Technology Lab at the University of Maryland. SACOG’s travel time reliability ratio is based on the MAP-21 (Moving Ahead for Progress in the 21st Century Act) level of travel time reliability definition of reliability measurement as 80th percentile travel time divided by 50th percentile travel time. The RCTC 2 respondent noted that the CTC-required metrics of peak period travel time reliability index and VHT time reduction are sufficient to measure this outcome.

Table 12 summarizes survey responses.

Table 11. Freight Reliability Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Truck Travel Time Reliability	RCTC 2, SCAG	SCAG: Caltrans PeMS	*RCTC 2*: CTC metrics. *SCAG*: Day-to-day variation in travel times experienced by trucks along a specified roadway
Freight Travel Time Reliability	Minnesota DOT	Same as federal performance measure	Same as federal performance measure.
Peak Period Travel Time Reliability	SBCTA	• Existing data: Probe-based data (ClearGuide) • Forecasting data: Increment in speed calculated by Cal-B/C	Speeds estimated for peak and off-peak periods. Off-peak speed is divided by peak speed for freight.
80% Travel Time Reliability	SCCRTC	• Existing data: PeMS • Forecasting data: Unknown	N/R
Priority to Projects on NHFN Routes	Illinois DOT	Illinois DOT GIS data	Qualitative measure

Daily Vehicle Hours of Travel Time Reduction	SANDAG	• TCEP cycle 2:
		  ○ Otay Mesa East Level II Traffic and Revenue model (vehicle wait time simulation)
		  ○ Average vehicle occupancy
		  ○ Hourly wait times
		  ○ Hourly volumes
		  ○ Reliability ratio
		  ○ Average vehicle occupancy.
		• TCEP cycle 1: Previous traffic studies.
			• TCEP cycle 2: Using Cal-B/C. Average daily vehicle hours of delay at the border (2025-2044).
			• TCEP cycle 1: Using Cal-B/C.

Vehicle Hours of Travel Time Reduction	RCTC 2	N/R	CTC metrics

Performance Measure	State/Agency	Data Sources	Methodologies
Vehicle Hours of Buffer Time	SANDAG	• TCEP cycle 2: ○ Otay Mesa East Level II Traffic and Revenue model (vehicle wait time simulation) ○ Average vehicle occupancy ○ Hourly wait times ○ Hourly volumes ○ Reliability ratio ○ Average vehicle occupancy. • For TCEP cycle 1: Previous traffic studies.	• TCEP cycle 2: Difference between 95th percentile of wait times and average wait times (2025-2044). • TCEP cycle 1: Cal-B/C.

N/R No response.

Table 12. Nonfreight Reliability Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Travel Time Reliability	Boston Region MPO, RCTC 2	*Boston Region MPO*: RITIS	*Boston Region MPO*: 80th percentile travel times are compared to 50th percentile travel times for a corridor. Projects with ratios of greater than 1.25 are awarded points for addressing an unreliable corridor by making multimodal improvements. *RCTC 2*: CTC metrics.
Travel Time Reliability Ratio Based on MAP-21 Level of Travel Time Reliability	SACOG	NPMRDS	Follows MAP-21 level of travel time reliability metric.
80% Travel Time Reliability	SCCRTC	• Existing data: PeMS • Forecasting data: Unknown	N/R
Automobile Travel Time Reliability	SCAG	Caltrans PeMS	Day-to-day variation in travel times experienced by automobile travelers along a specified roadway.
Peak Period Travel Time Reliability	SBCTA	• Existing data: Probe-based data (ClearGuide) • Forecasting data: Increment in speed calculated by Cal-B/C	Speeds estimated for peak and off-peak periods. Off-peak speed is divided by peak speed for freight.
Percent On-Time Performance for Transit	SBCTA	Schedule adherence data	N/R
Positive Impact on Travel Time	Maryland DOT	MSTM	**Highway Projects** 1. Identify zones that comprise the study area for each project. 2. Use the MSTM multi-resolution framework to assign traffic at the higher-resolution (Level 2) zone structure. 3. Combine VHT for each time of day to develop daily VHT under free-flow conditions. 4. Combine VHT for each time of day to develop daily VHT under congested conditions. 5. Subtract congested VHT from free-flow VHT to calculate VHD.

Performance Measure	State/Agency	Data Sources	Methodologies
			6. Annualize daily VHT and divide by 1000 to report in thousands. **Transit Projects** 1. Obtain the number of daily new transit passengers. 2. Calculate the travel time savings for transit users through the Multi-Modal Accessibility tool: a. Compute a comparison of the matrix of zone-to-zone transit travel time savings against the highway trip table from the MSTM to compute a weighted average of travel time savings multiplied by transit ridership and annualized. 3. Compute travel time savings for highway users as a result of the transit project. a. Multiply daily new transit passengers by travel time savings for new transit passenger (constant value expressed in minutes/trip). b. Convert from daily to annual travel time savings. This value represents the annual minutes of travel time saved by new transit passengers produced by the project. c. Divide by 60 to convert minutes of travel time savings to hours of travel time savings. Then divide by 1000 to convert value to align with the thousands of hours scale. 4. Add the values for annual travel time savings for highway and transit users. 5. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database.

N/R No response.

Safety

A range of performance measures were reported in the safety category, most related to crash rates, the number of fatalities and the number of serious injuries. Additional metrics were reported for reduction in crashes, fatalities and severe injuries; bicycle and pedestrian incidents; presence of bicycle/pedestrian facilities; pavement condition; property damage; and impact on the implementation of Complete Street policies. The RCTC 2 respondent noted that the CTC-required metrics related to safety are sufficient to measure this outcome.

Table 13 summarizes survey responses.

Supporting Documents

Ohio

Program Resource Guide: Fiscal Year 2020, Ohio Department of Transportation, 2019.
https://www.transportation.ohio.gov/wps/portal/gov/odot/working/publications/program-resource-guide
Many of the agency's programs and high-level metrics are listed in this guide, including the agency's County Highway Safety Program (page 9 of the report; page 11 of the PDF).

TRAC Policy and Procedures, Transportation Review Advisory Council (TRAC), May 2015.
https://www.transportation.ohio.gov/static/Programs/TRAC/TRAC-policy.pdf
This resource provides detailed explanations of project scoring in Ohio DOT's TRAC program. A discussion of scoring criteria and methodology begins on page 8 of the guide, including transportation and economic performance factors such as public transit (page 12), intermodal freight (beginning on page 14) and air quality (page 17).

Table 13. Safety Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Crash Rates	Boston Region MPO, Minnesota DOT, Ohio DOT	*Boston Region MPO*: • Massachusetts Registry of Motor Vehicles • Project design documents	*Boston Region MPO*: • Intersection projects: Calculated per million entering vehicles. • Corridor projects: Calculated per million VMT. *Ohio DOT*: See Supporting Documents.
Collision Rates by Severity and Mode	SCAG	Traffic Accident Surveillance and Analysis System (TASAS)	• Collision and fatality rates per 100 million vehicle miles by mode (all, bicycle/pedestrian) • Number of fatalities and serious injuries by mode
Share of Fatal Collisions on Project Segment	SACOG	• Traffic Injury Mapping System (TIMS) • Project Performance Assessment tool user's estimate of traffic volume on project	Geospatial tool
Number of Fatal and Serious Injury Crashes	Minnesota DOT	N/R	N/R
Total Injury/Fatality Collisions on Project Segment	SACOG	• TIMS • Project Performance Assessment tool user's estimate of traffic volume on project	Geospatial tool
Injury/Fatality Collision Rate Per 100 Million VMT on Project Segment	SACOG	• TIMS • Project Performance Assessment tool user's estimate of traffic volume on project	Geospatial tool
Number and Rate of Fatal Collisions	SCCRTC	• Statewide Integrated Traffic Records System (SWITRS) • TIMS	N/R

Performance Measure	State/Agency	Data Sources	Methodologies
		• TASAS • Traffic counts	
Number and Rate of Serious Injury Collisions	SCCRTC	• SWITRS • TIMS • TASAS • Traffic counts	N/R
Number of Nonserious Injury Collisions	SCCRTC	• SWITRS • TIMS • TASAS • Traffic counts	N/R
Number of Nonmotorized Fatalities and Serious Injuries	SCCRTC	• SWITRS • TIMS • TASAS • Traffic counts	N/R
Number of Fatalities (Motorist/Pedestrian)	RCTC 1	Traffic safety statistics from local jurisdictions	Cal-B/C
Number of Fatalities: Total Over Five Years and Rate Per Million Vehicle Miles	SBCTA	• SWITRS • Collision reduction factors from Cal-B/C	Baseline from existing data (or default rates), with fatalities for build using Cal-B/C
Number of Serious Injuries: Total Over Five Years and Rate Per Million Vehicle Miles	SBCTA	• SWITRS • Collision reduction factors from Cal-B/C	Baseline from existing data (or default rates), with injuries for build using Cal-B/C
Crash Frequency	Illinois DOT, RCTC 1	*Illinois DOT*: • Illinois DOT crash data • 2010 Highway Safety Manual *RCTC 1*: Traffic safety statistics from local jurisdictions	*Illinois DOT*: Crash record types from Illinois DOT crash data are assigned values based on the human capital costs from the Highway Safety Manual. The sum of these values for a given project is divided by the length of the project. This measure assumes that projects will improve road safety or will be adjusted to ensure that safety conditions are improved. *RCTC 1*: Cal-B/C

Performance Measure	State/Agency	Data Sources	Methodologies
Crash Reduction	Minnesota DOT	N/R	N/R
Expected Reduction in Total Fatalities/Severe Injuries in All Modes Affected by Project	Maryland DOT	*Maryland DOT*: Maryland State Highway Administration (SHA) Road Severity Index	1. Obtain SHA Road Severity Index value for the project. 2. Determine the number of safety improvements included in the proposed project using the list below. Only consider improvements designed to reduce fatalities and/or severe injuries. 3. Multiply the Road Severity Index value by the number of safety improvements. 4. If the project is expected to produce new transit passengers, calculate the additional safety benefit related to new transit ridership. Multiply the number of daily new transit passengers by the transit safety improvement factor (0.625). 5. Add the benefit calculated in Step 3 to the benefit calculated in Step 4 to obtain the unscaled benefit. 6. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database. <u>Safety Improvements Scoring</u>: • Widen shoulders: 1 • Add turn lanes: 1 • Install rumble strips: 1 • Improve road alignment: 1 • Install guardrail, median and/or buffers: 1 • Install lighting: 1 • Construct pedestrian facilities: 1 • Construct cyclist facilities: 1
Bicyclist and Pedestrian Crashes	LA County Metro	TIMS	Weighted by population and taken by percentile.
Share of Injury or Fatality Collisions That Involve a Cyclist or Pedestrian	SACOG	• TIMS • Project Performance Assessment tool user's estimate of traffic volume on project	Geospatial tool
Number of Pedestrian Incidents	RCTC 1	Traffic safety statistics from local jurisdictions	Cal-B/C
Separate Statistic for Bicyclists/Pedestrians	SBCTA	• SWITRS • Collision reduction factors from Cal-B/C	Baseline from existing data (or default rates), with fatalities/injuries for build using Cal-B/C

Performance Measure	State/Agency	Data Sources	Methodologies
Presence of Bicycle/ Pedestrian Facilities	Boston Region MPO	N/R	N/R
Coverage/Locations of Crash Clusters	Boston Region MPO, Minnesota DOT	*Boston Region MPO*: • Massachusetts Registry of Motor Vehicles • Project design documents	N/R
State Highway System Pavement Condition	SCAG	Caltrans Pavement Management System	N/R
Local Roads Pavement Condition	SCAG	Local Arterial Survey Database	N/R
Equivalent Property Damage Only	Boston Region MPO, Ohio DOT	*Boston Region MPO*: • Massachusetts Registry of Motor Vehicles • Project design documents	*Boston Region MPO*: Calculated using: • Property damage crashes: 1 point • Injury/fatality crashes: 21 points *Ohio DOT*: See Supporting Documents.
Number of Property Damage Only Collisions	SCCRTC	• SWITRS • TIMS • TASAS • Traffic counts	N/R
Implementation of Complete Streets Policies	Maryland DOT	*Maryland DOT*: Maryland SHA Road Severity Index	1. Obtain the total land area of the project in acres. 2. Determine if the project is in a short-trip opportunity area or has had any bicycle/pedestrian safety incidents reported in the last five years. 3. Determine the number of points to attribute to the project using the list below. 4. Multiply the total project acres by the project points. 5. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database. Scoring: The project: • Manages speed and volume of traffic by narrowing/removing through traffic

Performance Measure	State/Agency	Data Sources	Methodologies
			lanes or by adding bump-outs, pedestrian refuge islands and medians: 1 • Improves accessibility and safety for transit riders, cyclists and pedestrians by using appropriate design elements such as surface treatments, curbs, striping, lighting and landscaping: 1 • Connects two separate bicycle/pedestrian facilities: 1 • Constructs or replaces bicycle/pedestrian facilities: 1 • Is in a local bicycle and pedestrian plan: 1
Other	RCTC 2	N/R	CTC metrics

N/R No response.

Throughput (Freight)

Truck volume performance measures included daily and peak period volume, percent of traffic volume that is trucks and change in annual truck volume as a result of the project. Additional measures assess the project's alignment with a state freight plan and share of jobs near projects in industrial sectors, which indicates the volume of freight traffic that will travel on the project segment.

Table 14 summarizes survey results.

Supporting Document

Maryland

2017 Maryland Strategic Goods Movement Plan, Maryland Department of Transportation, 2017.
https://www.mdot.maryland.gov/OPCP/Strategic_Goods_Movement_Plan_2017.pdf
From the plan purpose:

> This Strategic Goods Movement Plan examines existing conditions and long-range projections, and establishes policy positions, strategies, and identifies freight projects over the next five years to improve freight movement efficiency and safety. Maryland's multimodal transportation system for goods movement provides a critical support structure for the economic vitality of the [s]tate and surrounding region.

Section 5 addresses tracking performance (page 56 of the report, page 67 of the PDF).

Table 14. Throughput (Freight) Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Truck Volume	SCCRTC	PeMS	N/R
Daily and Peak Period Truck Volume (Existing and Future)	SBCTA	• Original counts for project • Caltrans and local traffic census counts.	Future volumes estimated through travel demand model or freight-specific traffic study.
Peak Period Person/Vehicle Throughput by Mode	RCTC 2	N/R	Preference for this CTC metric instead of the change in annual truck volume that can be accommodated due to the improvement, which is a less natural calculation for highway projects.
Percent of Traffic Volume That is Trucks (Freeways Only)	SACOG	N/R	N/R
Change in Annual Truck Volume Accommodated Due to Improvement	SANDAG	• TCEP Cycle 2: Otay Mesa East Level II Traffic and Revenue model • TCEP Cycle 1: Previous traffic studies	• TCEP Cycle 2: Using Cal-B/C, assumptions included in Otay Mesa East Level II Traffic and Revenue model. (For specific Otay Mesa East project, project will add five new commercial vehicle lanes, increasing capacity by 38%.) • TCEP Cycle 1: Used Cal-B/C as main tool.
Share of Jobs Near Projects in Industrial Sectors*	SACOG	N/R	N/R
Alignment With State Freight Plan	Maryland DOT	Maryland Strategic Goods Movement Plan	1. Award one point to proposed projects in the Strategic Goods Movement Plan (see Supporting Document). 2. Multiply project cost by the assigned number of points. 3. To scale the benefit, divide by the maximum unscaled value across all projects in the comparison database.

N/R No response.

* Proxy for the volume of freight traffic that will travel on the project segment.

Velocity (Freight)

Respondents from three agencies—RCTC 2, SANDAG and SBCTA—provided performance measures in the velocity (freight) category. SANDAG uses travel time or total cargo transport time, including dwell time in a logistics facility such as a port or railyard if applicable to the project. SBCTA uses peak and off-peak period speeds for all traffic, with the understanding that trucks travel with all traffic under congested conditions and at the speed limit for uncongested conditions. The agency anticipates that the improvement will not increase speeds for trucks as much as it will for automobiles. The RCTC 2 respondent noted that the CTC metrics of travel time per trip and change in average peak speed are sufficient to measure this outcome.

Table 15 summarizes survey responses.

Table 15. Velocity (Freight) Performance Measures

Performance Measure	State/Agency	Data Sources	Methodologies
Peak and Off-Peak Period Speed	RCTC 2, SBCTA	*SBCTA*: 1. Existing speeds based on probe-based data analyzed with ClearGuide (Iteris) 2. Future speeds based on increment of model-based speeds or Cal-B/C-generated speeds	*RCTC 2*: CTC metrics of travel time per trip and change in average peak speed are sufficient to measure this outcome. *SBCTA*: Speeds are for all traffic. Trucks assumed to travel with all traffic under congested conditions. Trucks assumed generally at speed limit for uncongested conditions. (An improvement will not increase speeds for trucks as much as it will for automobiles.)
Travel Time or Total Cargo Transport Time*	RCTC 2, SANDAG	*SANDAG*: • TCEP cycle 2: ○ Otay Mesa East Level II Traffic and Revenue model (vehicle wait time simulation) ○ Average vehicle occupancy • TCEP cycle 1: Previous traffic studies	*SANDAG*: • TCEP cycle 2: ○ Cal-B/C ○ Total annual vehicle hours of delay at the border (2025-2044) • TCEP cycle 1: Cal-B/C

* Including dwell time in logistics facility (such as a port or railyard).

Additional Performance Measures

Several respondents provided information about performance measures in other categories, including economic development, social benefit–cost ratios, resiliency and system preservation/asset management. The SBCTA respondent noted that metrics and methodologies vary across state agencies. CARB has a separate GHG reduction calculator for Transit and Intercity Rail Capital Program (TIRCP) projects, especially for transit projects. Cal-B/C is a very important analytical tool, but may not yield the same result.

Table 16 presents the additional categories and performance measures.

Table 16. Additional Performance Measures

Category/Performance Measure	State/Agency	Data Sources	Methodologies/Description

Economic Development:
• **Size, Status and Employment Density of Planned Development in the Project Area**
	Maryland DOT	N/R	1. Determine land area (in acres) of proposed development.
			2. Multiply by the points according to the methodology below for the development land area.
			3. Scale by dividing by the maximum unscaled value.
			Scoring:
			• Is the project consistent with the local comprehensive plan?
			  ○ Consistent with: 0.5
			  ○ Referenced in: 1
			• What is the development project's site plan status?
			  ○ Submitted: 0.5
			  ○ Approved: 1
			• What is the development project site utilities status?
			  ○ Programmed: 0.5
			  ○ In-place: 1
			• What is the expected employment density of the proposed development? *Note*: Most developments will generate high employment density. A storage facility is an example of low employment density.
			  ○ None: 0
			  ○ Low: 0.5
			  ○ High: 1

Equity Score (for RTP): • **Equity Score**	MTC	Travel model outputs	• Ratio of accessibility benefits gained by individuals with low incomes (below the regional median) to accessibility benefits gained by all individuals. • Accessibility benefits include consumer surplus derived from travel time savings, travel cost savings and number of options to make a given trip.
Guiding Principles Alignment (for RTP): • **Guiding Principles Alignment**	MTC	Staff assessment based on sponsor's project description	Qualitative assessment of whether a project is in support of or counter to the five guiding principles adopted by MTC and ABAG: affordable, connected, diverse, healthy and vibrant.

Category/Performance Measure	State/Agency	Data Sources	Methodologies/Description
Resiliency: • **Project's Ability to Improve Connections to Critical Community Facilities in Emergencies**	Boston Region MPO	Project design documents	Award points to projects that improve multimodal access to schools, police/fire stations, hospitals, permanent and emergency shelters, community centers, food banks and churches.
Societal Benefit–Cost Ratios (for RTP): • **Societal Benefit–Cost Ratios**	MTC	Travel model outputs and costs from project sponsors audited by independent cost consultant	Calculated as benefits divided by costs (each calculated over 80-year period, discounted): 1. Benefits include: • Accessibility benefits (such as consumer surplus derived from travel time savings, travel cost savings and number of options to make a given trip) • Freeway reliability • Transit crowding reduction • Environmental (including emissions and natural land gained/lost) • Health (including physical activity, air pollution and noise) • Safety (including fatalities and serious injuries) 2. Costs include: • Capital costs (including initial investment, rehabilitation/ replacement costs and a credit for residual value that remains after the plan period) • Annual operation and maintenance costs
System Preservation: • **Increased Life Span of the Affected Facility** • **Increased Functionality of the Facility**	Maryland DOT	• Maryland pavement measure (to determine pavement area in fair and poor condition) • Maryland bridge measure (to determine pavement area in fair and poor condition) • Maryland rail and facility Transit Economic	**Facility Life Span:** 1. Select the first asset type. Assets can be selected if the project includes system preservation activities for that particular asset. 2. Determine the amount of the asset in fair and poor condition. a. For highways, use Maryland DOT SHA's pavement and bridge measure to quantify pavement and bridge area in fair and poor condition. b. For transit assets, use condition data collected based on Federal Transit Administration's TERM 5-point scale.

Category/Performance Measure	State/Agency	Data Sources	Methodologies/Description
		Requirements Model (TERM) condition score	3. Multiply the asset quantity in fair condition by the adjustment factor for fair condition. 4. Multiply the asset quantity in poor condition by the adjustment factor for poor condition. **Facility Functionality:** 1. Obtain the total cost of the project. 2. Determine the number of points to attribute to the project using the list below. 3. Multiply the total project cost by the project points. 4. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database. Scoring: Does the project: • Change the classification of a bridge from structurally deficient to not deficient? 1 • Widen existing lanes or shoulders? 1 • Include improvements that support ADA compliance? 1 • Include improvements to transit or other fixed facilities to replace equipment classified as obsolete based on current design standards? 1
System Preservation/Asset Management: • **Improvements to Bridges and Pavement Condition** • **Improvements to Transit Assets**	Boston Region MPO	*Bridges and pavement condition*: Massachusetts DOT bridge and pavement databases *Transit assets*: Project design documents	*Bridges and pavement condition*: • Pavement condition is measured using IRI. • Bridge condition is measured using federal good/fair/poor system, along with notations on weight restrictions and whether bridges are structurally deficient. *Transit assets*: Award points to projects that improve the condition of transit assets, including bus stops, rail stations, transit vehicles and other assets.

Category/Performance Measure	State/Agency	Data Sources	Methodologies/Description
System Redundancy: • **Potential to Increase Alternatives and Redundancy in the Transportation System**	Maryland DOT	N/R	1. Obtain total project cost. 2. Determine the number of points to assign to the project using the list below. 3. Multiply project cost by the assigned number of points. 4. Scale the benefit by dividing by the maximum unscaled value across all projects in the comparison database. Scoring: To what degree does this project increase transportation redundancy? • This project does not increase transportation redundancy: 0 • This project increases transportation redundancy in one direction of travel: 1 • This project increases transportation redundancy in both directions of travel: 2

N/R No response.

Tools and Documentation

Data Collection and Mapping Tools

Ten responding agencies reported using Esri tools such as ArcGIS and ArcMap to gather and map data needed to support the project-level performance measures. Eight agencies reported using additional tools such as Google Maps and CalEnviroScreen. For RTPs, MTC uses Travel Model 1.5, an activity-based travel simulation model developed in house, and UrbanSim Two, an urban modeling tool that simulates household location choice, employer location choice and developer action. (MTC modifies UrbanSim to meet Bay Area specifications.) SACOG uses a custom Project Performance Assessment geospatial tool that aggregates data layers that the agency maintains and completes calculations by project; many of the measures use a buffer approach drawing on characteristics within the project travel shed. At StanCOG, local agency applicants use the CARB Automated Cost-Effectiveness Calculation Tool for CMAQ project submittals.

Table 17 summarizes survey responses.

Table 17. Geospatial Tools Used for Data Collection and Mapping

State/Agency	Esri ArcGIS	Esri ArcMap	Other	Description
Boston Region MPO	X		X	Google Maps
Illinois DOT		X		
LA County Metro	X			
Maryland DOT		X	X	• Renaissance Planning Multimodal Accessibility Tool • MSTM
Minnesota DOT	X			
MTC			X	• Travel Model 1.5 • UrbanSim Two
RCTC 1	X		X	Other tools related to ArcGIS
RCTC 2			X	Consultant preference
SACOG			X	Custom Project Performance Assessment tool
SANDAG	X		X	CalEnviroScreen
SBCTA	X			
SCAG	X			
SCCRTC	X			
StanCOG			X	CARB Automated Cost-Effectiveness Calculation Tool (used by local agencies for CMAQ project submittals only)
Total	**8**	**2**	**8**	

Data Management Tools and Models

Respondents reported a range of vendor, in-house and other tools and models to gather and manage the data needed to support the project-level performance measures. For RTPs, MTC employs REMI, which is used for regional economic forecasting, including future demographics and economic conditions. SACOG uses the select link analysis in its travel model in performance assessment. More recently, the agency has completed a pilot project using Replica data and will most likely be incorporating this as a tool in project-level assessment moving forward.

SANDAG's Activity-Based Model (ABM) is useful for horizon year data; however, since running the model takes significant resources, grant applications typically rely on Cal-B/C since it is quicker. The ABM is also not intended to be used for yearly reporting since it is a forecast tool and is not intended to be a monitoring tool for specific projects.

Among the tools used by SBCTA are the San Bernardino Transportation Analysis Model (SBTAM), a subregional TransCAD model that is based on the four-step SCAG Regional Model; FTA STOPS, a model generally used to analyze transit alternatives, which generates person-hours and some VMT reductions; and SYNCHRO for intersection/signal analysis (to analyze bottleneck relief and delay reduction for freight). RCTC 2 noted the agency's reliance on consultants to gather and manage data that supports performance measures, adding that it provides project documents, including environmental documents and any studies that have been completed in support of a project, to consultants that prepare grant applications.

Table 18 summarizes survey responses.

Table 18. Tools and Models Used for Data Collection and Management

State/Agency	RITIS	CARB Tools	In House Tools	Vendor Tools	Other	Description
Boston Region MPO	X					
Illinois DOT	X				X	2010 HSM
Maryland DOT			X			Microsoft Excel (for project scoring)
MTC				X		REMI (for RTP)
RCTC 1		X			X	• EMFAC • CARB's Carl Moyer Program Guidelines • Caltrans methods for calculating cost-effectiveness of CMAQ projects
RCTC 2					X	Consultant preference
SACOG			X	X		• Select link analysis in performance assessment travel model • Replica data
SANDAG			X			• SANDAG ABM • Cal-B/C
SBCTA				X	X	• SBTAM • ClearGuide (Iteris) • FTA STOPS • SYNCHRO

State/Agency	RITIS	CARB Tools	In House Tools	Vendor Tools	Other	Description
SCAG			X			• SCAG Regional Travel Demand Model • SCAG Scenario Planning Model.
SCCRTC		X	X		X	• TransCAD • AMBAG travel demand model • Esri ArcGIS
StanCOG		X				CARB Automated Cost-Effectiveness Calculation Tool (CMAQ project submittals only)
Total	**2**	**3**	**5**	**3**	**5**	

Assessment and Recommendations

Successes Using Performance Measures in Applications

Common successes using project-level performance measures in transportation project applications include:

Ensuring equitable access to funding

- To administer the 2% set-aside of local transportation funds for bicycle and pedestrian projects, RCTC 2 reported that the agency creates a subcommittee of the agency's Technical Advisory Committee that is made up of agencies that apply to receive competitive funds. RCTC establishes the scoring for applications, considering all input and the potential adverse impact some factors may have on particular applicants. To ensure equitable treatment among applicants, RCTC makes applications easy to compile and is fully transparent about scoring for each required category.
- At MTC, project costs are used to calculate the benefit–cost ratio. These costs come from project sponsors that use varying methods for estimating project costs. The agency uses an independent consultant to verify cost estimates from sponsors to ensure a more uniform comparison across projects from different sponsors.
- The SACOG respondent reported that online evaluation tools are available to anyone.

Modeling project elements and cost-effectiveness

- MTC quantifies benefits to individuals with low incomes to objectively assess projects' impacts on equity. Previously MTC had limited abilities to assess performance and had to rely on the geographic location.
- SBCTA uses big data tools such as ClearGuide to quantify existing conditions and make the case for projects, particularly freight projects.
- SBCTA also uses a cost-effectiveness index to prioritize interchange improvements for investment in its Measure I interchange program, which helped to structure and organize the interchange program in 2009.

- The StanCOG respondent noted that CMAQ projects with the best cost-effectiveness are funded and implemented, and provide air quality benefits to the region.
- The SACOG respondent noted that performance measures have been the "cornerstone element of review" in recent funding rounds; the board "look[ed] for [the] quantitative component of [the] evaluation."

Using performance and equity assessment results to identify project deficiencies

- MTC uses this information to help project sponsors re-scope projects or identify complementary policies that should be pursued to mitigate deficiencies if the project is implemented.

Obtaining required design and other documentation

- Boston MPO Region is "generally pretty successful" at getting the information needed to score projects, such as functional design reports, road safety audits and conceptual designs and plans. Applicants are required to complete a questionnaire to ensure project information is complete (see Supporting Document).
- RCTC 1 reported that template-based application sections help ensure all essential information is provided to facilitate project evaluation.

Maintaining flexibility with performance measures

- The SANDAG respondent reported that funding agencies have been supportive of requests for flexibility in performance measures.

Building interagency relationships

- SANDAG has built strong relationships with some of its statewide freight agencies to build consensus on most TCEP performance measures.

Challenges Using Performance Measures in Applications

Challenges that agencies have when working with applicants are summarized below:

Incomplete information

- Boston Region MPO noted that the level of detail across applications varies, which can create challenges given the short timeline to score projects (usually about four weeks). Additional information is usually obtained through follow-up discussions with project proponents.
- The RCTC respondents noted that "missing or inconsistent information" is challenging. In addition, many local agencies don't have sufficient staff to complete applications or acquire information, such as safety data.
- Maryland DOT sometimes receives applications for projects that are either exempt from scoring or do not have sufficient planning to score.

Accessing data

- The Minnesota DOT respondent noted that obtaining data can create a barrier for potential applicants.
- SACOG noted a lack of comprehensive, detailed traffic count data precludes the calculation of weighted congestion measures (e.g., vehicle hours of delay or person hours of delay).

Accommodating all projects

- MTC finds that some projects do not lend themselves to regional assessments, including small projects that have highly localized benefits (such as bicycle or pedestrian investments) or that improve reliability (that an agency's model cannot assess reliability benefits).
- MTC also noted that analyzing projects in isolation is useful, but does not recognize that projects are part of a transportation network and can have improved or degraded performance in the presence of other projects.
- SACOG reported challenges evaluating across project types, such as freeway high occupancy vehicle lane versus transit bus replacement versus road rehabilitation.

Tool issues

- SACOG noted a number of potential challenges with tools
    - Ensuring tools are available to all users, including nonmodelers.
    - Managing expectations (e.g., a project/no project analysis versus reality, state of the tool, level of effort).
    - Understanding the tool: SACOG's tool produces many indicators. Using the tool can be a "steep learning curve" for some applicants.
    - Ensuring online tool stability.

Understanding how projects will perform in an uncertain future

- For RTP measures, MTC finds that analyzing projects in multiple futures was invaluable in understanding projects' anticipated performance, though this approach substantially increased the workload.

Maintaining flexibility with performance measures

- For TCEP, SANDAG has pushed for funding opportunities to allow flexibility in performance measures, especially for qualitative answers when quantitative answers are not feasible. For example, traditional performance measures don't always apply to the agency's land ports of entry, so the agency submits qualitative answers. In some cases, the agency applying for the freight grant is not the freight operator, and due to market conditions, the project may not realize the intended performance measures due to these market conditions.
- SCCRTC finds that data and methodology for performance measures are often unique for the metric and project mode. Flexibility may be needed for applicants to determine the best information for assessing the benefit.
- StanCOG noted that not all projects meet the $45 per pound threshold.

<u>Implementation Recommendations</u>

Respondents offered recommendations for other agencies beginning to implement project-level performance measures to evaluate the effectiveness and/or competitiveness of transportation project applications:

Boston Region MPO:

- **Allow performance measures to vary by project type.** Recent revisions to the agency's project selection criteria prioritized this approach and created a better overall

system by ensuring each performance measure appropriately applies to each project (for example, bicycle and pedestrian projects versus Complete Streets projects).

- **Balance breadth with clarity.** The agency has about 25 scoring criteria, which makes scoring cumbersome (though the MPO board prefers this level of detail). Fewer criteria or performance measures can make a scoring system more legible, especially to the public, but that requires sacrificing some level of detail and thoroughness.
- **Conduct public outreach.** The agency conducted two rounds of public outreach (through surveys and focus groups) in support of its new criteria and found these conversations to be rewarding. Several updates were made to the scoring criteria in direct response to public feedback.

Maryland DOT:

- **Provide some areas where the reviewing agency has some evaluation input.** Using objective data and analysis are most desired in project performance criteria but some measures cannot always be evaluated based on data alone.
- **Ensure a transparent development and education process for new programs.** Bring in various stakeholders when measures are developed to solicit data that will be applied and weight criteria. Get input from subject matter experts for each criteria field. Also, work to make the applicants part of the criteria development process. Invite some to sit on a development committee for review along the way. After the criteria are finalized, provide continual awareness about the evaluation process.

Minnesota DOT:

- **Carefully consider the level of effort required versus the benefit of getting or using the data.**
- **Be transparent with methodology and selection decisions.**
- **Take an iterative approach.** Try some new criteria, and then reflect and update measures.

MTC:

- **For RTP measures, base equity assessments on modeled utilization of a project instead of simply on a project location.** This is especially important given the history of transportation infrastructure projects in disrupting communities of color without providing benefits to community members themselves.

RCTC 1:

- **Use templates within the application to request essential project information and data.** Applicants fill in the appropriate data fields.
- **For correctness and consistency, make the calculations instead of relying upon applicants to do them.**
- **Request and evaluate supporting documents to corroborate and substantiate performance measure representations.**

RCTC 2:

- **Keep it simple by sticking with the basics.** Provide a straightforward explanation of the impetus for creating the application process.
- **Ensure all agencies have an equal shot at applying and receiving funds.**

SACOG:

- **Define outputs and wherever possible, give a relative comparison.** Understanding the meaning of outputs can be a steep learning curve for some applicants.
- **Start with observed data to demonstrate an existing need.**
- **Recognize upfront limitations and trade-offs.** Avoid false precision.

SANDAG

- **Attend workshops on the process of developing guidelines for funding opportunities.** This is the time that agencies can comment on potential performance measures and push for some flexibility.
- **Ensure the performance measures in the grant applications can be vetted with data sources/methodologies.** The funding agencies will question numbers that are not explained in the application.
- **Develop a process for tracking the performance measures.** The awarded agency will need to revisit these performance measures often for annual reporting and audits.

SBCTA:

- **Keep performance measures simple and consistent across project types.** The CTC had a much more extensive set of performance measures for SB 1 cycle 2 TCEP and SCCP applications.
- **Reconsider post-implementation performance measures.** The CTC requires post-implementation assessments, using actual data, for projects it has funded. This step is much more difficult and expensive, and many times not even feasible for before/after analysis. Recognize that these sets of performance measures are different, based on the feasibility and cost of data collection.
- **Continue to use cost-effectiveness as a criterion.** It is a key component of how the public and businesses perceive the worthiness of a project. Savings in travel time is the principal determinant of a project's cost-effectiveness and benefit to the economy, particularly for freight projects. The state needs to continue to include it as an evaluation factor for freight/economic competitiveness even though delay is being downplayed for automobile travel.

SCCRTC:

- **Provide the best information for evaluation instead of following the exact wording of the performance measure requirement**. Measures are not always applicable for all situations.

StanCOG:

- **When selecting performance measures, tailor each to a specific region.** Not all performance measures are applicable to each region.
- **During performance measure development, consult with local agencies to assure each measure's feasibility before finalizing it.**
- **Once performance measures are developed, work with the agencies to help generate projects with the ability to meet the performance goals.** Collaboration among multiple agencies to create a bigger project may score higher depending on the performance measure.

Additional Information

Two respondents provided additional suggestions:

- *RCTC 2*: The respondent noted that adding a sheet to the Cal-B/C model that automatically summarizes the safety, travel time and emissions-related metrics in the manner desired by CTC for performance monitoring would be very helpful. RCTC recently submitted four Cycle 2 SB 1 applications (Local Partnership Program C, Solutions for Congested Corridors Program, Trade Corridor Enhancement Program and Local Partnership Program F). Many of the metrics required additional analysis that was not easily derived from the required Cal-B/C model, which made for a more difficult analysis. The respondent suggested that it would benefit these applications and the grantees to either use a model that directly modeled the metrics requested (rather than requiring additional methodology or analysis) or update the metrics to more closely mirror the outputs of Cal-B/C, where applicable. Specifically, the summarized outputs of Cal-B/C show only the total change in top-level metrics over the 20-year operations period and an annual average. They do not show the build and no-build totals, and they do not show the daily information often requested in the CTC metrics. This information is available within the model but it requires significant effort to make the necessary calculations to summarize the information in the required manner.
- *SANDAG*: The modeling staff shared the following suggestions:
    - *Data related to cost of heavy duty truck operations and ownership:* The SANDAG ABM has an auto operating cost, which is a combination of fuel and maintenance. It would be helpful if there were similar annual reports that have that information. Usually the fuel costs have multiple sources but the modeling staff relies on the AAA maintenance cost calculator for the non-fuel costs (expressed in cents per mile driven). Trade groups or other freight organizations may survey operators about their annual operating costs, and could provide this information.
    - *Regular counts at major freight facilities by time of day:* Knowing whether certain sites have a high proclivity of truck activity during nonstandard peak hours would help the staff in estimating its baseline model. For example, if a commercial ship at 10th Avenue generates most of its trips between 10 p.m. and 4 a.m., SANDAG could adjust its commercial vehicle model to assign those trips during the evening period in the model.
    - *Overall major freight facility throughput:* Having a regular snapshot of what kind of activities are happening on a year-to-year basis would be useful. This information could be provided by loads, trips or tonnage, as long as it's done by mode (such as truck, rail or ship).

Supporting Document

Boston Region Metropolitan Planning Organization

Project Proponent Guidance and Questionnaire, Memorandum, Boston Region Metropolitan Planning Organization, October 2019.
https://www.ctps.org/data/pdf/plans/TIP/FFYs-2021-2025-TIP-Project-Proponent-Guidance.pdf
Local agencies interested in receiving federal funding for transportation construction projects use this guidance to provide information that is used to initiate the project, advance it through design review and evaluate for possible inclusion in the TIP.

Related Research and Resources

Below is documentation provided by survey respondents that is related to the use of project-level performance measures with competitive transportation project funding programs. Following these resources is contact information for survey respondents and others who are available to provide additional information about project-level performance measurement practices.

Related Research

Boston Region Metropolitan Planning Organization

Creating New TIP Criteria, Boston Region Metropolitan Planning Organization, undated.
https://www.ctps.org/tip-criteria-dev
The agency recently completed a 15-month process of revising its project selection criteria and is building a larger suite of materials to communicate this information. Details about the revision process and proposed changes to project selection criteria are available at this web site.

Los Angeles County Metropolitan Transportation Authority

Metro Active Transport (MAT) Program: Cycle One Screening and Prioritization Methodology, Los Angeles County Metropolitan Transportation Authority, January 2020.
http://media.metro.net/about_us/committees/images/mat-cycle1-screening-methodology.pdf
The screening and prioritization methodologies are presented for the Metro Active Transport Program. The processes address equity, safety and mobility/connectivity.

Maryland

Chapter 30: Transportation Project-Based Scoring Model, 2019 Technical Guide, Maryland Department of Transportation, 2019.
https://www.mdot.maryland.gov/OPCP/FY2019_Chapter30_Technical_Guide.pdf
From the introduction: Pursuant to Chapter 30, Acts of 2017 (Senate Bill 307), the Maryland Department of Transportation (MDOT) "shall, in accordance with federal transportation requirements, develop a project-based scoring system for major transportation projects using the goals and measures established under [Transportation Article 2-103.7(c)] for projects" being considered for inclusion in the Consolidated Transportation Program (CTP). … This document presents details on the Chapter 30 scoring model including information on roles and responsibilities, project eligibility requirements, the project application process, and the goals and measures used for scoring projects.

Metropolitan Transportation Commission

Horizon/Plan Bay Area 2050: Project Performance Findings, Anup Tapase, Metropolitan Transportation Commission, Association of Bay Area Governments, January 2020.
https://mtc.ca.gov/sites/default/files/ProjectPerformance_FinalFindings_Jan2020.pdf
The key objectives of project performance and documentation about project methodologies used in the RTP are provided in this presentation.

Minnesota

P**roject Selection: How We Select Highway Construction Projects**, Minnesota Department of Transportation, undated.
www.mndot.gov/projectselection
Information about the agency's project selection processes is available on this web page.

Sacramento Area Council of Governments

Project Performance Assessment, Sacramento Area Council of Governments, undated.
https://www.sacog.org/project-performance-assessment
Documentation about the updated Project Performance Assessment tool and other materials is available at this web site.

Santa Cruz County Regional Transportation Commission

The following reports both evaluate performance measures quantitatively:

> **Unified Corridor Investment Study**, Santa Cruz County Regional Transportation Commission, January 2019.
> https://www.sccrtc.org/wp-content/uploads/2019/01/UCS-Final-January2019.pdf
> *From the web site*: The objective of the Unified Corridor Investment Study (UCS) is to identify multimodal transportation investments that provide the most effective use of Highway 1, Soquel Avenue/Soquel Drive/Freedom Boulevard, and the Santa Cruz Branch Rail Line while best serving the community's transportation needs. The study's goals focus on developing a sustainable and well-integrated transportation system while maximizing benefits in terms of efficient mobility, health and equity, the natural environment, and economic vitality.
>
> **Transit Corridor Alternatives Analysis and Rail Network Integration Study**, Draft Report, Santa Cruz County Regional Transportation Commission, 2020.
> https://sccrtc.org/draft-results-of-the-transit-corridor-alternatives-analysis-study-released/
> *From the web site*: The report details the results of the TCAA/RNIS [Transit Corridor Alternatives Analysis and Rail Network Integration Study] which evaluates high-capacity transit investment options and identifies a locally preferred transit system that utilizes all or part of the length of the Santa Cruz Branch Rail Line Rail Right-of-Way (SCBRL ROW). The yearlong study analyzed various transit alternatives to identify a locally preferred alternative that provides the greatest benefit to Santa Cruz County residents, businesses and visitors in terms [of] the triple bottom line goals of improving economy, equity, and the environment.

Follow-Up Contacts

Below is contact information for agency representatives who are available to provide additional information about project-level performance measurement practices:

Boston Region Metropolitan Planning Organization:
- Matt Genova (survey respondent), mgenova@ctps.org.

Illinois DOT:
- Kyle Johnson (survey respondent), kyle.johnson@illinois.gov.
- Steve Prefountain, stephen.prefountain@illinois.gov.

Kern COG:
- Joseph Stramaglia (survey respondent), 661-472-2887.

Los Angeles County Metropolitan Transportation Authority
- Shelly Quan (survey respondent), quans@metro.net.

Maryland DOT:

- Phil LaCombe (survey respondent), placombe1@mdot.maryland.gov.
- Dan Favarulo, dfavarulo@mdot.maryland.gov.

Minnesota DOT:

- Philip Schaffner (survey respondent), philip.schaffner@state.mn.us.

MTC:

- RTP: Raleigh McCoy, rmccoy@bayareametro.gov.
- STP/CMAQ: Mallory Atkinson (survey respondent), matkinson@bayareametro.gov.

RCTC:

- Ray Gorski (survey respondent 1), rgorski@pacbell.net.
- Jillian Guizado (survey respondent 2), jguizado@rctc.org.

SACOG:

- Garett Ballard-Rosa (survey respondent), gballard-rosa@sacog.org.
- Darren Conly, dconly@sacog.org.

SANDAG:

- Keri Robinson (survey respondent), keri.robinson@sandag.org.

SBCTA:

- Steve Smith (survey respondent), ssmith@gosbcta.com.
- Tim Byrne, tbyrne@gosbcta.com.

SCCRTC:

- Ginger Dykaar (survey respondent), 831-460-3213, 831-334-9705 (cell), gdykaar@sccrtc.org.

Absence of Project-Level Performance Measures

Twelve respondents from 11 agencies reported that their agencies have not developed project-level performance measures:

State DOTs

Florida DOT
New Mexico DOT
Wyoming DOT

California MPOs

SANDAG (two responses: Planning, and Grants and Contracts)
San Luis Obispo Council of Governments
SBCAG

California RTPAs

Madera County Transportation Commission
Modoc County Transportation Commission
Shasta Regional Transportation Planning Agency

Tehama County Transportation Commission
Trinity County DOT

Five of these agencies provided more detail about current circumstances related to competitive transportation project funding, which is largely related to the limited number of projects that are funded:

- *Modoc County Transportation Commission*: This agency operates in a very rural county with deferred maintenance needs.
- *SANDAG/Planning*: Performance measure efforts are typically applied to plans and programs rather than specific projects.
- *SBCAG*: SBCAG does not administer funding programs to the extent that performance measures are necessary. The respondent expects this condition to continue for the foreseeable future. The agency does administer a local sales tax initiative (Measure A). Most of the funding associated with this initiative is formula-based; funding that is not is largely associated with Safe Routes to School and Active Transportation programs. STIP funding has been used for a single large project. As STIP funding becomes available for other projects, circumstances may change and SBCAG will revisit the issue.
- *Shasta Regional Transportation Agency*: The respondent noted that only a limited number of projects can be funded in smaller regions. The agency is usually focused on top-tier, long-established priorities. Local agency projects with a regional funding component must support implementation of the region's adopted Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), which includes goals and performance targets.
- *Wyoming DOT*: The only competitive transportation project applications in Wyoming are the Technical Advisory Panel and CMAQ funds for local governments, which is a small portion of Wyoming DOT's budget (about $4.5 million).

The SANDAG/Planning respondent also provided information about agency tools and implementation recommendations related to plan- and program-level performance measures (not project-level):

Geospatial tools to gather and map data:	Esri ARC products, including online hosting services.
Other tools to gather and manage data:	• ABM • Database management tools, such as SQL Management, Access and Excel
Implementation recommendations:	• Support applicants with common data sources and processes. Not all agencies will have the same resources for data analysis. Supplying as much of the material as possible will help level the playing field. Existing conditions assessments help identify areas of need that may not fit in modeling of anticipated future conditions. • Provide flexibility for applicants to showcase project strengths outside the performance measure structure.

The respondent is available to provide additional information about the agency's practices.

Related Resource:

> **Federal 2020 Regional Transportation Plan (Archived)**, Activity-Based Model (ABM)—Reporting, San Diego Association of Governments, updated August 25, 2020. https://github.com/SANDAG/ABM-Reporting/wiki/Federal-2020-Regional-Transportation-Plan-(Archived)
> *From the web page*: The Federal 2020 Regional Transportation project contains SQL objects, a Python project, and a formatted Excel template. The main output product is a formatted and populated Excel workbook containing all [p]erformance [m]easures used in the Federal 2020 Regional Transportation Plan.

Future Plans

Three of these agencies—SANDAG/Planning, SANDAG/Grants and Contracts, and Tehama County Transportation Commission—are considering developing project-level performance measures for competitive transportation project funding. According to the SANDAG/Grants and Contracts respondent, SANDAG has six competitive grant programs and will be implementing performance measures for each in the next scheduled call for projects, which is expected to occur in summer 2021. Tehama County Transportation Commission is considering developing performance measures but has not finalized plans.

Contacts

CTC contacted the individuals below to gather information for this investigation.

State Agencies

Florida

Regina Colson
Transportation Performance Measures Coordinator
Florida Department of Transportation
850-414-5271,
regina.colson@dot.state.fl.us

Illinois

Kyle Johnson
GIS Database Specialist, Planning and Programming
Illinois Department of Transportation
217-622-5519, kyle.johnson@illinois.gov

Indiana

Louis Feagan
Asset Management
Indiana Department of Transportation
317-412-1670, lfeagans@indot.in.gov

Maryland

Philip LaCombe
Transportation Planner
Maryland Department of Transportation
413-648-7445,
placombe1@mdot.maryland.gov

Michigan

Kelly Travelbee
Performance
Michigan Department of Transportation
517-898-4875, travelbeek@michigan.gov

Minnesota

Philip Schaffner
Director, Statewide Planning, Planning
Minnesota Department of Transportation
651-366-3743,
philip.schaffner@state.mn.us

New Mexico

Tamara Haas
Capital Program and Investments Division
New Mexico Department of Transportation
505-795-2126, tamarap.haas@state.nm.us

Ohio

Tim McDonald
Planning
Ohio Department of Transportation
614-466-8981, tim.mcdonald@dot.ohio.gov

Wyoming

Martin Kidner
State Planning Engineer
Wyoming Department of Transportation
307-777-4411, martin.kidner@wyo.gov

California Metropolitan Planning Organizations

Kern Council of Governments

Joseph Stramaglia
Regional Planner, Project Delivery
661-635-2914, jstramaglia@kerncog.org

Metropolitan Transportation Commission

Mallory Atkinson
Funding Policy Analyst, Funding Programs and Policy
415-778-6793,
matkinson@bayareametro.gov

Sacramento Area Council of Governments

Garett Ballard-Rosa
Transportation Group
916-319-5183, gballard-rosa@sacog.org

San Diego Association of Governments

Keri Robinson
Goods Movement Planner, Planning
619-699-6954, keri.robinson@sandag.org

Jenny Russo
Grants and Contracts
619-699-7314, jenny.russo@sandag.org

Sam Sanford
Planning
619-595-5607,
samual.sanford@sandag.org

San Luis Obispo Council of Governments

Daniel Audelo
Transportation Planner
805-781-4219, daudelo@slocog.org

Santa Barbara County Association of Governments

Dylan Tonningsen
Transportation Planner II, Programming
510-898-8178, dtonningsen@sbcag.org

Southern California Association of Governments

Mike Gainor
Senior Regional Planner
213-236-1822, gainor@scag.ca.gov

Stanislaus Council of Governments

Isael Ojeda
Senior Planner
209-272-6381, iojeda@stancog.org

California Regional Transportation Planning Agencies

Los Angeles County Metropolitan Transportation Authority

Shelly Quan
State Policy and Programming
213-922-3075, quans@metro.net

Madera County Transportation Commission

Dylan Stone
Regional Planning Supervisor
559-675-0721, dylan@maderactc.org

Modoc County Transportation Commission

Debbie Pedersen
Executive Director
530-233-6410,
dpedersen@modoctransportation.com

Riverside County Transportation Commission

Ray Gorski (respondent 1)
Consultant, Planning and Programming
760-715-5391, rgorski@pacbell.net

Jillian Guizado (respondent 2)
Planning and Programming
951-787-7923, jguizado@rctc.org

San Bernardino County Transportation Authority

Steve Smith
Director, Planning
760-567-0382, ssmith@gosbcta.com

Santa Cruz County Regional Transportation Commission

Ginger Dykaar
Senior Transportation Planner
831-460-3213, gdykaar@sccrtc.org

Shasta Regional Transportation Agency

Daniel Wayne
Senior Transportation Planner
530-262-6186, dwayne@srta.ca.gov

Tehama County Transportation Commission

Jessica Riske-Gomez
Transportation Manager
530-385-1462, jriskegomez@tehamartpa.org

Trinity County Department of Transportation

Kimi Taguchi
Transportation Planner
530-623-1365, ktaguchi@trinitycounty.org

Other Metropolitan Planning Organizations

Boston Region Metropolitan Planning Organization

Matt Genova
Transportation Improvement Program Manager
857-702-3702, mgenova@ctps.org

Puget Sound Regional Council

Kelly McGourty
Director, Transportation Planning
206-971-3601, kmcgourty@psrc.org

Consultant

Mark Thomas

Ryan Bissegger
New Business Director
916-539-4680, rbissegger@markthomas.com

Appendix A: Survey Questions

The following survey was distributed to members of the American Association of State Highway and Transportation Officials (AASHTO) Committee on Performance-Based Management, a select group of California metropolitan planning organizations (MPOs) and regional transportation agencies, and a select group of MPOs from other states.

Survey on Methodologies Supporting Project-Level Performance Measurement

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Note: The response to the question below determined how a respondent was directed through the survey.

(Required) Has your agency developed project-level performance measures that are used to evaluate proposals submitted by applicant agencies to competitive transportation project funding programs?

- No. (Directed the respondent to the **Agencies Without Project-Level Performance Measures** section of the survey.)
- Yes. (Directed the respondent to the **Describing the Performance Measures** section of the survey.)

Agencies Without Project-Level Performance Measures

Is your agency considering developing project-level performance measures for use by applicant agencies submitting proposals to competitive transportation project funding programs?

- No
- Yes (Please briefly describe your agency's plans.)

Note: After responding to the question above, the respondent was directed to the **Wrap-Up** section of the survey.

Agencies With Project-Level Performance Measures

Describing the Performance Measures

Please describe each of your agency's project-level performance measures under the most appropriate corresponding general category below:

Accessibility

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Climate

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)
Please also describe indicators specifically addressing emergency incidents and repairs.
Please report on any vulnerability studies used to define these performance indicators.

Congestion

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Economy and Cost-Effectiveness

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Efficient Land Use

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Environment: Short-Term Assessment

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Environment: Long-Term Goals and Objectives

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Equity

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Innovation

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Partnership

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Quality of Life and Public Health

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Reliability (Freight)

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Reliability (Non-Freight)

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Safety

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Throughput (Freight)

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Velocity (Freight)

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Other (Please describe.)

Performance measure(s)
Data sources
Methodologies (including assumptions, standards and calculations)

Tools and Documentation

1. What geospatial tools does your agency use to gather and map the data needed to support the project-level performance measures? Please provide the name and vendor of commercial products.
2. What other tools and models does your agency use to gather and manage the data needed to support the project-level performance measures? Please provide the name and vendor of commercial products.
3. Has your agency developed documentation related to the use of project-level performance measures in connection with competitive transportation project funding programs?
    - No
    - Yes (Please provide a link or electronic copy of this documentation or send any files not available online to carol.rolland@ctcandassociates.com.)

Assessment and Recommendations

1. What successes has your agency experienced when working with applicant agencies required to include project-level performance measures in transportation project applications?
2. What challenges has your agency encountered when working with applicant agencies required to include project-level performance measures in transportation project applications?
3. What are your top three recommendations for other agencies beginning to implement project-level performance measures to evaluate the effectiveness and/or competitiveness of transportation project applications?
4. Can Caltrans contact you or a colleague to request additional information about your agency's project-level performance measurement practices?
    - No
    - Yes (Please provide contact information for your colleague, if applicable.)

Wrap-Up

Please use this space to provide any comments or additional information about your previous responses.