

**ORTP Scenarios Evaluation Methodology
Technical Memorandum**

Oahu Regional Transportation Plan 2035 Project

Deliverable 9.1.2



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Acronyms Used in this Document

AVO	Average Vehicle Occupancy
CBD	Central Business District
CMP	Congestion Management Process
DBEDT	State of Hawaii Department of Business, Economic Development, and Tourism
EJ	Environmental Justice
HOV	High Occupancy Vehicle
ITS	Intelligent Transportation Systems
LOS	Level of Service
OahuMPO	Oahu Metropolitan Planning Organization
ORTP	Oahu Regional Transportation Plan
T6/EJ	Title VI and Environmental Justice
TAZs	Transportation Analysis Zones
TDM	Transportation Demand Management
TMA	Transportation Management Areas
TSM	Transportation System Management
VMT	Vehicle Miles Traveled

The Oahu Regional Transportation Plan (ORTP) Scenarios Evaluation Methodology describes the process for evaluating and selecting strategies (transportation projects, programs, and policies) for inclusion in the 2035 ORTP update. A scenario evaluation approach will be used to gauge how combinations of strategies might perform in terms of transportation performance, effects on land use and development patterns, and impacts to the natural and human environments. Results from this assessment of alternative scenarios will inform stakeholder and public outreach efforts. A hybrid recommended preferred scenario will be developed comprising elements from the initial scenarios. The preferred scenario will be assessed similarly and refined to finalize selection of elements for inclusion in the adopted 2035 ORTP.

The ORTP 2035 Update Project evaluation process is depicted in Figure 1, in context with the overall study approach.

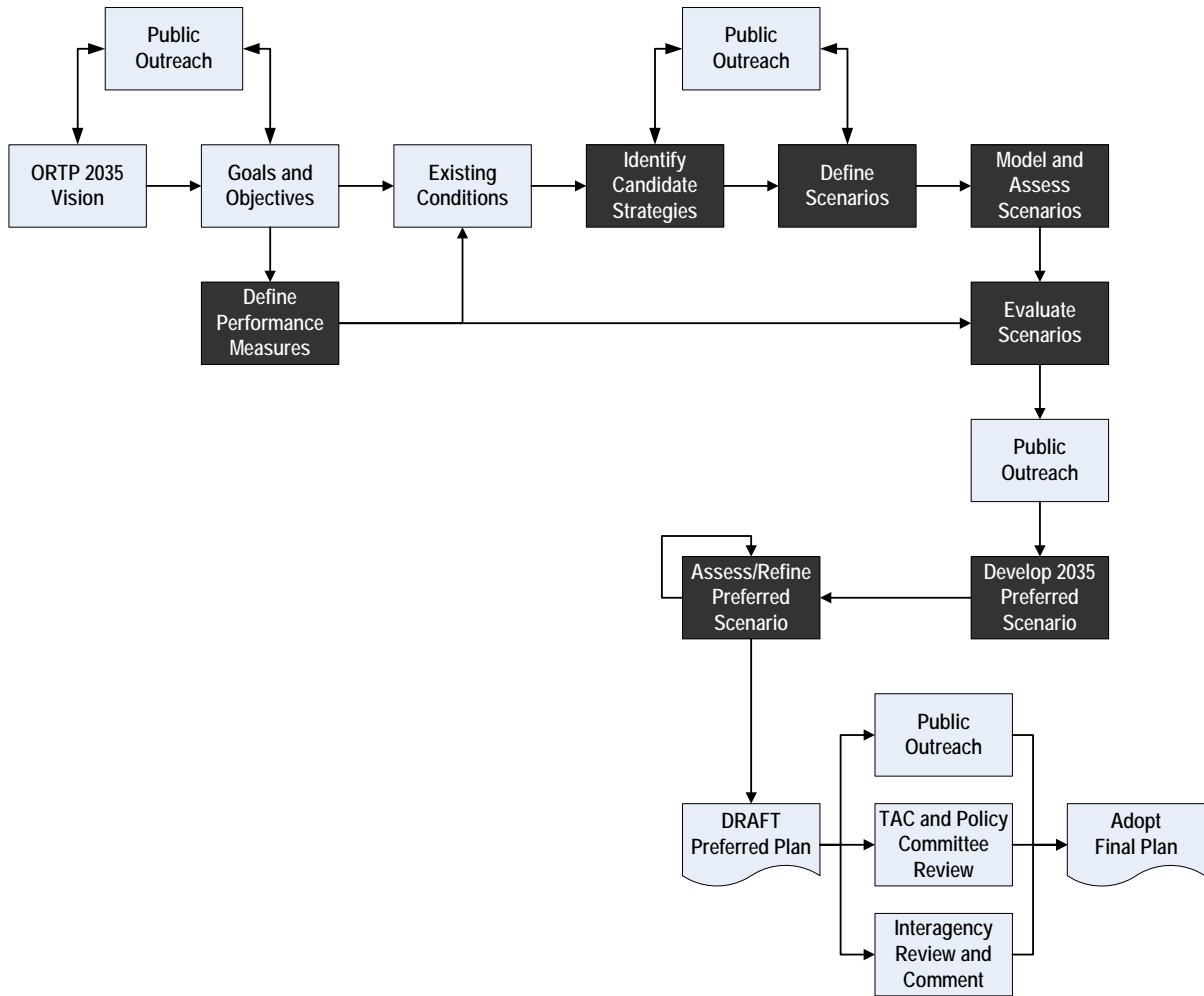
The primary steps involved in the evaluation process are:

- Identification of candidate strategies and related public outreach activities to facilitate this process.
- Grouping of strategies into three themed scenarios for evaluation.
- Technical analysis of the scenarios, including travel demand modeling.
- Evaluation of performance measures to assess the scenarios and their components.
- Development of a preferred scenario comprising elements of the initial three scenarios. The assessment of the three initial scenarios and feedback garnered from the public outreach process will form the basis for selecting components of the preferred scenario.
- The preferred scenario will be similarly assessed and refined to finalize selection of the elements of the Draft 2035 ORTP.

The evaluation process is designed to incorporate public and stakeholder input in identifying potential strategies, defining scenarios, and providing feedback on evaluation results to inform the selection of recommended plan elements. Public outreach efforts, which are described in detail in study deliverable 2.1, *ORTP 2035 Public Outreach Plan* (June 2009), will involve a broad range of actions to engage the community, including a series of focus groups specifically targeted to Title VI/Environmental Justice (T6/EJ) communities.

Figure 1: ORTP 2035 Update Project Process

Shaded boxes indicate evaluation activities



Shaded boxes indicate evaluation activities

2.1 Scenario Planning

2.1.1 ORTP Plan Scenarios

Three scenarios will be developed by the project team for initial evaluation. These scenarios will include a range of potential strategies and actions organized around distinct central themes, which have yet to be defined. A scenario evaluation process is being employed for several reasons:

- Independent evaluation of strategies is impractical in this case given the number of different strategies under consideration.
- Scenario evaluation can shed light on the combined effects of various strategies or help highlight potential inconsistencies in strategies.

- Scenario evaluation can identify tradeoffs in the allocation of limited resources to specific areas of interest.
- Scenarios can illustrate the types of effects likely for a broader set of actions that are consistent with the general theme(s) of the scenario, whether those actions are specifically included in the scenario or not.
- The scenario planning process offers flexibility in developing and selecting potential plan elements.

Scenarios will be developed in a comprehensive manner so that each could reasonably stand alone as a potential improvement package. However, the intent of scenario planning is not to select any one of these initial scenarios as a preferred option. Instead, the initial assessment should shed light on the potential outcomes associated with the unique composition of strategies associated with each scenario. These findings will assist in creating a distinct preferred scenario that may include elements from any (or each) of the initial scenarios, and could include other new or revised strategies as well. The scenarios will be fiscally constrained, consistent with federal planning requirements.

While the three initial scenario themes have yet to be determined, one possibility is that they could focus on geographical distribution of transportation infrastructure investments. The following are offered as an example:

- Second Access scenario – Emphasizes development of new routes to complement Interstate H-1 and Farrington Highway (SR 93) access to/from the Waianae Coast and Interstate H-2 access to/from central Oahu.
- Ewa scenario – Emphasizes development of an integrated network of new roadways within the Ewa area and providing improved connectivity to adjacent communities..
- Interstate H-1 Corridor scenario – Emphasizes investments that complement the Interstate H-1 corridor and access into Honolulu.

The ultimate composition and theme for the three study scenarios will be documented separately.

2.1.2 Sensitivity Test Scenarios

Three sensitivity tests will be performed to supplement the scenario planning process. These sensitivity test scenarios are intended to assess independently unique and specific planning issues. An analysis methodology is provided below for each sensitivity test scenario.

- Highway Capacity – Use the project travel demand model to estimate how much highway expansion would be needed to achieve a global operating level of service (LOS) D or better through capacity expansion alone. This would involve adding lane capacity to identified capacity constrained areas (i.e., LOS E or F) in the OahuMPO travel demand model. The model would then be run to determine if all major roadway facilities achieve at least LOS D

conditions. If this standard is not met, then additional lane capacity would be provided, and the travel demand model run again. This process is repeated until the standard is achieved.

- Tolling/Managed Lanes – Explore potential for implementing managed lanes or other forms of tolling. This would involve identifying candidate facilities that could either be tolled or operated as managed lanes. Then, a tolling strategy would be developed to provide direction on how the travel demand model will be configured to test the effects for the tolled/managed facility. Questions such as will this facility be tolled during peak periods only, will managed lanes allow for free transit and carpool/vanpool access, etc., will need to be answered to help guide the analysis process. Measures such as mode share, vehicle miles of travel, screenline volumes (to test for trip redistribution) and changes in district to district trip patterns could be used to describe the effects of tolling on the transportation system.
- Pricing – Test cordon area congestion pricing for the Honolulu central business district (CBD). This could involve establishing a “virtual” line around the Honolulu CBD and applying tolls at all access points into the CBD. The effects that these tolls would have on the transportation system would be tested via the OahuMPO travel demand model. Measures such as mode share, vehicle miles of travel, screenline volumes (to test for trip redistribution), and changes in district to district trip patterns could be used to describe the effects of tolling on the CBD transportation network and whether the strategy had any impacts on encouraging single occupancy vehicle trips to shift to transit, high-occupancy vehicle (HOV) or non-motorized travel.

2.1.3 Congestion Management Process

A congestion management process (CMP) presents a systematic process for managing traffic congestion and provides information on transportation system performance. Based on federal regulations, a CMP must:

- Measure multi-modal transportation system performance.
- Identify the causes of congestion.
- Assess alternative actions.
- Implement cost-effective actions.
- Evaluate the effectiveness of implemented actions.

A CMP is required for metropolitan areas, such as Honolulu, with populations exceeding 200,000, known as Transportation Management Areas (TMAs). Federal requirements state that – for all TMAs – their CMP’s performance measures and strategies should be reflected in their long-range regional transportation plans.

The ORTP 2035 plan development process will address these federal requirements by evaluating the performance of candidate multi-modal congestion relief projects

against a 2035 Baseline condition. The methodology for conducting the CMP analysis will include the following steps:

1. Using results of the 2035 Baseline assessment identify the most congested facilities on Oahu.
2. Based on results of item 1, identify CMP analysis corridor areas. Likely use existing travel sheds¹ to define corridors. Up to five major travel corridors will be identified.²
3. Identify CMP candidate projects for each corridor to address the congested areas identified in item 1.
4. Conduct CMP corridor travel demand model runs and performance measure analysis.
5. Evaluate Transportation System Management (TSM), Intelligent Transportation System (ITS), and Transportation Demand Management (TDM) projects in CMP travel corridors. Use existing performance data from a variety of national sources. Conduct a high level, "sketch planning" assessment for these types of projects.
6. Identify most promising congestion relief projects by corridor and conduct a final model run which consolidates improvements across all corridors.
7. Produce final report.

Candidate performance measures for use in the evaluation are derived from the *OahuMPO Congestion Management System Performance Monitoring and Evaluation Plan* (2005), and include the following:

Highway Projects (Baseline vs. CMP Build)

- Change in volume/capacity ratio in corridors and at selected screenlines
- Vehicle volumes in travel corridors and at selected screenlines
- Mode share (auto, carpool, transit, bike and walk trips)
- Vehicle miles of travel
- Vehicle hours of travel
- Vehicle hours of delay

Transit Projects (Baseline vs. CMP Build)

- Transit mode share

¹ A travel shed is an area defined by the geographic boundaries that have characteristics of facilities serving similar travel patterns.

² Preliminarily, the five corridors are identified as: (1) Ewa to CBD; (2) Waianae to CBD; (3) Central Oahu to CBD; (4) East Honolulu to CBD; and (5) Windward/North Shore to CBD.

- Transit trips to work
- Vehicle miles of travel
- Vehicle hours of travel
- Vehicle hours of delay

TDM/ITS/TSM Measures

- Use existing performance data from a variety of local and national sources. Conduct a high level, sketch planning assessment of these types of projects.

2.2 Scenario Testing and Presentation of Results

Scenarios will be evaluated against a broad range of diverse performance measures. The evaluation process will result in a variety of quantifiable data and qualitative information. To facilitate quick and straight-forward comparison of evaluations of these data, standardized ratings will be applied to summarize the results of each performance measure. An evaluation matrix will compare these summary ratings for each of the three initial study scenarios in relation to all performances measures. An example showing the look and format of the proposed evaluation matrix is shown in Figure 2.

Figure 2: Example Evaluation Matrix Excerpt

	Scenario 1	Scenario 2	Scenario 3
Natural Environment Performance Measure			
21. Natural Resource/ Environmental Effects			
22. Reliance on Renewable and Sustainable Energy Sources			
23. Susceptibility to Global Climate Change			

Note: Data shown for illustrative purposes only. Not indicative of actual assessment results.

Scale:
 < Negative effect Neutral Positive effects ->

This example summarizes performance measures related to the natural environment. Each scenario has been assigned a rating using a standardized set of graphic icons. Ratings are representative of the underlying evaluation results, whether quantitative or qualitative, and intended simply to illustrate the relative strengths and weaknesses of the scenarios.

Detailed evaluation results will be presented in narrative format by performance measure. Maps, graphs, and tables will summarize quantifiable information, while descriptive text will further describe qualitative assessments. Specific performance measures and the types of information that will be used to assess them are described in section 2.4, *Performance Measures*.

2.3 Selecting the Preferred Elements of the 2035 ORTP Plan Update

A challenge in planning exercises that rely on scenario evaluation is linking outcomes with the specific actions included within the scenario. The summary matrix results will indicate the overall performance of the combination of elements in the three initial scenarios, but in-depth consideration of the more specific detailed evaluation results will be necessary to develop an understanding of the specific contributions of individual elements.

It is possible that the highest scoring initial scenario will form the base for the preferred scenario. This will particularly be likely if one scenario clearly outperforms the other two. Regardless, the project team will assess the detailed evaluation results of all the scenarios to identify which elements are the primary contributors to the positive (and negative) evaluation results for each performance measure. This information will be summarized and presented to the public for comment through a survey and series of workshops prior to assembling the preferred plan scenario.

The project team will develop a draft preferred plan scenario considering public input, evaluation results, and potential costs associated with specific strategies. This scenario will be tested in a manner similar to the original three scenarios to evaluate its effectiveness and allow for final adjustments and refinement.

2.4 Performance Measures

Performance measures were previously identified and described in study deliverable 4.3.1, *ORTP 2035 Performance Measures* (July 2009). The tables presented in the following sections further described the specific types of information that will be presented for each measure.

2.4.1 Transportation Facilities

Performance Measure	Description	Results
Transportation Facilities		

Performance Measure	Description	Results
Transportation Facilities		
1. Bicycle and Pedestrian Facilities	Compares the level of investment in new or improved non-motorized transportation elements as well as potential impacts to existing bicycle and pedestrian facilities, and assesses how the scenario affects continuity of and accessibility to the bicycle/pedestrian network.	<ul style="list-style-type: none"> • List of proposed bicycle and pedestrian improvements. • Estimate of total new nonmotorized program investment (\$).
2. Intermodal Freight Connections	Assesses the quality of connections between freight modes (highway, air, and seaports) based on quality (suitable routes, design standards, conflicts, etc.) and redundancy of connections.	<ul style="list-style-type: none"> • Qualitative assessment of intermodal connections
3. Modal Conflicts	Assesses the potential for modal conflicts with other travel modes.	<ul style="list-style-type: none"> • Identification of potential conflicting improvements, or changes to known existing modal conflicts. • Qualitative assessment of conflicts between travel modes.
4. Mode Share	Measures the share (as a percentage) of person-trips carried by travel modes (e.g., single-occupant vehicle, high-occupant vehicle, transit, bicycle, pedestrian) based on travel demand model output.	<ul style="list-style-type: none"> • Modeled percentage of person-trips by major travel modes for each scenario, both for ALL trip purposes as well as for commute trips.
5. Regional Transportation Linkages	Assesses whether the candidate improvements provide connections between regional transportation facilities or services.	<ul style="list-style-type: none"> • Qualitative assessment of transportation connectivity
6. Improved Accessibility to the Transportation System for Persons with Disabilities	Assesses the level of investment in the proposed project or program that support Americans with Disabilities Act Accessibility Guidelines.	<ul style="list-style-type: none"> • List of strategies that directly or indirectly affect accessibility for persons with disabilities. • Qualitative assessment of how each scenario addresses barriers to mobility.

2.4.2 Transportation Operations and Service

Performance Measure	Description	Results
Transportation Operations and Service		
7. Economic Vitality	Assesses the contribution of candidate improvements to the economic development and vitality of the region in terms of both job creation and reducing the costs associated with congestion.	<ul style="list-style-type: none"> • Use of DBEDT multipliers to calculate job benefits from candidate projects.
8. Average Vehicle Occupancy (AVO)	Measures the average number of occupants per automobile based on travel demand forecasting model output, excluding buses and commercial vehicles.	<ul style="list-style-type: none"> • AVO for automobiles for each scenario.
9. Condition and/or Life Span of Transportation Infrastructure	Assesses whether the candidate improvements improve the condition and/or life span of transportation infrastructure and the degree to which strategies balance resources for construction, rehabilitation, and maintenance.	<ul style="list-style-type: none"> • Qualitative assessment of the degree to which strategies improve the condition of transportation infrastructure.
10. Highway and Arterial LOS	Measures (in lane-miles) and maps LOS for all major highway and arterial segments based on travel demand forecasting model Volume/Capacity ratios.	<ul style="list-style-type: none"> • Maps and tables depicting LOS by segment. • Lane-miles of highway and arterials operating at each LOS threshold (A-F) by roadway classification.
11. Historical Accident Risks	Assesses whether candidate improvements address existing high-accident locations and maps those locations based on compiled accident data for available modes.	<ul style="list-style-type: none"> • Map of current high-accident locations. • Qualitative assessment of potential safety benefits.
12. Homeland Security, Personal Security, and All-Hazards Preparedness	Assesses whether candidate strategies are consistent with and support Homeland Security initiatives, personal security concerns, and all-hazards preparedness.	<ul style="list-style-type: none"> • Qualitative assessment of support for Homeland Security initiatives, personal security and hazard preparedness.
13. Operations Management Strategies	Assesses whether the candidate improvements effectively employ ITS, TSM, or TDM techniques.	<ul style="list-style-type: none"> • Qualitative assessment of the extent and potential effectiveness of proposed ITS, TSM, or TDM techniques.
14. Screenline Person-Trips	Measures the person-trips (all modes) crossing study area screenlines based on travel demand model output.	<ul style="list-style-type: none"> • Results will be reported at up to 10 screenline locations - covering all five of the primary study corridors - chosen from the 22 available in the travel demand forecasting model (see <i>Multi-Modal Transportation System Existing Conditions Performance Report</i>, October 2009 for screenline locations).
15. Total Annual System Costs	Estimates annualized transportation costs (capital, operating and maintenance) over a predetermined span of time based on available cost information.	<ul style="list-style-type: none"> • Planning level, order-of-magnitude costs (\$) for major scenario elements.
16. Transit Ridership	Measures number of transit patrons based on travel demand model output.	<ul style="list-style-type: none"> • Number of daily transit boardings under each scenario.

Performance Measure	Description	Results
Transportation Operations and Service		
17. Travel Demand	Assesses the degree to which candidate improvements employ or support TDM techniques to reduce travel demand based on the potential to reduce vehicle trips.	<ul style="list-style-type: none"> • Discussion of proposed TDM techniques and potential for the proposed strategies to reduce vehicular travel demand. • Qualitative assessment of the scope and potential effectiveness of TDM strategies.
- Auto	Measures and maps as travel time contours the average peak period travel time between key destinations based on travel demand model output.	<ul style="list-style-type: none"> • Travel time contour map. • Key travel times [up to five major travel time route origin-destination (OD) pairs].
- Freight	Measures and maps as travel time contours the average peak period travel time between key destinations on transit based on travel demand forecasting model output.	<ul style="list-style-type: none"> • Description of how freight travel would be affected based on auto modeling results. Reference travel time ODs that address major freight routes.
- Public Transit	Measures the total hours of delay (daily and peak period) experienced by all vehicles on the network based on travel demand forecasting model output. Delay is the difference between predicted travel times and travel time under free-flow (uncongested) conditions.	<ul style="list-style-type: none"> • Travel time contour map. • Key travel times (up to five major travel time route OD pairs).
18. Vehicle Hours of Delay	Measures the total duration of trips by motorized vehicles (automobiles, buses, trucks) based on travel demand forecasting model output.	<ul style="list-style-type: none"> • Modeled hours of delay.
19. Vehicle Hours of Travel	Measures the total length of trips by motorized vehicles (automobiles, buses, trucks) based on travel demand forecasting model output.	<ul style="list-style-type: none"> • Modeled hours of travel.
20. Vehicle Miles of Travel (VMT)	Measures the total length of trips by motorized vehicles (automobiles, buses, trucks) based on travel demand forecasting model output.	<ul style="list-style-type: none"> • Modeled VMT (autos and buses). • Qualitative assessment of VMT effects for freight.

2.4.3 Natural Environment

Performance Measure	Description	Results
Natural Environment		
21. Natural Resource/ Environment Effects	Assesses potential disruption or other impacts to natural areas such as animal habitats, open spaces, beaches, archeological sites, and forested areas/vegetation based on the mapped location of sensitive areas and potential footprint changes associated with proposed projects.	<ul style="list-style-type: none"> • Map (Geographical Information System-based) of environmental constraints and proposed projects. • Qualitative assessment of effects on natural areas.
22. Reliance on Renewable and Sustainable Energy Sources	Assesses the degree to which candidate actions promote the use of renewable and sustainable energy sources for transportation (over non-renewable sources).	<ul style="list-style-type: none"> • Qualitative assessment of support for renewable energy sources.
23. Susceptibility to Global Climate Change	Evaluates the effects of global climate change on transportation infrastructure.	<ul style="list-style-type: none"> • Identification of existing or proposed transportation infrastructure susceptible to global climate change, including major storm surge and sea-level rise.

2.4.4 Human Environment and Quality of Life

Performance Measure	Description	Results
Human Environment and Quality of Life		
24. Disruption during Construction	Assesses potential disruption to neighborhoods (access, mobility, noise, dust, etc.) during construction of candidate improvements based on degree of travel disruption, availability of suitable alternate routes, and proximity to sensitive neighborhoods.	<ul style="list-style-type: none"> • Identification of major infrastructure construction projects and high-level qualitative assessment of potential travel and neighborhood impacts during construction.
25. Energy Consumption	Assesses whether candidate actions reduce energy consumption based on VMT, presumed fuel efficiency assumptions, and mix of fuel/power sources.	<ul style="list-style-type: none"> • Estimate of consumption of fossil fuels for transportation purposes.
26. Air Quality	Assesses the level of greenhouse gas emissions as the result of proposed projects based on VMT, presumed fuel efficiency assumptions, and mix of fuel/power sources.	<ul style="list-style-type: none"> • Estimate of greenhouse gas production.
- Accessibility	Compares share of people within T6/EJ and non-T6/EJ Traffic Analysis Zones (TAZs) who are within a 20-minute trip of selected work, shopping, education and healthcare destinations based on travel demand model output.	<ul style="list-style-type: none"> • Percentage of populations meeting 20-minute threshold in T6/EJ areas compared to non-T6/EJ areas.
- Equity	Compares transportation funding allocations for T6/EJ and non-T6/EJ areas needs based on available cost information.	<ul style="list-style-type: none"> • Proposed funding for transportation infrastructure and services for T6/EJ areas compared to non-T6/EJ areas.
- Mobility	Compares travel times for work trips from T6/EJ and non-T6/EJ TAZs based on travel demand model output.	<ul style="list-style-type: none"> • Average commute times for T6/EJ areas compared to non-T6/EJ areas.
- Public Involvement and Outreach	Assesses concerns and issues of T6/EJ populations regarding transportation system performance and plan project selection based on feedback from focus groups, telephone surveys, and other public outreach initiatives. Assesses the degree to which outreach was done to T6/EJ populations.	<ul style="list-style-type: none"> • Comparison of outreach efforts for T6/EJ areas and non-T6/EJ areas.

2.4.5 Land Use and Transportation Integration

Performance Measure	Description	Results
Land Use and Transportation Integration		
27. Land Use Plans	Assesses whether the candidate improvements serve planned growth areas based on forecast population and employment growth.	<ul style="list-style-type: none"> • Qualitative assessment of correlation between transportation improvements and populated or developing areas.
28. Built Environment Effects	Assesses potential displacements of people and/or activities and structures to developed areas.	<ul style="list-style-type: none"> • High level qualitative description of potential impacts to people and structures.
29. Compact, Mixed-Use Growth	Assesses the degree to which candidate actions would encourage land development that supports more efficient use of transportation services as a result of concentrated growth patterns, mix of uses, and/or development around public transportation facilities.	<ul style="list-style-type: none"> • Qualitative assessment of support for concentrated, mixed-use growth.