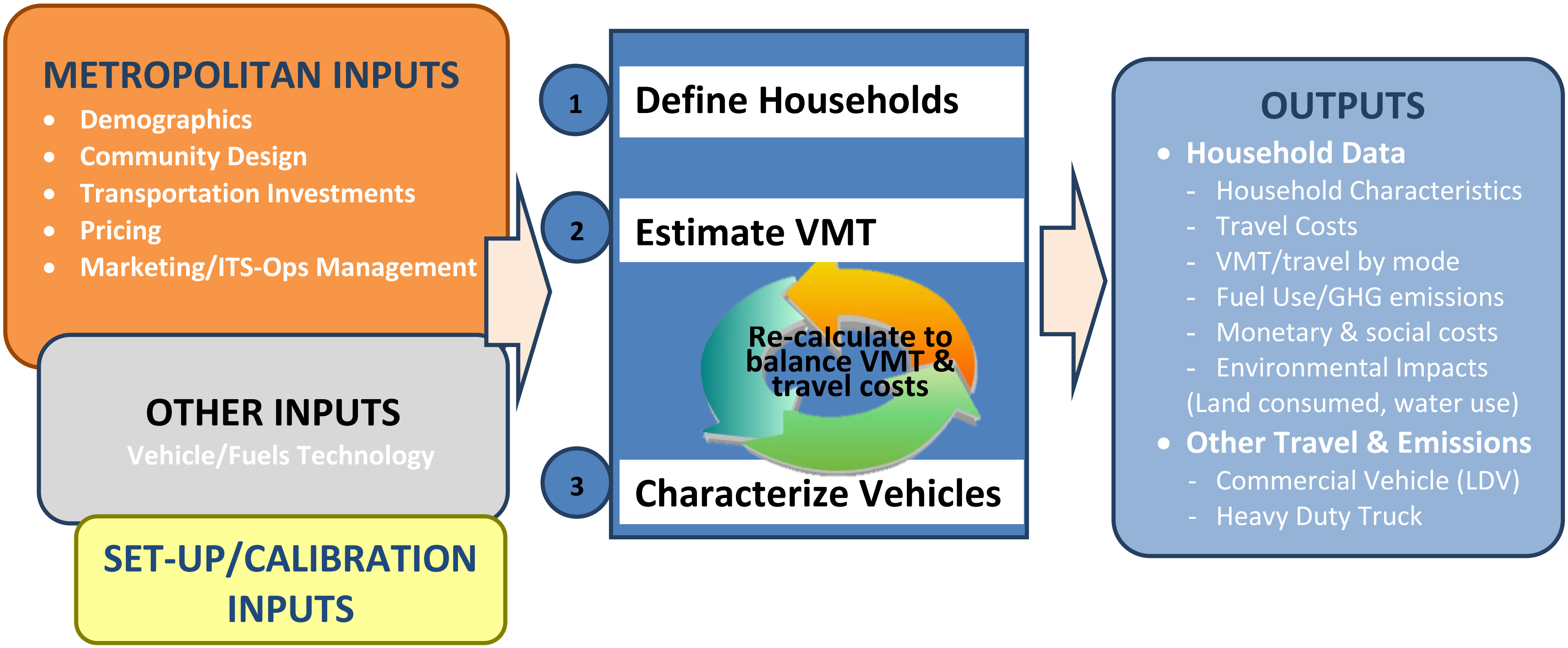
DRAFT Oregon Strategic Assessment – RSPM User's Guide

RSPM (Regional Strategic Planning Model)

January 2014



Purpose of User's Guide

The purpose of this guide is to inform metropolitan planning organizations (MPO) staff, local planners, and decision makers about the resources required to conduct a Strategic Assessment. More specifically, this guide:

1. Provides some background on the planning processes, State support available to metropolitan areas, and the Regional Strategic Planning Model (RSPM);
2. Identifies the key inputs, including datasets and key decisions needed to run the RSMP;
3. Explains the RSPM outputs and how to interpret these results; and
4. Includes more detailed technical information about the RSPM in the appendices.

By clarifying terminology, roles and responsibilities, resource requirements, and data needs, this guide provides the information needed for metropolitan areas to determine if they wish to conduct a Strategic Assessment.

Contents

Background

The Regional Strategic Planning Model (RSPM) is a tool developed by ODOT to assist metropolitan areas and local governments in developing long range transportation and land use plans for their regions and communities. The RSPM helps Metropolitan areas and local governments who wish to:

- Evaluate the outcomes of their existing plans and various sensitivity testing through a **Strategic Assessment**, or
- Engage in **scenario planning** to evaluate a set of different future scenarios.

This User's Guide provides an outline for collecting the data and making key assumptions for the Strategic Assessment process. It also supports development of base and reference case scenarios for Scenario Planning.

Strategic Assessment

A Strategic Assessment provides metropolitan areas an opportunity to evaluate how their region's transportation system will perform in the future assuming that current plans are carried out and current trends continue. Although GHG emissions reduction is an important component of Strategic Assessments, it is not the only component and Strategic Assessments help to inform long-range planning. In addition, through sensitivity testing, a Strategic Assessment helps metropolitan areas understand how different aspects of the transportation system, land use, and other factors affect future performance. The future time horizon that is assessed includes 2035, in parallel to the greenhouse gas (GHG) reduction targets, but also extends beyond to 2050 to enable metropolitan areas to consider the potential consequences of longer range trends that have significant planning implications.

Sensitivity testing is done as part of a Strategic Assessment to evaluate how changes in policies and trends at the metropolitan and state levels could influence GHG emissions from light-duty vehicle travel in metropolitan areas, as well as other indicators. Sensitivity tests are 'what if' analyses to help planners understand what the relative effect of changes to policy, investments, and programs could be. Depending on the variables used, sensitivity testing allows metropolitan areas to determine how large an effect potential actions are likely to have on the results of the Strategic Assessment and scenario planning. Sensitivity testing can be used to evaluate a wide range of variables such as the impact of increasing downtown density, doubling transit service, or promoting eco-driving. To streamline the sensitivity testing process, ODOT staff identified seven key policy measures to test as part of the Strategic Assessment process. Please refer to the *Outputs: Interpreting Results* section of this User's Guide for a list of these measures.

A Strategic Assessment uses models and other analysis tools to allow metropolitan areas to ascertain the extent to which current policies and trends at the metropolitan and state levels will reduce GHG emissions and other regional goals and community visions. Information on travel and environmental trends that result from the assessment will include indicators such as GHG emissions, household transportation expenditures, and community health indicators, such as air quality.

Metropolitan areas can use the results of a Strategic Assessment to inform development of transportation plans and investment priorities. In addition, a Strategic Assessment can help the metropolitan area governments to develop a long-range vision for their region which addresses community goals and prepares the community for the future. It will also help the region to identify state-level actions that are important for enabling necessary reductions in GHG emissions from metropolitan area light-duty vehicle travel.

Strategic Assessments also help to implement the Oregon Statewide Transportation Strategy: A 2050 Vision for Greenhouse Gas Emissions Reduction (STS). The STS is a state-level scenario planning effort that examines all aspects of the transportation system, including the movement of people and goods, and identifies a combination of strategies to reduce GHG emissions. Through acceptance in March 2013, the Oregon

Transportation Commission agreed with the general course of action presented in the STS for reducing transportation related GHG emissions. For more information on the STS, please visit the STS Web site .

Scenario Planning

Scenario planning allows communities to explore the potential benefits of a variety of different land use and transportation related scenarios. Scenario planning encourages local policy makers, planners and stakeholders to consider a wider range of opportunities, challenges and possible futures than are typically considered in most traditional planning processes. Through the process of conceiving, developing and evaluating a series of future scenarios and the outcomes they produce, communities can obtain information for decision-making that combines real community values with choices and options for on the ground solutions.

Required per HB 2001 (2009), the Portland Metro and Central Lane MPOs are currently engaged in scenario planning. For other metropolitan areas, this process is voluntary. After the conclusion of a Strategic Assessment, some areas may decide to move forward with scenario planning.

State Support

To assist in these efforts, the Oregon Departments of Transportation (ODOT) and Land Conservation and Development (DLCD) provide support to metropolitan areas interested in engaging in Strategic Assessments and scenario planning. More specifically, through contracts negotiated by ODOT, metropolitan areas can request financial and technical assistance. The funding available can be used to cover MPO staff time associated with data collection, model assembly and calibration, as well as other costs associated with the Strategic Assessment or scenario planning process. Furthermore, DLCD staff provides assistance with data collection and reporting of results and ODOT staff provides modeling assistance and runs analyses, in addition to providing overall project management support.

RSPM Modeling Approach

The Regional Strategic Planning Model (RSPM), was developed by the Oregon Department of Transportation (ODOT) for the purpose of estimating and forecasting the effects of various policies and other influences on the amount of vehicle travel, the types of vehicles and fuels used, and the resulting greenhouse gas (GHG) emissions among other things. As the name indicates, the RSPM is a model which supports strategic planning processes, such as Strategic Assessments and scenario planning, at a regional level.

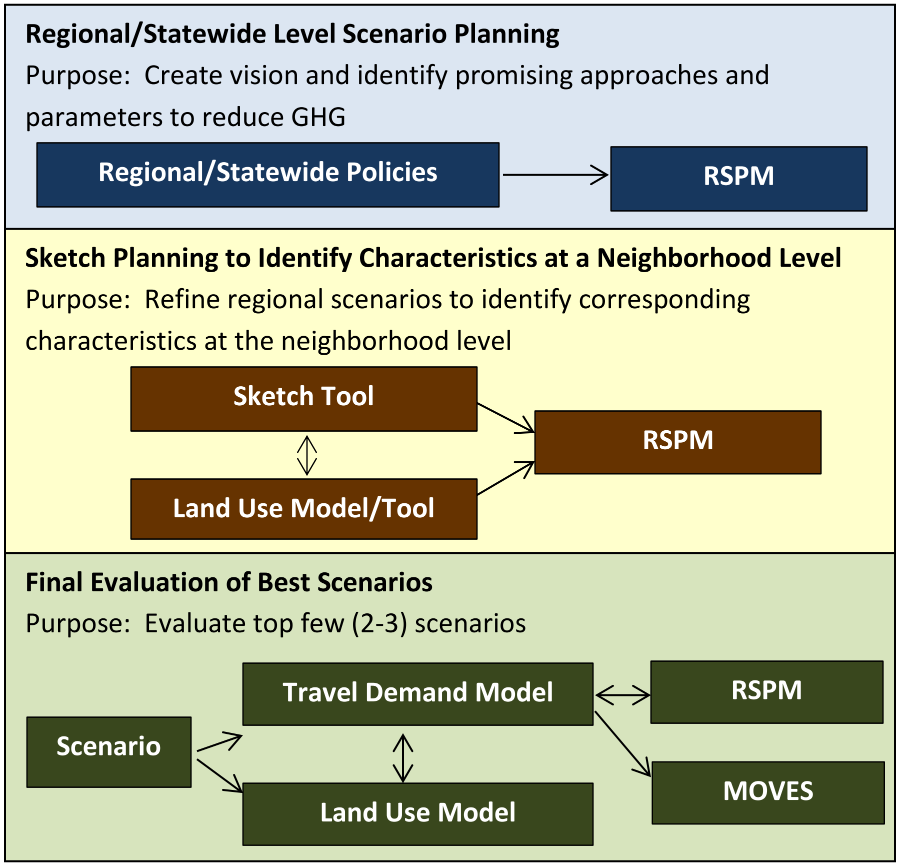
The RSPM[1] is a tool to help regions better assess the effects of fundamental shifts underway that will affect future travel (e.g., demographics and vehicle technology), as well as the impact of policy options (e.g., TDM programs, car sharing) not yet fully addressed in traditional travel models. The development of RSPM was reviewed extensively by state, national and international travel and emissions modeling experts in multiple venues.[2]

RSPM differs from the travel demand models that support planning in most urban areas. The RSPM operates at a strategic level and is less detailed but considers a wider range of potential policies and outcomes. Urban travel demand models, in constrast, are designed to model the effects of specific transportation projects or groups of projects on specific parts of the transportation system. They are also important in meeting air quality conformity regulations and detailed project studies. Figure 1 shows the interactions of Oregon's various modeling tools in GHG analysis and planning.

Figure 1. Examples of Interactions of Oregon Tools for GHG Analysis

[1] RSPM was formerly known as GreenSTEP. The name change reflects expanded capabilities for metropolitan area application while addressing a more general set of transportation and land use considerations in addition to greenhouse gas emissions.

[2] In 2010, the American Association of State Highway and Transportation Officials (AASHTO) awarded ODOT its 'Presidents Award for Planning' for the development of the GreenSTEP model. Evaluation at the national level lead to the Federal Highway Administration adopting GreenSTEP as the basis for their EERPAT[2] model



Since RSPM was developed to assess GHG emissions, its initial focus was on a household's total annual *vehicle* miles; Indicators for the use of other modes was secondary. This contrasts with the multi-modal trip-based focus of traditional travel demand models. Because of this, RSPM accounts for vehicle miles traveled (VMT) and emissions in a different manner. Whereas urban travel demand models forecast weekday average and peak period VMT on study area roadways based on trips, the RSPM forecasts total VMT (weekend as well as weekday) generated by study area households. Urban models thus capture congested peak periods which highly influence air quality pollutants. In contrast, GHG emissions are widely dispersed and have a cumulative effect more suited to the strategic level of detail in RSPM.

A final distinction between models is how the RSPM considers a more complete cost of travel. The total cost of travel to each household from gas prices, gas taxes, parking charges, etc. is calculated with an evaluation of whether the total cost exceeds an estimate of a household's total budget. If so, then the household's forecasted travel is reduced so that their budget is not exceeded. This is an important capability of the RSPM given future fuel prices increase and the effectiveness of pricing in managing transportation system demand. The interactions between vehicle fuel economy and prices are also modeled. For example, increasing fuel economy can result in more VMT (the rebound effect) because the same budget can buy more travel. These aspects are not currently accounted for in most urban travel models.

The models are complementary, with the RSPM supporting a discussion of a region's future, helping to identify a mix of policies that might meet the region's vision. An urban travel demand model can then be used to evaluate specific elements of this vision.

How the RSPM Works

The RSPM estimates vehicle ownership, vehicle travel, fuel consumption, and GHG emissions at the individual household level. This structure accounts for the synergistic and antagonistic effects of multiple policies and factors (e.g., gas prices) on vehicle travel and emissions. For example, the battery range of electric vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs) is less of an issue for households residing in compact mixed-use neighborhoods because those households tend to drive fewer miles each day. Modeling at the household level makes it possible to evaluate the relationships between travel, emissions and the characteristics of households, land use, transportation systems, vehicles, and other factors. In addition, household level analysis makes it possible to evaluate the equitability of the costs and benefits of different strategies.

Figure 2 shows a schematic of model calculation steps.[3] Each step is composed of a number of calculations that operate on the results of the previous step and on input data that reflect scenario assumptions. The nature of each calculation was determined through the statistical analysis of several data sources such as the National Household Travel Survey.

The process to balance the VMT with travel costs allows congestion and other costs introduced at this step to influence the amount of travel. This step recalculates household VMT, fuel and GHG in the balancing process.

The primary outputs of the RSPM are household travel, fuel and power consumption, and GHG emissions calculations. Similar information is produced for commercial (light duty) and freight (heavy duty) travel.

The RSPM operates at the household level using Census data and local inputs and decisions related to land use and transportation systems. It does not examine the interactions between different districts within the study area. This limits some of the analytical capabilities of the model, as discussed in more detail in Appendix 3.

Components of the RSPM were tested throughout the development process to check the reasonability of results and whether the model could replicate observed behavior and conditions. Sensitivity tests were also performed to check whether the sensitivity of the model is consistent with results reported by other studies.[4]

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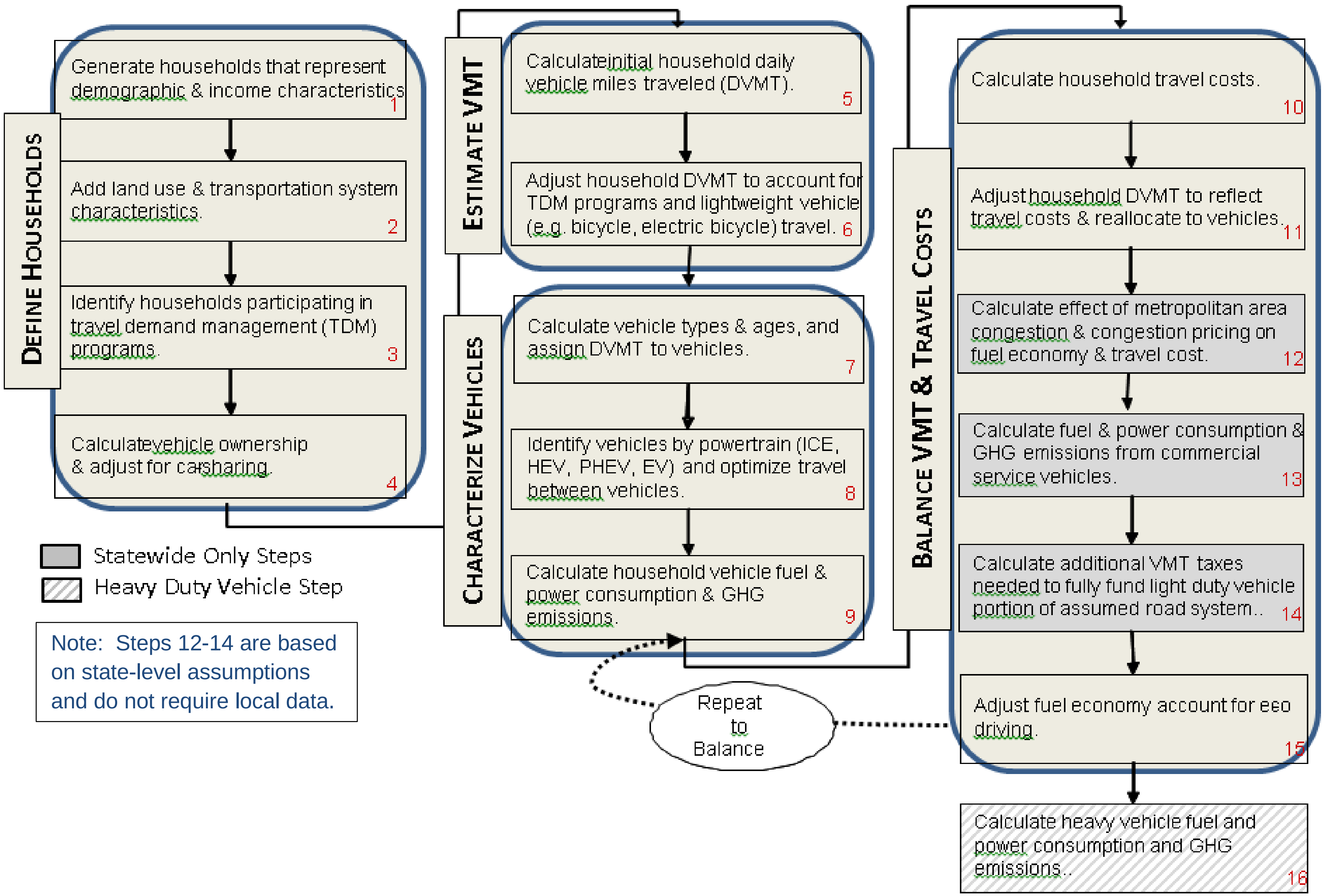
[3] The diagram shows the current structure of the RSPM model, reflecting changes over the course of the STS as well as Metro and CLMPO scenario planning.

[4] For example, the sensitivity of RSPM to changes in urban area population density and land use mix was compared to findings published in the Transportation Research Board TRB Special Report 298, *Driving and the Built Environment: Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions*. September 2009.

Figure 2 RSPM - Model Schematic



Inputs: Decisions & Data

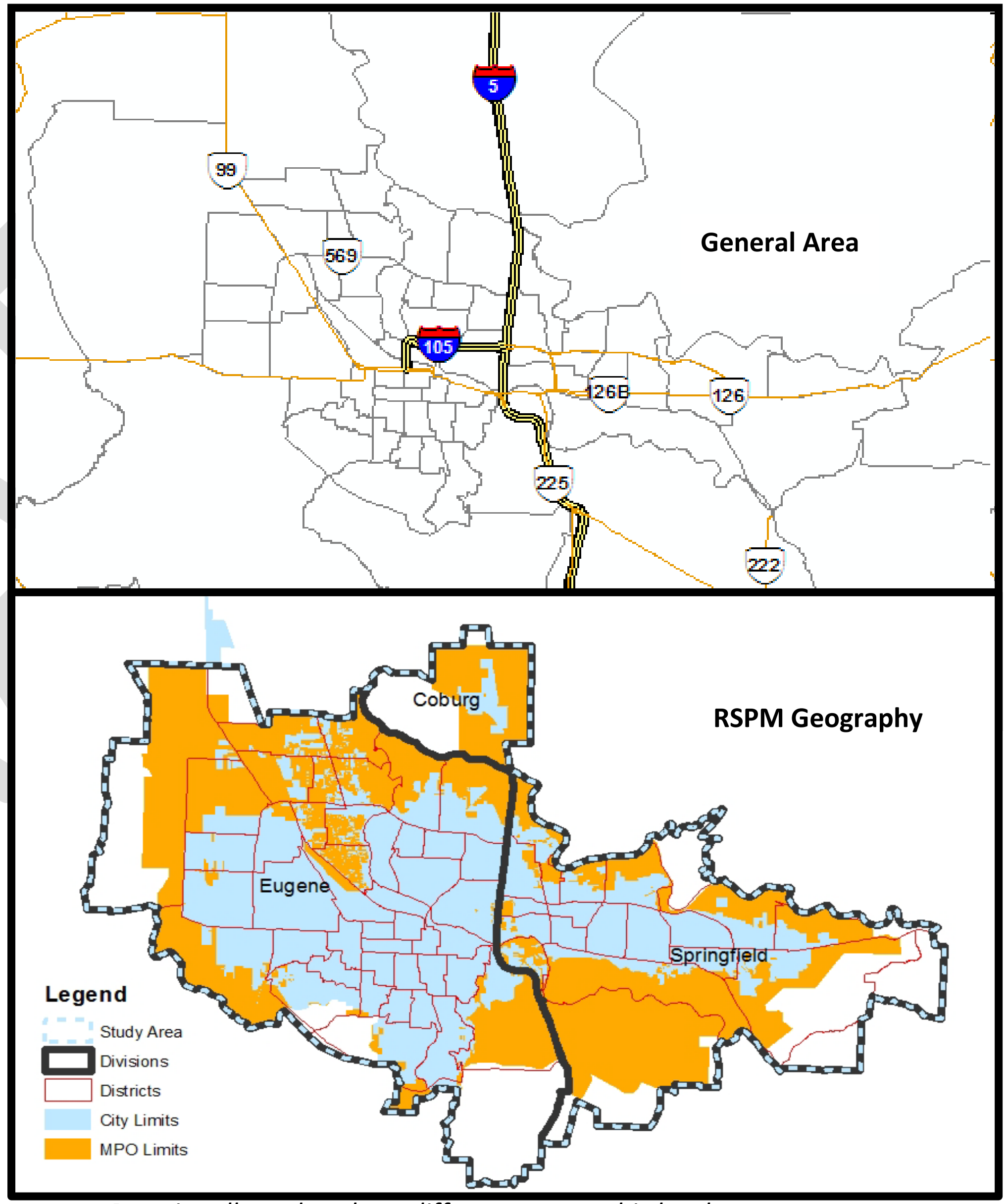
Each RSPM run requires a number of decisions and inputs from the local metropolitan area. The initial decision is to determine the model geography. Given this geography, inputs need to be developed to first calibrate the base year RSPM and identify future year assumptions. The geography and data needed for calibration are the most time critical and will allow the ODOT staff to begin setting up and calibrating the model. The remaining inputs and decisions are not required immediately, and can continue to be worked on while the model is being calibrated. The geography and inputs are described below with more detail in Appendix 2.

Step 1: Establish RSPM Geography

RSPM has three different geographic units at which different critical information must be collected to operate RSPM. The geographies are nested largely to align with US Census tracts for key data inputs and with existing MPO boundaries to allow for data outputs that address the GHG target rule. Figure 3 identifies the RSPM geography in Central Lane MPO.

- **Study Area -** Defines the extent of the area included in the model. It can be as small as the MPO boundary (used in the GHG target rule), or may add additional areas where the region might expand to accommodate growth by 2050. The area should break along Census boundaries. The inclusion of multiple, dispersed, urban areas is discouraged due to RSPM limitations in capturing intercity travel (see Appendix 5).
- **Divisions** - The study area <u>may</u> be partitioned into "divisions" which define large portions of the metropolitan area which have different land use and transportation policies or where differing policies may be applied in the future. Divisions should be relatively large (e.g. population greater than 50,000) and/or identify unique parts of the study area. Divisions were created to address the significantly different policy decisions in the Central Lane MPO (CLMPO) for Eugene, Springfield, and Coburg, beyond the

Figure 3. RSPM Nested Geography (CLMPO)



Data is collected at three different geographic levels.

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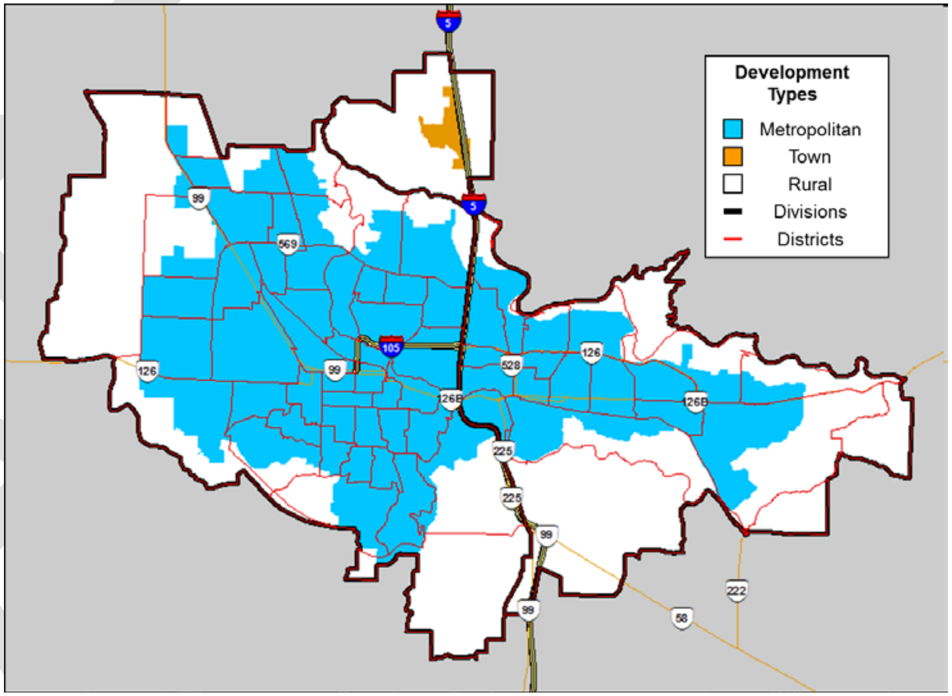
need to report results differently.

- **Districts** - The geographic unit used for assigning the projected households to a place. To align with the GHG target rule, districts should fall entirely inside or outside the MPO boundary. Additionally, some policies (e.g. bicycling goals and transportation demand management goals) are specified at the district level. Districts are ordinarily defined according to Census Tract boundaries (approximately 1,200 – 8,000 persons) to simplify input data collection and to match the geographic units used in model estimation. Deviations from census tracts may be allowed based on more detailed census data (block or block group). If splitting Census Tracts to conform to the MPO boundaries (or potential UGB expansion study areas) results in small acreages, it is desirable to combine them with adjacent districts for ease in analysis/reporting.

Within RSPM, land area is characterized by **development type**. A district generally contains a mix of types (see Figure 4 for CLMPO example). For modeling purposes, land area and dwelling units are defined by a combination of the district boundaries and the assigned development type. These determine the density important to many variables in the model including those that define how urban mixed use areas perform. Thus, a critical determination is to distinguish between currently urbanized and potentially urbanizable land. The development types include:

- **Metropolitan** –The most urban areas of the region, typically defined as all urbanized land within the urban growth boundary (UGB) of the MPO's primary city or contiguous cities. If large areas within the UGB are not urbanized, they should be classified as rural, to better reflect the actual density of the urbanized area.
- **Town** – Typically less dense but still urbanized areas within the study area that fall outside of the UGB of MPO's primary city or contiguous cities (e.g. small towns within the MPO).
- **Rural** – All non-urbanized, less dense lands within the study area. This development type can include lands inside and outside the UGB (and outside the MPO boundary if the study are is larger than the MPO). Rural lands can be assumed to convert to the urbanized development types in future years, reflecting anticipated development densities.

Figure 4. RSPM Development Types (CLMPO)



Geography is important in the RSPM and treated differently than in traditional urban travel models:

- RSPM predicts household travel based on the characteristics of the geographic area where a household resides including population density and housing type(s).
- Inputs can vary by geographic area and therefore can be tailored to represent the differing characteristics of an urban pattern. For example, the proportion of mixed-use development is likely to be higher in districts near the city core than in those in the urban fringe.

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- By measuring land use details at the district level, RSPM captures the relationship of each household to the land use characteristics in the whole neighborhood around it (i.e., the influence area appropriate to inform travel behavior). Isolated density is not as effective as a full Census tract of higher activity concentrations and mixed uses.
- By altering the mix of development types within a district, the effects of different allocations of population around the metropolitan area can be assessed in RSPM. For example, modeling a scenario which allocates a larger proportion of households to lower density districts will produce higher VMT forecasts than modeling a scenario which allocates more households to higher density urban districts.

Step 2: Collect Input Data for Base Year and Reference Case Future Year

The following years will be modeled in the RSPM for Strategic Assessments.

- **2005** – back-cast to match the MPO GHG reduction target base year.
- **2010** Base Year – basis for data collection, calibration, and other runs.
- **2035** – the date associated with MPO GHG reduction targets and is near the RTP forecast date.
- **2050** – the date associated with statutory GHG reduction goals in the STS. The longer time frame enables consideration of more visionary changes that will take longer than the RTP time frame to occur.

The RSPM inputs can be grouped into two sequential parts, reflecting the timeline when the data is required:

- **Set-up/calibration inputs** - These include data based on the geography and the base and future year demographics and community design data used to establish the basic households, their location and attributes. This is needed early in the process to set-up the model framework, and
- **Other assumptions and inputs for the base and future year** reflecting existing conditions and adopted local plans respectively.

These inputs require a mix of data and decisions by the metropolitan area. Local inputs are combined with statewide assumptions provided by others.

Figure 5 provides a one-page summary of RSPM inputs, expanding the cover graphic. It summarizes the metropolitan inputs as well as those provided by others, with a quick guide on the geographic level at which data must be provided. Inputs specified as “DEFAULT” can be customized for local conditions, or can use statewide default estimates (e.g., STS values).

Appendix 1 is a detailed checklist table that outlines all of the inputs and decisions by the local metropolitan area required to operate the model. The checklist includes a line for each discrete data input or decision that is needed at the local level. The table also notes DEFAULT inputs where local data could override default values. The checklist provides MPO and local government staff and decision makers with information to estimate the local/regional level of effort required for a Strategic Assessment.

Appendix 2 provides more detail including sources and approaches for collecting input data. A **template set of input files** for the CLMPO RSPM is provided as a companion to the User’s Guide (Attachment 1).

Step 3: Decide on Sensitivity Test Inputs

A key value of the Strategic Assessment is the ability of the metropolitan area to determine the relative effect of potential changes to the reference case on GHG emissions and the other evaluation measures. These include changes in local investments, programs, and/or policy direction. In order to streamline this process, the ODOT staff identified the following set of sensitivity tests. A recommended set will be customized for the local area, and reviewed with the MPO:

Sensitivity Tests

1. Compact Land Use
2. Transit Investment
3. Light Vehicle Promotion
4. Parking Policies
5. Driving Efficiency
6. Demand Management
7. Aggressive Vehicle/Fuels
8. Aggressive State Actions

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The following sensitivity tests are planned for Strategic Assessments:

1. More compact and mixed **land use** patterns;
2. Increased **transit** service levels;
3. Increased shift of short-distance single-occupant vehicle (SOV); travel to bicycle, electric bicycle, and similar **light-weight vehicles**;
4. Expanding **parking pricing** programs (e.g. proportion of workers who pay for parking and/or employers implementing cash-out-buy-back programs);
5. Improving **driving efficiency** through eco-driving, ITS deployment, etc.;
6. Expanding **travel demand management** programs such as employee commute options and individualized marketing;
7. Further improvements of **vehicle technology, fleet and fuel** characteristics identified in the STS (e.g. higher levels of adoption of PHEV and EV); and,
8. Other **state-level changes** in pricing and other factors that influence vehicle travel and GHG emissions such as pay-as-you-drive (PAYD) insurance and user fees.

Each sensitivity test is represented by a small number of changes to reference case input files. Once the changes are made (e.g. changing the input regarding the proportion of households having pay-as-you-drive insurance) an automated procedure is used to create scenarios which combine the inputs into a variety of tests (e.g. increasing transit service and improving TDM). The results of all the combinations are then evaluated to show be potential changes that can occur by combining various programs.

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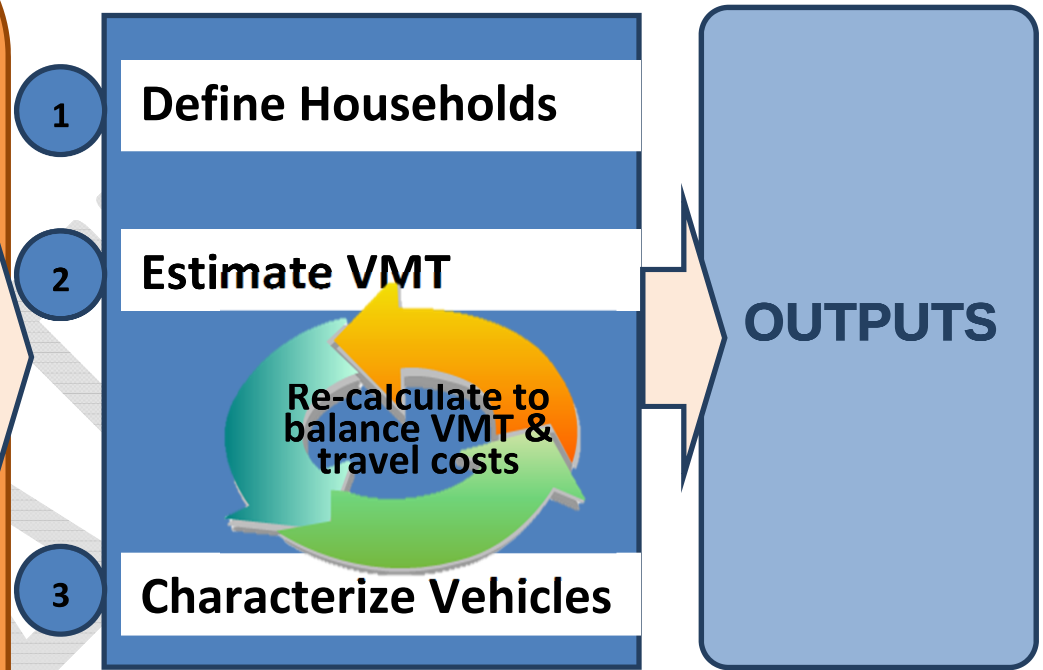
Figure 5. RSPM – Inputs Summary

METROPOLITAN INPUTS

DATA	Geography
Demographics	
- Population in Households by age	District
- Group Quarters(Pop by age,income,autos)	Division
- Average HH Size & % 1-person HHs	Division
- Per Capita Household Income	District
Community Design	
- Land Area by Dev type (acres)	District
- Dwelling Units by Dev & Hsg type	District
- % HHs living in Mixed Use Areas	District
Transportation Investments	
- Bike/Light Vehicle Usage (distance threshold, % SOV trips diverted below threshold)	District
- Transit Revenue Miles	Metropolitan
- Freeway & Arterial miles	Metropolitan
Pricing	
- Parking (% pay for parking, average parking rates; % cash payout)	Division
- Per Mile Fees (Gas, VMT, Carbon)	Metropolitan
- PAYD Insurance (% use)	Metropolitan
Marketing/ITS-Ops Management	
- Workplace TDM Programs	District
- Individualized Marketing Program	District
- Car Sharing (pop per vehicle)	Division
- ITS Degree of Deployment (Freeways - Ramps & incident, Arterials - signals, access)	Metropolitan
- Eco-Driving Practices	Metropolitan
- Low Rolling Resistance Tires	Metropolitan
- Vehicle Use Optimization	Metropolitan
Vehicle/Fuels Technology	
- Transit Vehicles/Fuels	Metropolitan
- Truck share of personal & fleet autos	Division
- Electricity emissions rate(Co2e lbs/kwhr)	District



OTHER INPUTS

(for Auto and Commercial fleet Light duty vehicles & heavy vehicles)

Vehicle Age & Fuel Economy

(Vehicle age, fuel type, fuel economy, %EV)

Vehicle Fuel Technology

(biodiesel/ethanol, emission rates)

SETUP/CALIBRATION INPUTS (Metropolitan-level geography)

- Model geography (Study Area, Divisions, and Districts)
- Light duty DVMT on area roads (from HPMS or TM)
- DVMT by user group (auto, light truck, heavy truck, **transit**) and functional class

Note: White Text indicates items where STS defaults are provided or required. Local adjustment for special considerations may be allowed.

Outputs: Interpreting Results

The RSPM has the capacity to calculate a number of evaluation measures and supplemental information that metropolitan areas and local jurisdictions can utilize to help inform future planning processes. This section provides information on the output measures available from the Strategic Assessment, sensitivity testing, and scenario planning processes:

Strategic Assessment

A Strategic Assessment includes output measures for a base year (e.g., 2005 and 2010), a future reference case (e.g., 2035 and/or 2050) and sensitivity tests. The Strategic Assessment provides a relatively quick regional estimate of baseline travel and its environmental implications. In addition, the reference case shows what the future will look like if the status quo continues and what various changes to the status quo could accomplish.

After the completion of the model runs, the ODOT staff provides the metropolitan area with tables and graphs which show regional outputs for the base year, reference case, and sensitivity tests. Some outputs can also be shown at the geographic division and district levels. For a list of potential outputs see Figure 6.

Working in partnership with the metropolitan area, the ODOT and DLCD staff will interpret the results of the model outputs and determining how best to display results. Sample graphics produced for the STS Technical Appendices are included in Figure 7.

Figure 6. Output Data available with each RSPM Run

Household/Transport Attributes

- Population and Household size
- Land use by development type
- Population in mixed-use neighborhoods
- Vehicles (type, powertrain, mpg)
- Household travel costs (fuel costs, auto ownership and O&M costs , gas taxes, parking, social costs)

Travel

- Household daily VMT (total and per capita)
- Bike/Light Vehicle miles, Pedestrian & Transit trips
- Transit service level
- Vehicle delay (total and per capita)

Fuel & GHG Emissions

- Auto Fuel & Electricity consumed
- Greenhouse gasses produced
- Other - Criteria Air Pollution, household water use

Sensitivity Tests

1. Compact Land Use
2. Transit Investment
3. Light Vehicle Promotion
4. Parking Policies
5. Driving Efficiency
6. Demand Management
7. Aggressive Vehicle/Fuels
8. Aggressive State Actions

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From the output data (Figure 6), the Strategic Assessment allows ODOT staff to quantify the following trends and complete other analyses:

Travel Trends

- **VMT and VMT per capita**. Contributors to changes in VMT may include changes in income, demographics, fuel prices and other factors as well as land use and transportation factors.
- **Travel Delay**. Contributors to travel delay may include changes in auto VMT, light vehicles (including bikes) and walking, transit, and ITS.
- **Transit service** trends per capita.
- **Walk and bike trip miles.**
- First order **Infrastructure costs** attributable to passenger vehicle traffic.

Environmental Trends

- **Energy, Fuel, and GHG emissions**, and the contributors including VMT, forecast changes in vehicle technology, and in fuel type (including increased electric vehicle use). This can be discussed in the context of current local region vehicle mix and the impact of future federal CAFE standards and further state plans.
- **Land consumed** due to residential development.
- First order **Air quality** (criteria air pollutants, kg/day).

Other First Order Assessments:[5]

- **Household costs** – Travel costs can be compared by income group.
- **Intercity Travel** – Non- RSPM analysis will identify existing trends in the region regarding intercity commuting and shopping patterns, making use of the Census and state and local OHAS survey data (see Appendix 5 for more on Intercity travel).
- **Social Costs** per household (safety, pollution, energy security, etc.)

[5] These measures are of interest but either not fully captured in the urban version of the model (household budgets, social costs), or are outside of the model and represent only base year conditions (intercity travel).

Scenario Planning

Many other measures are possible by customizing scripts using the raw RSPM outputs. Due to the effort required to customize these measures, they are not intended for use in Strategic Assessments, but provide opportunities for additional performance measures in the larger scenario planning process. Therefore, building off of a Strategic Assessment, metropolitan areas may choose to engage in a scenario planning process.

Whereas the Strategic Assessment provides metropolitan areas with a glimpse of its future under status quo conditions, a scenario planning process will help local jurisdictions and MPOs arrive at a vision of what mix of investments and programs are required to best meet regional goals. Future RTP and TSP efforts can incorporate policies and objectives that complement this vision.

For more information please refer to **Appendix 4** and the Scenario Planning Guidelines.

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Figure 7. Example Measures from the Statewide Transportation Strategy Model Results

(http://www.oregon.gov/ODOT/TD/OSTI/docs/STS/STS_TechAppendices.pdf, Technical Appendix 1, p.65+)