Puget Sound Regional Council

REGIONAL TRANSPORTATION PLAN 2022–2050

Appendix I:
Modeling Tools

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Puget Sound Regional Council

REGIONAL TRANSPORTATION PLAN 2022–2050

As Recommended for Adoption by the Executive Board– April 28, 2022

Regional Transportation Plan 2022-2050

Appendix I – Modeling Tools

Contents

PSRC Models and Tools

This appendix provides an overview of the full suite of PSRC forecasting tools used to model the Regional Transportation Plan and generate the evaluation metrics used to evaluate outcomes.

Figure 1. PSRC Model Suite

Regional Macroeconomic Model and Forecast

Purpose

The Puget Sound Regional Macroeconomic Model was used to produce PSRC's 2018 Regional Macroeconomic Forecast, which establishes long-range regional growth assumptions for population, households, and employment out to the year 2050. The regional forecast values serve as control totals for developing the population and employment growth allocations by county and regional geography that define the Regional Growth Strategy. The regional forecast and subregional growth assumptions then serve as key inputs to the UrbanSim land use model.

Model/Tool

The Puget Sound Regional Macroeconomic Model and 2018 Regional Macroeconomic Forecast were developed by the economic consulting firm ECONorthwest. The regional model is structured in a top down manner, with productivity, aggregate employment, income, and inflation forecast initially, followed by subsequent modules for demographic composition and industry detail. The model equations are estimated using over four decades of historical data. It also utilizes two key exogenous elements: a) an extension of results from the well-regarded national macroeconomic model developed and maintained by Yale University professor Ray Fair, and b) an Aerospace employment forecast based on global demand projections and labor productivity trends. The current model has been refined to better capture the effects of the demographic aging transition underway nationally and its workforce implications. The model now also includes a new housing supply module that explicitly accounts for the role of housing price in the behavior of the regional economy and demographics.

Key Assumptions

The latest 2018 Regional Macroeconomic Forecast assumes:

- The region is projected to reach a total of 5.8 million people and 3.4 million jobs by the year 2050. This translates into an additional 1.6 million people and 1.1 million jobs being added to the region between 2018 and 2050.
- The jobs forecast reflects a slight upward increase from PSRC's preceding forecast (2014), attributable to the strength of the regional economy relative to the broader U.S. economy in the recovery period following the last recession.
- The population forecast reflects a more substantial upward adjustment from the previous forecast series, in part due to the higher jobs forecast but primarily due to model adjustments that better account for the relationship between job growth, the workforce population, and the aging of the boomer generation in the forthcoming decades.
- The region is projected to add 830,000 households to reach a total of 2.4 million households by the year 2050. Average household size, which has been relatively stable over the last two and a half decades, is anticipated to begin declining again as boomers age and the number of empty nester and one-person households increases. Decreasing fertility rates also contribute to this trend. A smaller persons-per-household ratio translates into a greater demand for housing to meet the needs of a growing population.

UrbanSim Land Use Model

Purpose

PSRC used its UrbanSim model as a tool for modeling the Regional Growth Strategy at a disaggregate level. The UrbanSim output also serves as inputs to the regional travel demand model and other supplemental analyses.

Model/Tool

UrbanSim is an agent-based microsimulation model that predicts land development and the location choices of households and jobs over time at the parcel level. Land development is a function of zoned land uses, allowable densities, and market forces (e.g., demand, real estate prices, profitability of new development). Location choice decisions are simulated based on various factors that households/persons and firms/jobs consider when moving to or relocating within the region (e.g., price, building size, proximity to other types of land use, commute times).

Subregional population and employment growth allocations that define the Regional Growth Strategy are disaggregated to individual jurisdictions and serve as UrbanSim's control totals. The model then simulates how the jurisdiction-level growth assumptions are likely to unfold at the parcel level based on the model dynamics described above.

UrbanSim is run parallel to the SoundCast travel model (described below) within an integrated model framework that incorporates feedback loops from SoundCast at selected intervals (years). The feedback loop is comprised of accessibility factors from SoundCast that are used by various

UrbanSim sub-models. To learn more, visit: https://www.psrc.org/urbansim-parcel-based-land-use-model.

Key Assumptions

Key assumptions embedded in the UrbanSim model include:

- Jurisdiction-level growth assumptions (population, households, employment) for individual cities, urban unincorporated planning areas, and rural areas serve as control totals and key demand drivers in the UrbanSim model framework. These assumptions are derived from the county and regional geography level growth allocations for the Regional Growth Strategy in conjunction with locally developed growth targets.
- Development parameters in the model were established based on local comprehensive plans and zoning regulations circa 2015/2016, with selected updates for major rezones. The model does not account for anticipated future plan and zoning updates, such as updates that may be expected at transit station areas to support transit-oriented development or through local comprehensive plan periodic updates, required by June 2024.
- Accessibility factors from the SoundCast travel model inform the location choices of households and jobs and the attractiveness of available land for development within UrbanSim.

SoundCast Travel Demand Model

Purpose

PSRC has developed a customized set of software programs and mathematical procedures to simulate current and future travel patterns and conditions within the central Puget Sound region. These programs and procedures are collectively referred to as the "SoundCast regional travel demand forecasting model" or simply as the "SoundCast travel model." The travel model produces detailed spatial and network data that are used to analyze how the region's transportation infrastructure and environment are likely to be impacted by future growth and development as represented by the VISION 2050 Regional Growth Strategy. Selected travel model outputs serve as inputs to both UrbanSim and the regional air quality model and analysis.

Model/Tool

PSRC used its SoundCast travel model to analyze the transportation-related impacts of the Regional Transportation Plan. SoundCast is an activity-based model which represents how individual people travel to conduct their daily activities, as compared to the previous zone-based model which aggregately represented trips between zones. As an activity-based model, SoundCast allows for improved representation of travel behavior as well as greater temporal and spatial resolution to better evaluate the impacts of the RTP. As such, modeled performance of the transportation system is the result of complex interactions over time produced by assumptions about the location and nature of development, and the cost and accessibility of transportation choices. To learn more, visit: https://www.psrc.org/activity-based-travel-model-soundcast.

The current SoundCast model operates on a 2018 base year, with key variables validated against PSRC's most recent Regional Household Travel Survey.

Key Assumptions

The key input assumptions for any travel demand analysis framework include a set of land use growth allocations (representing demand conditions) along with transportation projects, policies, and network attributes (representing supply conditions):

- For the travel demand analysis conducted on the RTP, parcel level population, household, and employment outputs from the UrbanSim model for the Regional Growth Strategy comprise the key land use assumptions.
- The set of transportation projects and policies enumerated in the RTP provide the future (year 2050) transportation network assumptions used by SoundCast for this analysis.

EPA's Motor Vehicle Emissions Simulator (MOVES)

Purpose

The air quality model estimates future regional motor vehicle emissions of criteria pollutants and greenhouse gases. The analysis combines mobile source emissions factors from the U.S. Environmental Protection Agency's latest Motor Vehicle Emission Simulator (MOVES) and output from the travel demand model, including link-specific vehicle miles traveled and vehicle speed.

Model/Tool

PSRC used the most recent version of the MOVES model, MOVES3, to develop emissions factors used to conduct the air quality analysis of the alternatives. The MOVES3 model represents EPA's most up-to-date assessment of on-road mobile source emissions, including incorporation of the most current vehicle, fuel, and emissions standards and new and updated emissions data from a variety of test programs and other resources. Metropolitan planning organizations are required to use the most current tool for regional emissions analyses for transportation conformity determinations.

Key Assumptions

The assumptions underlying the air quality analysis are as follows:

- The fleet mix and age distribution from the base year are used.
- The model accounts for the phase-in of current emissions standards, inspection/maintenance programs, fuel standards, and engine technology, and contains assumptions regarding the rate of vehicle changeout and fleet turnover for each forecast year.
- The model does not predict future changes in regulations or technological advances, and PSRC does not make any additional assumptions about the future vehicle fleet inputs to the model.