

**Research Project Work Plan**

for

**Incorporate Travel Mode Choices in the Regional Strategic Planning Model  
(RSPM) Tool**

SPR 788

Submitted by

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for

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for  
INCORPORATE TRAVEL MODE CHOICES IN THE REGIONAL  
STRATEGIC PLANNING MODEL (RSPM) TOOL**

**1.0 Identification**

1.1 Organizations Sponsoring Research

Oregon Department of Transportation (ODOT)  
Research Unit  
555 13<sup>th</sup> St. NE, Ste. 2  
Salem, OR 97301-6867 Phone: (503) 986-2700

Federal Highway Administration (FHWA)  
Washington, D.C. 20590

1.2 Principal Investigator(s)

Liming Wang, Assistant Professor Jennifer Dill, Professor  
School of Urban Studies and Planning  
Portland State University  
PO Box 751  
Portland, OR 97201 Phone: (503) 725-5130

1.3 Technical Advisory Committee (TAC) Members

Tara Weidner, ODOT TPAU  
Josh Roll, LCOG  
Brian Hurley, ODOT Planning  
Matthew Barnes, ODOT Transit  
Jeremy Raw, FHWA  
Aaron Breakstone, Oregon Metro

1.4 Friends of the Committee (if any)

[Names, Affiliations]

1.5 Project Coordinator

Tony Knudson ([Anthony.h.knudson@odot.state.or.us](mailto:Anthony.h.knudson@odot.state.or.us)) (503)986-2848

1.6 Project Consultant

Brian Gregor, Oregon Systems Analytics [*ODOT person responsible for monitoring the technical aspects of the work being carried out by the principal investigator*]

## 1.7 Project Champion

Amanda Pietz, Planning Unit Manager

## 2.0 Problem Statement

Performance-based planning helps us to understand the potential impacts of decisions we make, supporting cost-effective investments and policy choices that we know can help us achieve our goals. In addition, it can enable monitoring of progress and facilitate needed adjustments, help us to communicate to the public, and assist us with meeting federal regulations and the intent of MAP21. ODOT has successfully developed a process for and applied performance-based planning in statewide and regional scenario planning efforts. These efforts have led to significant interest by regions and locals to integrate the process and tool<sup>1</sup> ODOT developed into other planning and decision-making efforts. Additionally, ODOT planning is using the tool to help quantify modal and topic plan visions and policies and better communicate the anticipated benefits in ways seeming to resonate well with stakeholders and elected officials. As popularity for using the tool and process grow, there is recognition that a deeper understanding is needed to determine how mode choices and mode share may be impacted by policy and investment decisions. This is particularly important when starting to apply the tool in a broader base of planning and decision-making processes to truly understand what may be the best decisions for the entire transportation system (multimodal and intermodal).

Research is needed to understand how traveler's mode choices may change in response to different policy and investment decisions. As an example, we have a good sense of how household vehicle miles traveled (VMT) is likely to change in response to policies like pricing, but we do not currently have the ability to estimate what effect pricing might have on travel by other modes, and how household mobility/accessibility might be affected. Placing ODOT's performance-based planning process in a multimodal context would enable ODOT, regions, and locals to cost-effectively deliver a transportation system that best achieves respective goals and to integrate what is learned from the research into existing tools.

## 3.0 Objectives of the Study

This project will research the key drivers of multi-modal transportation choice, as they relate to individual households, annual household travel, household budgets and price sensitivity. The research will explore travel survey (household and transit) and consumer expenditure data. The general research findings will support planning questions on these topics, and will bolster ODOT, region, and local analysis capabilities specifically by implementing a module

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<sup>1</sup> ODOT first developed the GreenSTEP model as the tool to assist with scenario planning, specifically focused on estimating policy and investment decision impacts on greenhouse gas (GHG) emissions. The tool has been enhanced over time to also assess goal areas like health, household and business costs, and other outcomes, and has been rebranded to the "Regional Strategic Planning Model"

that can be plugged into existing tools (specifically the Regional Strategic Planning Model – RSPM).

This project focuses on incorporating non-auto modes into a mode choice module for the RSPM tool utilizing existing data sources. To leverage this effort, ODOT research section and the project team at Portland State University applied for additional research funding at National Institute for Transportation and Communities (NITC) to expand the scope to emerging modes (especially bike sharing, car sharing and shared automated vehicles). In June, 2015, NITC awarded a grant of \$120,000 for the proposal. Given the novel nature of the related NITC project, it will design and collect stated preference experiments data, analyze travelers' perceptions and preferences for those emerging modes from this primary data source, and eventually incorporate these emerging modes into the RSPM mode shift module. The NITC project will convene a separate TAC with members from the academia and transportation professionals. Members of the TAC for this ODOT SPR project will have opportunities to be informed and/or involved in the NITC project, and vice versa.

### 3.1 Benefits

This research will assess the impact of different policy decisions on the use of alternative (non-auto) modes, particularly under changing vehicle and fuel pricing scenarios expected in the future, while the NITC funded project will collect extra data nationwide to better understand and analyze emerging travel modes, and to make the RSPM tool sensitive to policies and investment targeted to shift mode share and enable it to evaluate futures in which these modes may become the mainstream. Together, these two projects will support questions from planners and decision-makers across the state. Additionally, the travel behavior findings will support implementing the findings into the proven RSPM model, which supports ODOT and metropolitan area planning, and others through a ODOT-FHWA open source project that is creating a common framework for RSPM and 3 other GreenSTEP derived strategic planning tools. The use of the tool can help assess the performance of policies in a future world, where key attributes of that future differ significantly from today (pricing, travel options, demographics, etc.), and support strategic investments and policy decisions that simultaneously benefit our system and realize community goals. Other ODOT models may also be upgraded in future efforts based on insights from this research and results will be used in general planning decision-making. This capability will give us the information we need for a much more robust performance-based planning tool and to help assure that we meet the goals that we set for Oregon, ODOT, and our individual regions, counties, and cities.

## 4.0 Implementation

Generally Task 1 literature review will enhance understanding of multi-modal travel, particularly as affected by budgets useful for general planning and analysis purposes. Specifically, the new mode choice functionality will be implemented using R and incorporated in the RSPM tool and applied to CAMPO planning efforts. Additionally, the

upgrade with the new mode choice functionality will help with analysis when the Oregon Transportation Plan is updated, to understand how all policies add up to the overall quantifiable impacts on the entire transportation system. Overall, this will afford potentially new and more robust performance measures of non-auto travel resulting from investments, pricing, and policy choices, statewide, and in regions and local jurisdictions.

This project will coordinate with the NITC project on emerging modes. The two projects share the theme of better understanding policy and budget factors influencing mode choices. They will be carried on by the same project team with overlapping timeline – both running from 8/2015 to the end of 2016 and will share members in their respective TACs. But there are differences between them besides different focuses on specific modes. This project is more practical and relies on existing research and data sources, while the NITC project is more academic than practical, and will explore emerging transportation modes that we have little existing knowledge of and whose focus is to contribute to the research as well as to develop better modules and tools to support policy analysis. The two projects will combine literature review/existing data explorations, and it is hoped that the mode shift component implemented in RSPM under this project will be general enough to accommodate the current RSPM modes as well as the emerging modes analyzed under the NITC project. Brian Gregor of Oregon Systems Analytics (OSA), the author of RSPM, has been contracted with ODOT to support this combined project.

The results of the project will be further disseminated as presentations inside ODOT to the TAC and ODOT staff. They will also be presented through seminars at PSU to transportation researchers, professionals and students, as well as the public. The results will also be submitted for presentation and publication at the Annual Meeting of the Transportation Research Board, the TRB National Transportation Planning Applications Conference, etc.

## 5.0 Research Tasks

### Task 1: Literature review and data exploration

PSU researchers shall conduct a literature review to identify key drivers of household mode choice decisions, and what factors are important in determining which households will potentially shift to other modes. This review will cover topics for Tasks 2 to 4, and will be updated when conducting Tasks 2-4. The PSU researchers shall also explore Oregon and national survey data, expenditure data, and other data sources (e.g., land use, place type) that can be potentially used in modeling mode choice for RSPM. A particular focus should be on non-auto mode choice sensitivity to pricing and budget (both time and cost) constraints. The PSU researchers shall also investigate the ability to join expenditure and household data to enable time budget evaluation. The PSU researchers should also identify information and approaches to validate the new mode choice functionality.

Time Frame: 9/1/2015 – 8/31/2016

Responsible Party: Graduate Research Assistant (GRA), Liming Wang

Cost:

Deliverable: PSU researchers shall create a literature review and data exploration report. PSU researchers shall also present these findings to the TAC and possibly other members of ODOT.

TAC Decision/Action: TAC members/OSA will review and provide feedback on literature review and data exploration report to the PSU researchers.

Task 2: Model design and estimation

Based on literature review and data exploration in Task 1, one or more possible designs of the mode choice model will be selected and estimated by the PSU researchers to understand what mode shifts occur as vehicle travel is reduced, incorporating and testing interactions in RSPM. These approaches should build on the existing RSPM module and utilize household and land use inputs and budget constraints already embedded in the RSPM tool. Suggested functional form and independent variables for model estimation will be identified by the PSU researchers, with associated data sources for estimation and validation. Estimation should be done with Oregon and national data, as determined in consultation with ODOT. PSU researchers will identify sensitivity tests to assess the upgraded model with literature elasticities, repeating some of the tests previously calculated by the RSPM to ensure these remain intact, as well as adding tests to evaluate the new functionality. The PSU team will discuss and coordinate with Brian Gregor in the model design and estimation process, as he implements the RSPM common framework, to make sure the design and data format match the latest RSPM modeling framework. ODOT staff shall review and collaborate with the researchers to adjust the proposed designs, estimation data and validation data/approach.

Time Frame: 10/1/2015 – 1/31/2016

Responsible Party: Liming Wang, GRA

Cost:

Deliverable: PSU researchers shall create a working paper (working paper 1) describing model designs, data sources, estimation, results of sensitivity tests and validation; documented R scripts used to process and analyze data.

TAC Decision/Action: Members of the TAC/OSA contract will review and suggest adjustments to the PSU researchers for model design, estimation data and results, validation data, approach and results; guide the selection of the best model design.

Task 3: Model implementation

PSU researchers shall select an optimal model design from Task 2, based on TAC/OSA input, and implement it using R as a package for the unified RSPM framework. The result will be a new functionality in RSPM that can be applied across several Oregon and national tools. The implementation of the new functionality will be checked in by the PSU researchers to a shared code repository and estimation data properly documented.

Time Frame: 1/1/2016 – 4/30/2016

Responsible Party: Liming Wang, GRA.

Cost:

Deliverable: PSU researchers shall check in R code to the GitHub repository along with accompanying comments and separate documentation of the code, which documents the new mode choice functionality, estimation data/methods, inputs, outputs, parameters and configurations, as well as certain implementation details. The documentation will follow the documentation standard/convention of specified for the RSPM common framework.

TAC Decision/Action: TAC members/OSA shall review and provide feedback of the R code and documentation to the PSU researchers.

Task 4: Mode testing

PSU researchers shall apply the newly incorporated mode shift module (in the updated RSPM tool) in the Corvallis Area Metropolitan Planning Organization (CAMPO) to assess how it can inform decision-making and to adjust the model as needed to provide accurate and helpful information. ODOT staff will assist in assembling the necessary data for sensitivity test. Initial testing will be documented by the PSU researchers.

Time Frame: 3/1/2016 – 9/30/2016

Responsible Party: Liming Wang, GRA

Cost:

Deliverable: PSU researchers shall create a working paper (working paper 2) documenting the application and tests with CAMPO data. The deliverable will also include the test data sets, documented scripts, spreadsheets and/or other methods used to carry out the tests.

TAC Decision/Action: TAC members shall review and provide feedback to the PSU researchers.

Task 5: Brian Gregor training, consultation and support for Tasks 2-4

Brian Gregor/OSA, under separate contract with ODOT, will provide support to PSU researchers for Tasks 2-4. The specific tasks for Brian include helping train and equip the PSU team for working with RSPM via example code and documentation, meetings and presentations, updating the PSU team as the RSPM common framework is being developed. Brian will also provide consulting and support as necessary for literature review/data exploration, model design, testing and implementation decisions in Task 2-4.

Time Frame: 10/1/2015 – 9/30/2016

Responsible Party: Liming Wang

Deliverable: Formal and informal meetings and exchanges with Brian/OSA; Response to OSA comments.

TAC Decision/Action: None.

Task 6: Final report

PSU researchers shall compile and revise a final report from the working papers produced as deliverables for Task 1-4. This report will also include a chapter which summarizes the findings of the research and makes recommendations regarding future work further improving the mode choice module, in terms of data collection,

modeling approach and policy sensitivity, etc. If timing permits, this report should incorporate key findings from the NITC survey on emerging modes and success/recommendations from its initial implementation in the RSPM framework.

Time Frame: 10/1/2016 – 12/31/2016

Responsible Party: Liming Wang, GRA

Cost:

Deliverable: PSU researchers will deliver a final report following the standards, guidelines and styles recommended in FHWA Communication Reference Guide (FHWA-RD-03-074, available at <http://www.fhwa.dot.gov/publications/research/general/03074/qrg.pdf>), and formatted according to the template provided by ODOT.

TAC Decision/Action: TAC members/OSA will review and approve the final report

Task	Responsible Party(ies)	Cost
<p><b><u>Task #1: Literature review and data exploration</u></b>            A review that identifies key drivers of household mode choice decisions and explores Oregon and national data sources that can be potentially used in modeling mode choice for the RSPM tool. (paired with NITC Lit Review Task 1)  <u>Time Frame:</u> 9/1/2015 – 8/31/2016  <u>Deliverable:</u> A presentation and literature review and data exploration report  <u>TAC Decision/Action:</u> Review and provide feedback.</p>	Graduate Research Assistant (GRA), Liming Wang	\$10,000
<p><b><u>Task 2 : Model design and estimation</u></b>            Select one or more possible model designs for RSPM mode shift, estimate model parameters and evaluate the designs and estimated parameters with sensitivity tests and validation.  <u>Time Frame:</u> 10/1/2015 – 1/31/2016  <u>Deliverable:</u> A working paper (working paper 1) describing model designs, data sources, estimation, results of sensitivity tests and validation; documented R scripts used to process and analyze data.  <u>TAC Decision/Action:</u> Review and suggest adjustments for model design, estimation data and results, validation data, approach and results; guide the selection of the best model design.</p>	Liming Wang, GRA	\$15,000
<p><b><u>Task 3 : Model implementation</u></b>            A model design selected from Task 2 will be implemented using R as a package for the RSPM common framework.  <u>Time Frame:</u> 1/1/2016 – 4/30/2016  <u>Responsible Party:</u> Joe Broach, GRA, Liming Wang.  <u>Deliverable:</u> R code checked in to GitHub repository and accompanying comments and separate documentation of the code  <u>TAC Decision/Action:</u> Review and provide feedback</p>	Liming Wang, GRA	\$15,000

<p><b>Task 4: Mode testing</b>  This task will apply the newly incorporated mode choice module (in the updated RSPM tool) in the Corvallis Area Metropolitan Planning Organization (CAMPO) to assess how it can inform decision-making and to adjust the model as needed to provide accurate and helpful information. ODOT can assist in assembling the necessary data for sensitivity test. Initial testing will be documented.  <i>Time Frame:</i> 3/1/2016 – 9/30/2016  <i>Deliverable:</i> a working paper (working paper 2) documenting the application and tests with CAMPO data. The deliverable will also include the test data sets, documented scripts, spreadsheets and/or other methods used to carry out the tests.  <i>TAC Decision/Action:</i> Review and provide feedback</p>	Liming Wang, GRA	\$22,000
<p><b>Task 5: Brian Gregor training, consultation and support for Tasks 2-4</b>  Brian Gregor (Oregon Systems Analytics) will provide support to PSU researchers for Tasks 2-4.  <i>Time Frame:</i> 10/1/2015 – 9/30/2016  <i>Deliverables:</i> Formal and informal meetings and exchanges with Brian/OSA; Response to OSA comments.  <i>TAC Decision/Action:</i> None</p>	Liming Wang GRA	
<p><b>Task 6: Final report</b>  A final report will be compiled and revised from the working papers produced as deliverables for Task 1-4. This report will also include a chapter which summarizes the findings of the research and makes recommendations regarding future work further improving the mode choice module, in term of data collection, modeling approach and policy sensitivity, etc. (incorporate NITC project findings/recommendations, as time permits)  <i>Time Frame:</i> 10/1/2016 – 12/31/2016  <i>Deliverable:</i> A final report following the standards, guidelines and styles recommended in FHWA Communication Reference Guide (FHWA-RD-03-074, available at <a href="http://www.fhwa.dot.gov/publications/research/general/03074/qrg.pdf">http://www.fhwa.dot.gov/publications/research/general/03074/qrg.pdf</a>), and formatted according to the template provided by ODOT.  <i>TAC Decision/Action:</i> Review and approval of the final report</p>	Liming Wang, GRA	\$12,143

The PSU researchers will present research progress and results at TAC meetings, and provide meeting notes to ODOT. All reports will be produced in the standard ODOT Research Group report format unless some other format is deemed to be more appropriate as a supplement to the ODOT format.

## 6.0 Time Schedule

This section specifies the time line for the project, listing the task headings and showing monthly and/or quarterly time blocks in which each task will be accomplished. Also shown are interim and final deliverables. (The sample matrix below shows shaded cells and asterisks for designating task time lines and deliverables.)

Project Tasks	FY16				FY17				Cost
	Qtr 1 July - Sep	Qtr 2 Oct - Dec	Qtr 3 Jan - Mar	Qtr 4 Apr - Jun	Qtr 1 July - Sep	Qtr 2 Oct - Dec			
Task 1: Literature review and data exploration Deliverable: Presentation and report		(*) T				*			\$10,000
Task 2: Model design and estimation Deliverable: working paper 2			*						\$15,000
Task 3: Model Implementation Deliverable: R code and documentation				T	*				\$15,000
Task 4: Mode testing Deliverable: working paper 3						T	*		\$22,000
Task 5: Brian Gregor training, consultation and support for Tasks 2-4 Deliverable: Formal and informal meetings and exchanges with Brian/OSA; Response to OSA comments									
Task 6: Final Report Deliverable: Final report								* T	\$12,143

\* Deliverables (\*) Initial deliverables T – TAC Meeting

**7.0 Budget Estimate**

An itemized budget for the project is included here, showing expenditures for each item by fiscal year and in total.

Item	Year 1	Year 2	Total	Notes
<b>Salaries &amp; Wages</b>				
PI Wang	\$ 8,835.79	\$ 3,792.03	\$ 12,627.82	
Co-PI	\$ -	\$ -	\$ -	
Other	\$ -	\$ -	\$ -	
			\$ -	
Graduate Student	\$ 12,960.00	\$ 5,562.00	\$ 18,522.00	

Graduate Student	\$ 12,960.00	\$ 5,562.00	\$ 18,522.00	
Hourly Student	\$ -	\$ -	\$ -	
Hourly Student	\$ -	\$ -	\$ -	
<b>Fringe Benefits</b>				
PI	\$ 3,887.75	\$ 1,668.49	\$ 5,556.24	
Co-PI	\$ -	\$ -	\$ -	
Other	\$ -	\$ -	\$ -	
GRA	\$ 518.40	\$ 222.48	\$ 740.88	
GRA	\$ 518.40	\$ 222.48	\$ 740.88	
Hourly Student	\$ -	\$ -	\$ -	
Hourly Student	\$ -	\$ -	\$ -	
<b>Subtotal - Personnel</b>	<b>\$ 39,680.34</b>	<b>\$ 17,029.48</b>	<b>\$ 56,709.82</b>	
<b>Other Direct Costs</b>				
Tuition	\$ -	\$ -	\$ -	
Tuition	\$ -	\$ -	\$ -	
			\$ -	
			\$ -	
Printing & Publishing			\$ -	
Materials & Supplies			\$ -	
Travel	\$ 1,884.00	\$ 250.00	\$ 2,134.00	
Other			\$ -	
<b>Subtotal - Other Direct Costs</b>	<b>\$ 1,884.00</b>	<b>\$ 250.00</b>	<b>\$ 2,134.00</b>	
<b>Total Direct Costs</b>	<b>\$ 41,564.34</b>	<b>\$ 17,279.48</b>	<b>\$ 58,843.82</b>	
Indirect Costs	\$ 10,806.73	\$ 4,492.66	\$ 15,299.39	
<b>Total</b>	<b>\$ 52,371.07</b>	<b>\$ 21,772.15</b>	<b>\$ 74,143.22</b>	

