Appendix N

Evaluating the Performance of the Transportation Network

Appendix Contents

Evaluating the Performance of the Transportation Network

Introduction

Performance measures are used to help assess the performance of the Regional Transportation Plan (RTP). This Appendix shows the performance of the San Diego Forward: The 2019 Federal Regional Transportation Plan (2019 Federal RTP) Revenue Constrained network in relation to the RTP goals for 2025, 2035, and 2050. The performance of the Revenue Constrained network also is compared to the existing network (as of 2016) and No-Build scenarios for 2025, 2035, and 2050.

The performance measures are informed by the vision and goals of the San Diego Association of Governments (SANDAG) Board of Directors, which provide the overall policy framework for the RTP. In May 2012, the Board of Directors approved the goals of *Innovative Mobility and Planning*, *Vibrant Economy*, and *Healthy Environment and Communities*. These goals also were used in San Diego Forward: The 2015 Regional Plan (2015 Regional Plan) and build upon the core values from previous RTPs and the Regional Comprehensive Plan.

The 2019 Federal RTP utilizes the performance measures used in the 2015 Regional Plan.[1] Table N.1 provides a list of the key questions, performance measures, and methodology. The performance of the 2025, 2035, and 2050 Revenue Constrained Scenario compared to existing conditions (2016), and No-Build scenarios for 2025, 2035, and 2050 is shown in Table N.2.

Performance Measures

In an effort to highlight how the plan is expected to perform in a clearer and more understandable way, a list of 10 key questions was developed. The responses to the 10 key questions are supported by 22 performance measures, which are summarized in Table N.1.

Social Equity considerations have been incorporated into the performance measures to provide an indication of benefits and burdens to disadvantaged populations. The performance measures include a subset of seven measures which compare the three vulnerable populations against their respective non-population (e.g., minority versus non-minority), as well as an additional environmental burden measure. A separate comprehensive Social Equity analysis was conducted as part of the 2019 Federal RTP, in compliance with Title VI and Environmental Justice guidelines. The Social Equity analysis includes additional specific measures and can be found in Appendix H.

Table N.1

San Diego Forward: The 2019 Federal Regional Transportation Plan: Performance Measures

Goals	Policy Objectives	Key Questions	Performance Measure
Innovative Mobility and Planning	Mobility Choices	1. Are travel times reduced?	1A. Average peak-period travel time to work (drive alone, carpool, transit, bike, and walk) (Communities of Concern and Non-Communities of Concern)
			1B. Daily vehicle delay per capita (minutes)
		2. Are more people walking, biking, using transit, and sharing rides?	2A. Increase in walk, bike, transit, and carpool mode share
		3. Is the transportation system safer?	3A. Annual projected number of vehicle (driver/passenger) injury/fatal collisions per vehicle miles traveled (VMT)
			3B. Annual projected number of bike/pedestrian injury/fatal collisions per bike/pedestrian miles traveled (BPMT)
Vibrant Economy	Regional Economic Prosperity, Partnerships and Collaboration	4. Do the transportation investments help to improve the regional economy?	4A. Benefit/Cost Ratio of transportation investments
			4B. Average truck/commercial vehicle travel times to and around regional gateways and distribution hubs (minutes)
		5. Are the relative costs of transportation changing similarly for all communities?	5A. Change in percent of income consumed by transportation costs (Communities of Concern and Non-Communities of Concern)
		6. Are connections to neighboring counties, Mexico, tribal lands, and military bases/installations improved?	6A. Average travel times to/from tribal lands (minutes)
			6B. Average travel times to/from Mexico (minutes)
			6C. Average travel times to/from neighboring counties (Imperial, Orange, Riverside) (minutes)
			6D. Average travel times to/from military bases/installations (minutes)

Table N.1 (continued)

San Diego Forward: The 2019 Federal Regional Transportation Plan: Performance Measures

Goals	Policy Objectives	Key Questions	Performance Measure
Healthy Environment and Communities	Complete Communities, Habitat and Open Space Preservation, Environmental Stewardship	7. Does the transportation network support smart growth?	7A. Percentage of population/employment within 0.5 miles of high frequency (<=15 min peak and midday) transit stops (Communities of Concern and Non-Communities of Concern)
			7B. Percentage of population/employment within 0.5 miles of a transit stop (Communities of Concern and Non-Communities of Concern)
			7C. Percentage of population/employment within 0.25 miles of a bike facility (class I and II, cycletrack, and bike boulevard) (Communities of Concern and Non-Communities of Concern)
			7D. Average travel distance to work (drive alone, carpool, transit, bike, and walk) (miles)
			7E. Total time engaged in transportation-related physical activity per capita (minutes)
			7F. Percent of population engaging in more than 20 minutes of daily transportation related physical activity
		8. Is access to jobs and key destinations improving for all communities?	8A. Percent of population within 30 minutes of jobs and higher education (Communities of Concern and Non-Communities of Concern)
			8B. Percent of population within 15 minutes of goods and services (retail, medical, parks, and beaches) (Communities of Concern and Non-Communities of Concern)
		9. Is the region's air quality improving?	9A. On-road smog-forming pollutants (pounds/day) per capita
		10. Are GHG emissions reduced?	10A. On-road (all vehicle classes) CO_2 emissions (pounds/day) per capita and regionwide

Table N.2

Revenue Constrained Network Performance Measures

Number	Performance Measure	2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Regional Transportation Plan	2035 Regional Transportation Plan	2050 Regional Transportation Plan
1	*Are travel times reduced?*							
1A	Average peak-period travel time to work (minutes)	27	27	27	28	27	27	28
	drive alone	25	25	25	26	25	25	25
	carpool 2	23	23	23	24	23	24	24
	carpool 3+	23	23	24	24	23	23	23
	transit	62	61	60	60	60	56	54
	bike	21	22	22	22	22	23	24
	walk	23	22	22	22	22	22	22
1B	Daily vehicle delay per capita (minutes)	10	10	11	12	10	11	11
2	*Are more people walking, biking, using transit and sharing rides?*							
2A	Walk, bike, transit, and carpool mode share (all trips)	55.6%	56.2%	54.9%	55.4%	56.4%	55.5%	56.2%
	carpool	45.7%	44.9%	42.4%	42.0%	44.8%	42.2%	41.6%
	transit	1.7%	1.9%	2.0%	2.0%	2.2%	2.7%	3.0%
	bike & walk	8.2%	9.4%	10.5%	11.4%	9.4%	10.6%	11.6%
2B	Walk, bike, transit, and carpool mode share (work trips)	19.1%	20.2%	20.6%	21.0%	20.8%	23.3%	24.6%
	carpool	12.4%	12.1%	11.5%	11.5%	12.1%	12.6%	12.7%
	transit	4.0%	4.6%	5.1%	5.2%	5.2%	6.7%	7.6%
	bike & walk	2.7%	3.5%	4.0%	4.3%	3.5%	4.0%	4.3%
3	*Is the transportation system safer?*							
3A	Annual projected number of vehicle injury/fatal collisions per thousand vehicle miles traveled (VMT)	0.1269	0.1274	0.1272	0.1265	0.1274	0.1272	0.1262
3B	Annual projected number of bike/pedestrian injury/fatal collisions per thousand bike/pedestrian miles traveled (BPMT)	1.3683	1.2358	1.1802	1.1195	1.2170	1.1334	1.0560

Table N.2 (continued)

Revenue Constrained Network Performance Measures

Number	Performance Measure	2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Regional Transportation Plan	2035 Regional Transportation Plan	2050 Regional Transportation Plan
4	*Do the transportation investments help to improve the regional economy?*							
4A	Benefit/cost ratio of transportation investments	N/A	N/A	N/A	N/A	N/A	N/A	0.61
4B	Average truck/commercial vehicle travel times to and around regional gateways and distribution hubs (minutes)	17	17	18	18	17	18	19
5	*Are the relative costs of transportation changing similarly for all communities?*							
5A	Change in the percent of income consumed by out-of-pocket transportation costs	N/A	1.1%	0.2%	-0.2%	1.1%	0.2%	-0.2%
6	*Are connections to neighboring counties, Mexico, tribal lands, and military bases/installations improved?*							
6A	Average travel times to/from tribal lands (minutes)	29	29	29	30	29	29	29
6B	Average travel times to/from Mexico (minutes)							
	San Ysidro	22	23	24	25	23	24	25
	Otay Mesa	25	26	24	23	26	25	23
	Otay Mesa East	N/A	28	26	23	28	25	22
	Tecate	54	54	56	56	54	55	54
6C	Average travel times to/from neighboring counties (Imperial, Orange, Riverside) (minutes)	53	53	54	56	53	54	55
6D	Average travel times to/from military bases/installations (minutes)	19	19	20	20	19	20	20
7	*Does the transportation network support smart growth?*							
7A-1	Percentage of population within 0.5 mile of a high frequency (<=15 min peak and midday) transit stop (communities of concern and non-communities of concern)	32%	36%	38%	39%	46%	52%	55%
7A-2	Percentage of employment within 0.5 mile of a high frequency (<=15 minutes peak and midday) transit stop	43%	46%	45%	44%	63%	66%	69%

Table N.2 (continued)

Revenue Constrained Network Performance Measures

Number	Performance Measure	2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Regional Transportation Plan	2035 Regional Transportation Plan	2050 Regional Transportation Plan
7B-1	Percentage of population within 0.5 mile of a transit stop	67%	67%	67%	67%	68%	69%	70%
7B-2	Percentage of employment within 0.5 mile of a transit stop	82%	81%	81%	79%	85%	86%	86%
7C-1	Percentage of population within 0.25 mile of a bike facility (class I and II, cycletrack, and bike boulevard)	63%	64%	63%	63%	66%	68%	69%
7C-2	Percentage of employment within 0.25 mile of a bike facility (class I and II, cycletrack, and bike boulevard)	76%	77%	77%	77%	78%	79%	81%
7D	Average travel distance to work (drive alone, carpool, transit, bike, and walk) (miles)	11.4	11.1	11.1	11.2	11.2	11.3	11.3
	drive alone	11.8	11.6	11.7	11.8	11.6	11.7	11.8
	carpool	11.0	10.9	10.9	10.9	11.0	11.6	11.8
	transit	11.9	12.1	11.8	11.8	12.3	12.1	12.1
	bike	4.1	4.2	4.2	4.3	4.2	4.4	4.5
	walk	1.2	1.1	1.1	1.1	1.1	1.1	1.1
7E	Total time engaged in transportation-related physical activity per capita (minutes)	7	7	8	9	8	9	10
7F	Percent of population engaging in more than 20 minutes of daily transportation related physical activity	11.0%	12.3%	13.6%	14.4%	12.7%	14.4%	15.6%
8	*Is access to jobs and key destinations improving for all communities?*							
8A	Percent of population within 30 minutes of jobs and higher education							
	Auto	100%	100%	100%	100%	100%	100%	100%
	Transit	81.5%	81.3%	81.3%	81.3%	83.6%	83.7%	84.1%
8B-1	Percent of population within 15 minutes of retail							
	Drive alone	99.6%	99.7%	99.7%	99.7%	99.7%	99.7%	99.7%
	Transit	57.8%	58.1%	58.9%	59.0%	59.2%	60.6%	61.4%

Table N.2 (continued)

Revenue Constrained Network Performance Measures

Number	Performance Measure	2016	2025 No-Build	2035 No-Build	2050 No-Build	2025 Regional Transportation Plan	2035 Regional Transportation Plan	2050 Regional Transportation Plan
8B-2	Percent of population within 15 minutes of health care							
	Drive alone	99.8%	99.8%	99.8%	99.8%	99.8%	99.8%	99.8%
	Transit	58.8%	59.1%	59.9%	60.0%	60.1%	61.5%	62.3%
8B-3	Percent of population within 15 minutes of parks							
	Drive alone	99.1%	99.1%	98.8%	98.8%	99.1%	98.9%	98.8%
	Transit	34.4%	35.0%	35.9%	36.5%	35.7%	37.5%	39.2%
8B-4	Percent of population within 15 minutes of beaches							
	Drive alone	39.0%	39.4%	36.7%	34.5%	39.5%	37.5%	36.1%
	Transit	3.9%	3.9%	4.1%	4.2%	4.0%	4.2%	4.4%
9	*Is the region's air quality improving?*							
9A	On-road smog-forming pollutants (pounds/day) per capita	0.037	0.017	0.013	0.011	0.017	0.012	0.011
10	*Are GHG emissions reduced?*							
10A-1	Total on-road (all vehicle classes) CO_2 emissions (tons/day)	37,949	30,600	26,952	27,247	30,570	26,724	26,909
10A-2	Total on-road (all vehicle classes) CO_2 emissions (pounds/day) per capita	22.89	17.26	14.36	13.59	17.25	14.24	13.42

The Regional Transportation Plan Benefit-Cost Analysis

The Benefit-Cost Analysis (BCA) tool used to evaluate the transportation scenarios for the 2019 Federal RTP was created specifically to use the output from the SANDAG activity-based travel demand forecasting model (ABM). The BCA tool uses estimates of trips, travel times, travel costs, auto ownership, and other indicators output by the ABM and assigns monetary values to these outputs to create a stream of benefits that result from the transportation investments in the scenario. This stream of benefits is compared with the stream of costs (including capital costs, operating and maintenance costs, and financing costs) that results from the projects included in the scenario to get a benefit-cost (B-C) ratio. A B-C ratio greater than 1 indicates that the benefits of the scenario are greater than the total costs, and thus provide a net benefit to society.

Because the BCA relies on the outputs of the ABM, only transportation projects that can be modeled using the ABM are included in the BCA. For that reason, projects such as the new mobility hubs (which may influence travel behavior but are not modeled in ABM) are not included in either the costs or benefits of the BCA.

Another factor of the BCA is the discount rate chosen. Future costs and benefits are "discounted" in recognition of the "time value of money," the fact that a dollar next year is worth less than a dollar today.[2] The higher the discount rate, the less future benefits and costs affect the outcome of the analysis. The discount rate used in this BCA is 4 percent.[3]

Benefits for the BCA were calculated for the following types of benefits:

1. Time Savings
2. Vehicle Operating Cost Savings
3. Accident Cost Savings
4. Emissions Savings or Reductions
5. Reliability Savings
6. Physical Activity Benefits
7. Vehicle Ownership Cost Savings

- **Time savings** compares the time travel for all travelers for each scenario versus a no-build scenario. For example, by adding capacity to roads and transit, the time spent traveling is reduced. This time savings for personal travel has an economic value to people that is assumed to be roughly one-half of the average wage rate. The value of time for personal travel (calculated by the ABM as an average of all trips) is roughly $15 per hour. Higher values are assigned for truck travel ($30 per hour for light truck, $43.20 per hour for heavy truck) as it is work-related and assumed to include a factor for the time value of the freight in the truck. Higher values also are assumed for "out-of-vehicle" time, such as time spent waiting for transit (approx. $30 per hour), which is assumed to be roughly twice as burdensome as travel time.
- **Vehicle operating costs** are simply the avoided costs from not operating a vehicle, which may be due to a mode switch (e.g., from auto to transit), or from changes in destinations or overall trip-making. The operating cost is calculated on a per-mile basis, and is based on the assumed operating costs used in the ABM. In 2050, the assumed operating cost of personal vehicles is roughly $0.19 per mile, and for trucks is roughly $0.35.

- **Accident costs savings** simply result from an estimated net reduction in the number of accidents for automobiles versus the no-build scenario. The number of accidents is based on the estimated difference in vehicle miles travelled (VMT) between the base and the build scenario. The BCA analysis and the ABM do not reflect the effect of potentially safer roadway types, or of the potential safety gains from autonomous cars. Accident values are based on the most-recent federal guidelines and vary from roughly $4,500 for a property-damage-only (non-injury) accident to roughly $10 million for a fatality.
- **Emissions savings or reductions** results from fewer VMT, from reductions in congestion that improve vehicle efficiency, and from overall assumptions about future year fleet efficiency. Emissions are modeled using EMFAC, based on outputs from the ABM. Emissions values are based on the health effects of pollutants.
- **Reliability savings** are time savings that result from having more consistent travel times over the same trip. For example, if variable congestion or poor transit performance require a traveler to add five extra minutes onto their travel time to ensure timely arrival, this is a cost. Reliability savings are largely a function of congestion, and are valued as time savings.
- **Physical activity benefits** result from the increase in active transportation in the plan scenarios over the no-build. Benefits are based on the per-minute value of activity.
- **Vehicle ownership cost savings** are the result of reductions in the number of vehicles that households in the county opt to own. Ownership costs for a private automobile are approximately $6,000 annually.

The costs for this analysis were estimated by SANDAG project managers, engineers, and other experts.

The horizon year for the B-C analysis is 2070, which allows the projects completed in 2050 to accrue benefits over the typical 20-year lifespan.

Transportation Safety

The performance of the transportation system in terms of safety is measured by the following two performance measures:

- Annual projected number of vehicle (driver/passenger) injury/fatal collisions per VMT
- Annual projected number of bike/pedestrian injury/fatal collisions per bike/pedestrian miles traveled (BPMT)

The BCA, as discussed in the BCA section, was calculated to include benefits from accident cost savings which result from an estimated net reduction in the number of accidents for automobiles versus the no-build scenario. The inclusion of transportation safety in the performance measures is consistent with the California Strategic Highway Safety Plan.

Endnotes

[1] Additional details on the development of the key questions and performance measures can be found in Appendix N of San Diego Forward: The 2015 Regional Plan.

[2] The discount rate is often assumed to be similar to the real rate of return on investment, thus accounting for lost opportunity. This is not to be confused with the effect of inflation, as all costs and benefits in the BCA are "real" or "constant" dollars, eliminating the effects of inflation.

[3] Three percent and 7 percent are stipulated by the federal government in OMB Circular A-94.