Implementing the Rapid Policy Assessment Tool

Oregon Department of Transportation

Case Study Report

October, 2016

SHRP2 SOLUTIONS
STRATEGIC HIGHWAY RESEARCH PROGRAM

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1. Executive summary

ODOT implemented the RPAT, in partnership with the Corvallis Area Metropolitan Planning Organization (CAMPO), to enhance capabilities for integrating transportation and land use analysis into planning processes. ODOT combined analysis from RPAT and the Regional Strategic Planning Model (RSPM), which is ODOT's enhancement and rebranding of the GreenSTEP tool. The GreenSTEP tool provided the starting software for RSPM as well as RPAT and the Federal Highway Administration (FHWA) Energy and Emissions Reduction Policy Analysis Tool (EERPAT). An ongoing partnership between FHWA and ODOT is establishing a VisionEval Open Source Project, which will merge all of these tools into a common code framework and provide a forum for sharing how the tools are used and updated. An RPAT Scenario Viewer, developed by ODOT using FHWA funding, enabled ODOT to model and evaluate hundreds of alternative future scenarios for this analysis.

The Rapid Policy Assessment Tool (RPAT)

RPAT is a tool that regional decision-makers and land use and transportation planners can use to estimate impacts of changes to the built environment, travel demand, and transportation supply and demand management policies on vehicle miles travelled, as well as effects on sprawl, energy reduction, active travel, and carbon footprints. RPAT is designed to provide a high-level analysis at a regional scale that can be used to evaluate smart growth policies during a regional visioning process and at the program level in a regional transportation plan.

More information and resources related to RPAT as well as a link to download the software for free are available on the TravelWorks website: https://planningtools.transportation.org/551/rapid-policy-analysis-tool.html

Key Outcomes:

- At the state level, coordination with MPOs in their use of RSPM/RPAT allows state agencies to better understand key tradeoffs of policy actions, and work with local jurisdictions to collaboratively address state or federal requirements.
- At the state level, the strategic nature of RSPM/RPAT has enabled ODOT to quickly assess the impact of changes to transportation funding packages discussed in the State Legislature, and allowed statewide planning advisory committees to analyze the various impacts of state policy implementation scenarios.
- At the MPO level, the use of RSPM/RPAT allows CAMPO to engage stakeholders in the development and implementation of regional plans.
- RSPM/RPAT allows CAMPO to quantify additional policies and provide potential alternatives to adopted plans. Specifically, RPAT evaluates more detailed TDM programs, integration of employment and land use place types, and outcomes on accidents, transit trips and accessibility.
- The RSPM/RPAT Scenario Viewer allows stakeholders to explore the outcomes of hundreds of alternative futures, correct inconsistent thinking, and better understand complex tradeoffs of different policy choices.
- The comparison of the two models shows that they perform similarly despite a number of differences in inputs, methods, and outputs; however, there are areas where merging the functionality of the two models can improve their robustness and usefulness for policy applications.

2. Background

ODOT works to provide a safe, efficient, multi-modal transportation system that supports economic opportunity and livable communities for all Oregonians. The agency develops programs related to Oregon's system of highways, roads, and bridges; railways; public transportation; transportation safety; driver and vehicle licensing; and motor carrier regulation.

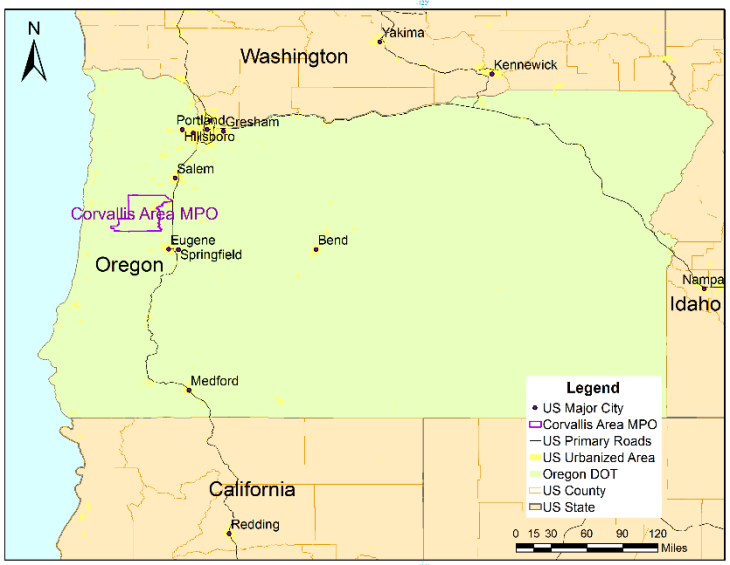

Figure 1. RPAT User Incentive recipient, ODOT, and Corvallis Area MPO highlighted

ODOT's long range planning activities have been enhanced through the development of the RSPM. The RSPM tool is an enhancement and rebranding of the GreenSTEP tool, originally built to assess changes in greenhouse gas (GHG) emission from state and local policy actions in a manner that includes a broader set of metrics, as well as implementation at a metropolitan area level. The GreenSTEP tool also provided the starting software for both RPAT and the FHWA EERPAT. An ongoing partnership between FHWA and ODOT is establishing a VisionEval Open Source Project, which will merge these tools into a common code framework and provide a forum for sharing how the tools are used and updated. For more on VisionEval see: https://gregorbj.github.io/VisionEval/

ODOT works closely with MPOs in the state, including the CAMPO (Figure 1). Due to limited staff at CAMPO, ODOT assists in the implementation of travel model tools, including traditional travel demand models and RSPM/RPAT. ODOT place type work and comparative tool analysis was assisted by Brian Gregor of Oregon Systems Analytics, an ODOT contractor and author of the RSPM/GreenSTEP framework. The Oregon Department of Land Conservation and Development (DLCD) provided assistance throughout the project.

3. Project Goals & Objectives

ODOT implemented RPAT to enhance its capabilities for integrating transportation and land use analysis into the planning processes, starting with the ongoing RSPM work with CAMPO and the local planning community. Additionally, to inform the partnership between FHWA and ODOT that is merging the GreenSTEP family of models into the VisionEval open source project on a common code base, a secondary goal was to compare the functionality of the two tools. The effort highlighted additional capabilities of RPAT that improved the ongoing CAMPO strategic planning with applications for other Oregon communities and statewide planning efforts, as well as the larger VisionEval user community across the nation.

A key value of the effort is contrasting the RSPM and RPAT tool implementation in the same location. This comparison included both technical differences in inputs and outcomes, as well as more subjective differences about how the tools were used and level of user engagement of the different processes, particularly in the application with the CAMPO local jurisdictions.

ODOT in partnership with CAMPO has completed the following efforts under this User Incentive award:

1. Policy Scenario Analysis with CAMPO (RPAT and RSPM)
2. RPAT –RSPM Comparison (including scenario viewer)

A related FHWA-funded task allowed ODOT to implement an RPAT scenario viewer, enabling hundreds of additional scenarios to be run automated and later evaluated in an interactive web-based tool. The CAMPO RSPM viewer can be found here.

Throughout this User Incentive award period, the recipient partners communicated with various agencies locally, throughout the state, and nationally about how Oregon has found value in using strategic planning supported by RSPM and RPAT tools.

4. Results

4.1. Inputs

The inputs needed to run RPAT involved collecting data from various national, state and regional sources, such as Census data, State and local population and employment forecasts, and adopted local plans. These inputs include assumptions on conditions for the base 2010 to 2040 scenario, as well as assumptions reflecting the alternative policy scenarios of interest to the CAMPO. MPO, ODOT, and DLCD staff engaged regional stakeholders and the CAMPO Technical Advisory Committee (TAC) in order to develop RSPM inputs that would test the different policy options identified by the CAMPO Policy Board. The regional stakeholders included the City of Corvallis, City of Philomath, Benton County, Oregon State University, and the regional Transportation Options provider Oregon Cascades West Council of Governments. The process was guided by the CAMPO TAC. The project team worked closely with staff from local jurisdictions to provide reasonable and accurate inputs to best represent the policy options identified for investigation.

4.2. Scenarios

4.2.1. Policy Scenario Analysis with CAMPO

Both RSPM and RPAT tools were applied in CAMPO for this scenario work. RPAT supplemented RSPM capabilities previously developed for the area as part of the prior Strategic Assessment project. The first part of the analysis tested and reported each policy option against the adopted plans reference case to understand how implementing each policy choice in isolation would impact the region relative to implementing the future adopted plans. The CAMPO Policy Board identified four issue areas of local importance to be used as evaluation criteria to assess the policy options and scenarios for their ability to achieve local planning goals; GHG Emission Reductions, Public Health, Sustainability, and Equity. The CAMPO TAC developed a set of indicators for each of the evaluation criteria categories from those available from RSPM and RPAT outputs. The evaluation criteria were used to compare the effectiveness of policy options and scenarios relative to the trend scenario of adopted land use and transportation plans. A single representative indicator was chosen to represent each evaluation criteria category in reporting.

Figure 2 identifies the policy in isolation scenarios, while Figure 3 demonstrates the maximum impact of policies on selected evaluation criteria. The Figure 3 plots show the relative impact of the policies on the evaluation criteria for GHG reduction, Public Health, Sustainability, and Equity. A single representative indicator has been chosen to represent each evaluation criteria category. The bars show the policy within that category with the most impact (e.g., transit vs. bike policies under alternative modes). These charts identify where each policy category has the most impact in reaching the desired outcome. For example, when considering equity, transit, bikes and car share programs do the most for reducing low income travel costs. More detailed results and findings are provided in ODOT's final project report.

Policy	Land Use	Parking	Alt Mode	Trans Options
0	Adopted Plans	Adopted Plans	Adopted Plans	Adopted Plans
1	**Decrease developments in central area and direct new developments to outer areas**	Adopted Plans	Adopted Plans	Adopted Plans
2	**Increase developments in central areas**	Adopted Plans	Adopted Plans	Adopted Plans
3	**Most new development is concentrated near alternative mode facilities**	Adopted Plans	Adopted Plans	Adopted Plans
4	**Climate Refugees-Increased population growth**	Adopted Plans	Adopted Plans	Adopted Plans
5	Adopted Plans	**Expanded parking districts**	Adopted Plans	Adopted Plans
6	Adopted Plans	**Increase parking fees downtown**	Adopted Plans	Adopted Plans
7	Adopted Plans	**Increased fees in downtown and expanded districts**	Adopted Plans	Adopted Plans
8	Adopted Plans	**Cash-out parking programs**	Adopted Plans	Adopted Plans
9	Adopted Plans	Adopted Plans	**Increase transit frequency**	Adopted Plans
10	Adopted Plans	Adopted Plans	**Expand transit to Philomath and Adair Village**	Adopted Plans
11	Adopted Plans	Adopted Plans	**Expand bicycle facilities**	Adopted Plans
12	Adopted Plans	Adopted Plans	Adopted Plans	**Home/Work-based marketing programs**
13	Adopted Plans	Adopted Plans	Adopted Plans	**Expanded car sharing**

Figure 2. Scenario analysis; Policy in Isolation scenarios

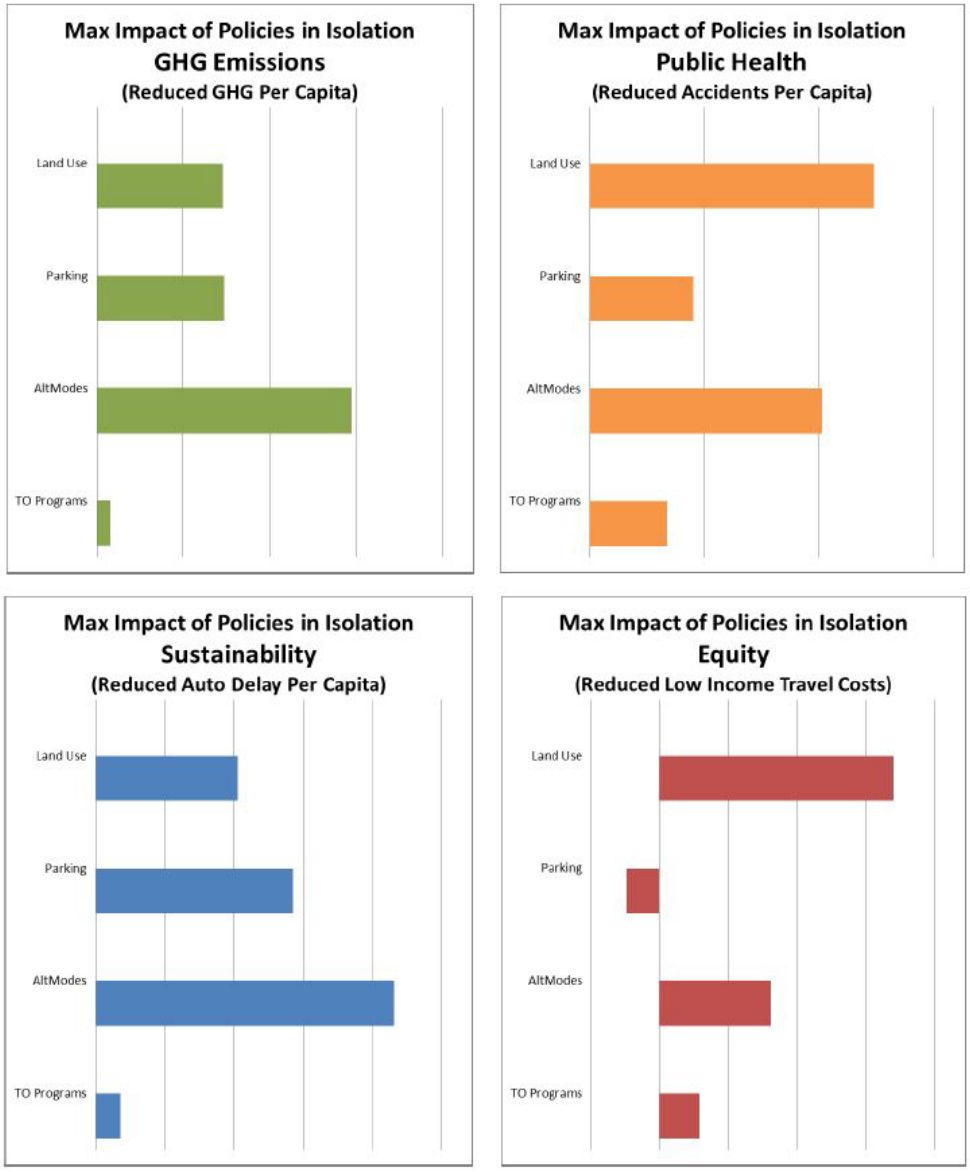

Figure 3. Scenario analysis; Policy in Isolation output reporting

The second part of the analysis combined policy options into bundles to represent policy scenarios to test relative to the adopted plans reference case future. The CAMPO TAC identified which policy bundles to test in order to assess the impacts of different combinations of policy scenarios that could potentially be implemented in the future. A mix of the policies previously tested in isolation in Part 1, are combined into more complete scenarios that include complementary land use, parking, and supportive multi-modal and Transportation Options policies and investments. These combination scenarios were evaluated through the lens of their impact on indicators of regional importance. Unlike the Strategic Assessment report that was largely a state-led exercise, in the second stage of analysis the MPO planning committees were very engaged in defining the evaluation criteria and specific metrics for assessing the scenarios. Figure 4 demonstrates how the CAMPO TAC bundled policies into scenarios for analysis, while Figure 5 provides an example of how the model results were packaged for reporting to the CAMPO TAC.

Part 2- Policies in Combination

		Land Use	Parking	Alt Mode	Transportation Options
Policy Bundles	A	Adopted Plans	Expanded parking districts	Expand bicycle facilities	Home/Work-based Marketing
			Increased fees downtown	Expand bicycle and pedestrian facilities	Car Sharing
			Cashout Parking		
	B	Decrease developments in central area and direct new developments to outer areas	Expanded parking districts	Expand transit to Philomath and Adair Village	Home/Work-based Marketing
			Adopted Plans		Transit Subsidies
	C	Increase developments in central areas	Expanded parking districts	Increased transit frequency	Home/Work-based Marketing
			Increased fees downtown	Expand bicycle facilities	Car Sharing
	D	Most new development is concentrated near alternative mode facilities	Expanded parking districts	Increased transit frequency	Home/Work-based Marketing
			Increased fees downtown	Expand bicycle facilities	Car Sharing
			Cashout Parking		
	E	Adopted Plans	Cashout Parking	Increased transit frequency	Home/Work-based Marketing
				Expand bicycle facilities	Car Sharing
Climate Refugee	F	Climate Refugees	Expanded Disticts	Increased transit frequency	Home/Work-based Marketing
			Increased fees downtown	Expand bicycle facilities	Car Sharing
			Cashout Parking		

Figure 4. Scenario analysis; Policy in Combination scenarios

Policy Bundle- Scenario A

This policy bundle uses the land use pattern from the adopted plans reference case, and combines the highest levels of parking with bicycle and Transportation Options policies. This scenario serves to give an understanding of the likely effects of implementing a more comprehensive set of transportation policies in the region with adopted land use plans.

Land Use	Parking	Alternative Modes	Transportation Options
Trend Scenario	• Expanded parking districts • Increased fees downtown • Cash-out parking	• Expand bicycle facilities	• Home/Work-based marketing • Car Sharing

Findings

Most of the evaluation criteria are trending in the right direction, however it under performs on most indicators in comparison to other scenarios. Inclusion of transit in Scenario B, leads to larger impacts on reducing driving than the parking policies in this bundle. Parking policies are much more aggressive than the parking policies tested in Scenario B and would require much more work to realize. Given the small differences between the outcomes, parking policies had a relatively small impact. Equity measures show that travel costs, mostly due to parking cost increase, have a disproportionate burden on poorer households. Walk and transit trips remain unchanged, primarily as a result of the unchanged population living in mixed use development.

	Annual GHG Emissions	Daily VMT	Annual Auto Delay	Daily Air Quality Pollutants	Daily Accidents	Annual Social Costs	Light Vehicle/ Bike Diversion	Travel Costs % of Household Income	Travel Costs % of Low Income Households	Auto Owned Per Household	% Zero Vehicle Households
A	-1.8%	-2.4%	-3.5%	-2.3%	-2.0%	-1.8%	3.0%	0.9%	2.3%	-0.1%	0.7%

Figure 5. Scenario analysis; Policy in Combination output reporting

4.2.2. RPAT–RSPM Comparison

For the model comparison test, the project team compared RSPM and RPAT functionality to gain an understanding of how the RPAT capabilities can be merged with ODOT's RSPM capabilities. Additional FHWA funding allowed the project team to run nearly 650 scenarios and visualize the RPAT results in a proof-of-concept scenario viewer.

The results have been grouped in the discussion below to combine related outcomes. It should be noted that this comparison is based on a quick review of the two models, including a cursory look at their methods as scripted. A more detailed review is recommended to confirm these comparisons/findings before making any changes to the models. More details on these comparison results, including potential sources for differences, are provided in the ODOT final project report.

- **Land Use**: The models are both highly sensitive to the share of population in urban mixed-use neighborhoods, but differ in how they represent land use and account for the effects of land use

policies on travel behavior. RSPM uses districts, with a housing allocation model locating population into district dwelling units sensitive to average household income and calculating mixed use shares from district population densities. RPAT land use is defined by regional inputs by place type with explicit mixed use assumptions, and applies elasticities within the model to adjust for differences in travel behavior across place types. Overall, use of data-driven place types, as created for Oregon under this award provides the opportunity for a stricter definition and ability to include more variables in the mixed use designation, such as factors related to employment and other 5D built form effects. Ideally mixed use effects would be incorporated directly in future estimated equations rather than applied as post-model elasticities.

- **Walking**: There are notable differences in walking trips generated by the two models in response to transit and income, which can be explained by the different calculation methods. RPAT uses a table of base level trip rates and then adjusts the values as a final step using place type elasticities. The RSPM uses a two-step method estimated from the 2001 NHTS datasets to predict the number of walk trips; both have income as a dependent variable along with urban mixed use land use designation. Generally RSPM showed more walk responsiveness to policies than RPAT.
- **DVMT**: Daily vehicle miles traveled (DVMT) per capita is within 20 percent, or 5 miles per person higher in RSPM than RPAT in the base scenario comparison. The difference in household DVMT predicted by the two models is larger than expected but not unreasonable given several key differences in how DVMT is modeled and how costs are accounted for, including RPAT's use of place type elasticities. RPAT also does not include fully electric vehicles that lower operating costs and increase VMT in the horizon years. These electric vehicle household cost differences mean RSPM and RPAT respond differently to pricing and income scenario tests.
- **Delay and speeds**: The average light-vehicle and heavy truck speeds calculated by the two models are very close (within 5 percent), but RSPM forecasts significantly more growth in hours of delay. This is attributed to the newer congestion model in RSPM and more significantly the 20 percent higher DVMT (after including light duty commercial vehicles and university group quarters), which results in more demand for the same road mile capacity.
- **Vehicle emissions and fuel gallons**: Although there are several similarities in how both models address emissions, owing to their common GreenSTEP roots, there are also several notable differences. In general, the estimates of annual fuel consumed per capita between the two models are quite close (within 5 percent), since the higher DVMT of the RSPM model is offset by lower miles per gallon (MPG) RPAT model inputs of the horizon year. However, the per capita GHG emissions estimates are more divergent with the net overall difference in carbon intensity (emissions per gallon) between the two models at about 24%, due in part to the different inventory approaches ("well-to-wheels" vs. "tank-to-wheels"[1]).

The plan to merge the tools in the VisionEval common framework will benefit RPAT in the following ways:

- Allow additional or enhanced policy analysis of electric vehicles and their different idling emission rates, low carbon fuel programs, and more ITS policy strategies (via a newer congestion model);
- Provide explicit treatment of commercial vehicle fleets and university group quarters;

[1] RSPM takes a "well to wheels" approach, which means that the calculated carbon intensity of a fuel includes the emissions produced by extracting, refining, and distributing the fuel as well as the emissions produced by burning the fuel to power the vehicle. RPAT adopts the EPA definition of "tank-to-wheels" carbon intensities (which doesn't include emissions from fuel production, refining, and distribution), as the default unless modified by the user (as done in the comparison scenarios).

- Allow the user to turn off the stochasticity in the model to be able to replicate prior results (fix the model's random seed);
- Automate hundreds of model runs; and
- Engage users to explore policy options through an interactive scenario viewer.

RSPM will benefit from use of land use place types, employment and job accessibility, safety and transit ridership outcomes and infrastructure cost estimates.

Overall, both models yield similar results regarding the relative effectiveness of policies for reducing GHG emissions. To tackle GHG reduction in the transportation industry requires significant changes to our vehicle fleet as well as pricing the externalities of vehicle travel. The models highlight how the former accrues significant benefits to air quality and safety. While the latter increases the effectiveness of implementing multi-modal investment strategies by lowering travel costs when auto ownership declines and increasing health with more active mode use. Pricing also provides some much needed revenue to maintain the 1950s roadway network we've established.

Land use policies and travel demand policies don't show nearly as much effect due to the small number of participating households. While compact land use has a demonstrable effect on VMT, very large changes in population density and land use mixing are necessary to achieve substantial reductions (as has been documented in TRB Special Report 298). Similarly, strong employer demand management programs are estimated to reduce VMT by about 5 percent; a substantial reduction only if a significant number of employers and employees participate in these programs.

Transit policies prove to be fairly effective at reducing GHG emissions in both of the models. The degree of reduction is similar despite significant differences in calculation methods. For bicycling RSPM calculates a similar level of reduction in emissions as transit in contrast to RPAT, which shows a much lower reduction; more like that of land use.

5. Conclusion

Similar to its own scenario planning tools GreenSTEP and RSPM, ODOT has found RPAT to provide significant value to the statewide and regional land use and transportation policy planning process. At the state level, the process to develop model inputs and create a baseline for assessment allowed state agencies, including ODOT and others to learn and discuss key tradeoffs of various policy actions. At the MPO level, the RPAT and RSPM policy analysis tools provided CAMPO with an effective method to engage local jurisdictions and regional stakeholders in a collaborative planning process to support ongoing development and implementation of regional plans. As a supplement to the RSPM analysis, the RPAT tool allowed the region to quantify additional policies and provide an expanded set of regionally important outcomes of alternatives to their adopted plans. Specifically the RPAT tool evaluated more detailed TDM programs, integration of employment and land use place types, as well as outcomes on accidents, transit trips and accessibility.

The creation of the web-based interactive Scenario Viewer integrated with RSPM and RPAT, allows stakeholders to explore the outcomes of hundreds of alternative futures, correct inconsistent thinking, and better understand complex tradeoffs of different policy choices. The strategic nature of these tools has enabled ODOT to quickly assess the impact of changes to transportation funding packages discussed in the State Legislature, and allowed statewide planning advisory committees to analyze the various impacts of state policy implementation scenarios. The tools help planners determine which policy choices have a significant impact on travel behavior, identify how the future will differ from today, and develop effective policies customized for their region. ODOT and DLCD also anticipate the place type approach, developed under this

award, to be a constructive way to engage mid-size MPOs with limited staff and technical capabilities to participate in meaningful land use planning at minimal cost.

The comparison of the RSPM and RPAT models has shown that they perform similarly despite a number of differences in inputs, methods, and outputs. There are a number of areas where merging the functionality of the two models can improve their rigor and usefulness for policy applications. A summary of key findings from the model comparison is provided in ODOT's final project report. These findings and recommendations are offered as ways to build on the success to date of both tools.

Both the RSPM and RPAT can provide a quantitative way for communities to realize the value of land use and travel demand policies, as politically infeasible as they may seem today. Oregon's work has shown that using these models helps engage planners, the public, and decision-makers in serious discussions about what can and should be done to meet the challenge of reducing the impact of transportation on the environment.

6. Performance Measures and Evaluation

At the start of the project, performance measures were identified in four topic areas (Implementation, Innovation, Deployment, and Communications and Outreach) to ensure the project realizes the intended long term outcomes of the award.

Table 1 summarizes some of ODOT's efforts that support these measures.

Table 1. ODOT Performance Measures

Performance Measures	Achievement
Implementation	
Project Deliverables are on schedule and on/under budget	All project deliverables, including the final report were submitted on time and on budget.
Base year and Reference future scenarios meets validation targets	RSPMv3.5R and RPATv1.8 validation tests were completed; results are documented in ODOT's final project report.
RPAT and RSPM models are used to inform existing planning process	After using Oregon Place Types in the Rogue Valley MPO Strategic Assessment, the MPO decided to use the framework for their RTP.
Innovation	
Tool outputs capture a range of community values useful in discussing tradeoffs of which policies help reach community goals.	Oregon Place Types were used to review land use inputs in Rogue Valley and Bend MPOs; agencies found value in thinking about land use in this way. In addition, per meetings with CAMPO TAC desired evaluation criteria included a mix of RSPM and RPAT-unique measures.
Stakeholders gain insight into how the future will differ from today (e.g., demographics, vehicles, transportation options) and the effectiveness of various polices.	RVMPO Strategic Assessment, using RSPM informed the MPO TAC of key findings about the future, and ability to meet GHG reduction goals, and other desired regional outcomes. The draft findings were shared with the TAC on 11/16/15; final project report and scenario viewer were published in early 2016.
Comparison of RPAT and RSPM tools highlights qualitative and quantitative value-added of each tool informing future model upgrades/research.	ODOT plans to incorporate the RPAT place type concept with impacts on commute-options into the RSPM model, and ultimately in the common VisionEval code base.
Deployment	
Stakeholders report tool is easy to use for developing desired inputs and output measures.	Interviews with local jurisdictions highlighted the tool's expected value in helping to quantify the benefits of local actions, e.g., a parking measure that was not approved by voters.
Agency and partner staff acquire additional skills and abilities.	ODOT Analysis and Planning Staff were trained in the RPAT tool. The state land use agency (DLCD) and the Rogue Valley MPO were trained on Oregon land use place types.

Performance Measures	Achievement
Use tool(s) and data-driven methods to improve planning of Agency and partner organizations (e.g., work processes, data, analysis tools, decision information).	DLCD was a key partner in the development of the Oregon place type method/logic and has indicated interest in building on this capability in their conversations with local planners about land use opportunities.
Communications & Outreach	
Methodologies, work processes, key decisions, problems encountered, and lessons learned are sufficiently well documented that peers in other agencies can follow the work and repeat the results.	Created spreadsheet documentation of individual outputs and their processing to make comparable across tools. Provided documentation of data-driven place type development methodology. Developed comprehensive final project report
Project partners are engaged with the work and familiar with results.	Participated and led various conversations with RPAT/RSPM users (Peer Exchange) and potential users (AMPO conference session and RPAT training) in October 2015 meetings in Las Vegas. Several formal ODOT presentations supported by partners and fellow attendees Ali Bonakdar/CAMPO and Brian Gregor/Oregon Systems Analytics.
Project data and information has been shared with the academic and practitioner communities.	ODOT shared project data and information as follows: -Coordination with CAMPO to identify policy scenarios. -Review of project and project kickoff with CAMPO (January & May 2015) -CAMPO Policy Scenario Meetings with MPO TAC, and meetings with local jurisdictions and stakeholders (June 2015-February 2016) -ODOT-DLCD collaboration on place types (Decembers 2014-ongoing) -Conversations with modeling staff and local DLCD land use reps in 5 Oregon MPOs (April 2015) -RPAT Peer Exchange/Training (October 2015, Las Vegas) -ODOT Transit Staff discussions (November 2015) -RVMPO Oregon place type training (December 2015)

For More Information

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