

SPR RESEARCH PROGRAM

SECOND-STAGE PROPOSAL SUMMARY

PROBLEM NUMBER AND TITLE:

24-06 E-commerce Impacts on Oregon Household Level Deliveries, Trips, and VMT

PROBLEM SUMMARY

The last decade saw double-digit growth of e-commerce sales, both in the US and Oregon, which translates to more delivery vehicles on the roads to meet this demand. However, there is no observed data available to determine the net impacts on system use for this rapidly expanding sector. It is unknown what the total number of miles driven by delivery vehicles is, nor how e-commerce impacts household miles traveled. The lack of data in this area prompts several questions, including:

- How much is being delivered? To what degree have household trips been replaced by deliveries? What is being delivered, food, goods, groceries, remote-work items, and how often?
- What is the impact to VMT? Is there a net decrease in household travel due to reduced household trips or a net increase due to additional deliveries?
- What are the Equity Impacts? To what extent is e-commerce expanding shopping opportunities to households with less accessibility to goods and services? Is e-commerce expanding opportunity to lower income households, potential home-based businesses, are impacts different across rural, suburban, and urban areas?

ODOT OBJECTIVES

Currently there is no data to evaluate e-commerce impacts on Oregon travel patterns or to forecast future system impacts. This research proposal will support collection of high-quality relevant e-commerce data, identify key e-commerce patterns and trends in Oregon, and provide methods and equations to quantify e-commerce demand. This project will provide information needed to estimate and develop long range travel forecast models that accurately represent e-commerce activity and the impacts on Oregonians and the transportation system.

BENEFITS

This project is a unique opportunity to collect and analyze e-commerce data leveraging existing resources within the [Oregon Travel Study](#) (OTS). Agency staff and travel survey consultant staff have not implemented an e-commerce focused survey before, this is a new field of study. This research project ensures the survey questions are designed correctly so that ODOT can use the data to integrate e-commerce activity into travel forecast models, as well as gain understanding of the e-commerce sector in Oregon.

SCHEDULE, BUDGET, AND AGENCY SUPPORT

Estimated Project Length: 24 months. Sept. 15, 2023 till Sept 15, 2025.

Estimated Project Budget: \$163,000

ODOT Support: Becky Knudson, ODOT TPAU

FOR MORE INFORMATION

For additional detail, please see the complete STAGE 2 RESEARCH PROBLEM STATEMENT online at:
<https://www.oregon.gov/odot/Programs/ResearchDocuments/24-06.pdf>

SPR RESEARCH PROGRAM

SECOND-STAGE PROBLEM STATEMENT

FY 2024

PROBLEM NUMBER AND TITLE

24-06 E-commerce Impacts on Oregon Household Level Deliveries, Trips, and VMT

RESEARCH PROBLEM STATEMENT

The last decade saw double-digit growth of e-commerce sales, both in the US and Oregon. This trend gained further momentum during the global pandemic. According to e-commerce sales reports released by the US Department of Commerce, e-commerce sales increased 50% between 2019 and 2021 and accounted for approximately 15% of total retail sales in 2022 (US Department of Commerce, 2022).

Rising parcel deliveries mean more delivery vehicles on the roads to fulfill growing e-commerce demand. However, there is no data available to determine the net impacts on system use for this expanding sector. It is unknown what the total number of miles driven by delivery vehicles is, nor how e-commerce impacts household miles traveled. The lack of data in this area prompts several questions, including:

- To what degree have household shopping trips been replaced by deliveries?
- Is there a net decrease in household travel due to reduced household shopping trips or a net increase due to additional deliveries? Is there a substitution effect from shopping or recreational activities?
- To what extent is e-commerce expanding shopping opportunities to hard-to-reach households with fewer travel options and businesses in more isolated rural regions?
- What are the equity and accessibility impact of the e-commerce growth for Oregon households? How have the impacts been felt differently across rural, suburban, and urban areas?

Given ODOT goals and objectives related to managing VMT, Vision Zero for safety, social equity, managing traffic congestion, and reducing GHG, more information on e-commerce is needed to support long range transportation planning and policy development.

ODOT needs to obtain data related to e-commerce trips, which is necessary to develop analytical tools that include this aspect of system use and household demand. Data used to develop travel forecast models come from household travel surveys. Through the Oregon Modeling Statewide Collaborative, ODOT (TPAU) is partnering with all 8 Oregon MPOs to implement the 2023-24 Oregon Travel Study (OTS), designed to collect the data needed to estimate and develop long range travel forecast models.

The statewide survey is very expensive and because of that, only carried out every 10 to 15 years. The planning process for the current OTS survey started before the COVID-19 pandemic and did not originally include questions related to e-commerce. These are questions that ODOT-TPAU now recognizes in hindsight are key to understanding e-commerce transportation impacts. The pandemic and post-recovery highlight the increasing role of e-commerce in the Oregon economy and its significance for both urban and rural populations across numerous industries.

A review of TRB research in progress databases found no existing or ongoing research that answers the research questions posed by this problem statement. Somewhat related research projects are overall general in nature and do not provide the data or the analysis needed to better understand e-commerce trends in Oregon. Without an improved understanding based on observed data, this cannot be represented in ODOT forecast models nor used to evaluate potential public policy impacts to commercial users.

RESEARCH OBJECTIVES

The ultimate research goal is to gather data that can be used to develop forecast models that incorporate e-commerce behaviors from the demand (buyers) perspective. Accounting for real-world user behavior is key to the development of accurate long-range forecast models. To achieve this goal the project has the following objectives:

- a) Data Collection: develop a set of e-commerce questions to be used in the OTS, to include two questions in the primary survey and approximately twenty questions for a focused follow up e-commerce survey (funded under a separate project). Questions will be designed in a manner that generates data to be used in travel forecast models in order to accurately simulate real world behavior;
- b) Data Evaluation: evaluate the OTS e-commerce data, compare it against other e-commerce data, identify key e-commerce patterns – such as by state regions and household attributes; and identify strengths and weaknesses of the data set, including making recommendations to refine OTS data collection;
- c) Modeling: analyze the survey e-commerce results, using appropriate statistical tools and hypotheses, and develop a basic e-commerce demand equation.

ODOT needs expertise in the field of e-commerce to design questions related to household e-commerce in a form that can be used to estimate household demand in this area. No other travel survey has included extensive questions related to e-commerce behavior, to the best of our knowledge. In addition to this, ODOT needs expertise in the area of statistical estimation of e-commerce demand in a manner that can be implemented in ODOT forecast models. This is cutting edge research residing mostly in the academic realm, and very little progress has been made in current best-practice travel models. Good data collection requires the development and implementation of good survey questions. Equally, for a reliable forecast model a reliable statistical estimation must be included, which is particularly true for an emerging area of behavior like the one related to travel and e-commerce.

WORK TASKS, COST ESTIMATE AND DURATION

The specific tasks to be undertaken by the researchers are as follows:

Task 1: Literature Review. (2 months)

Task 2: Design of an OTS follow-on e-commerce specific survey. (3 months)

Task 3: Analysis of sampling guidelines using data from the fall OHAS survey to adequately provide the data needed for the model estimation stage and to ensure that results are applicable to the state as well as urban and rural regions. (2 months)

Task 4: Development of a pilot survey and evaluation of results. Refinement of the survey instrument. (2 months)

Task 5: ODOT-TPAU implements follow-on survey in the field and obtains clean collected data (this task is separate from this study and self-funded but included here to underscore the timing and relationship of this research with the OTS survey).

Task 6: Evaluate and validate e-commerce dataset. (4 months)

Task 7: Identify key demographic and spatial trends related to e-commerce in Oregon. (4 months)

Task 8: Identify appropriate model structure and statistical methods for an integrated and efficient model estimation. (4 months)

Task 9: Summary of key findings, recommendations and final report writing. (3 months)

NOTE: some tasks overlap, but the duration of the project is two years.

Key Deliverables:

The expected deliverables of the project include:

- An e-commerce questionnaire adapted to ODOT needs and survey constraints.
- Sampling guidelines.
- Report summarizing key demographic and spatial trends related to e-commerce in Oregon.
- Results of the integrated statistical modeling and recommendations to incorporate the key findings into ODOT forecasting models.
- A final project report that provides a summary of the statistical and technical documentation of the models and results.

Estimated Project Length: 24 months. Sept. 15, 2023 till Sept 15, 2025.

Estimated Project Budget: \$163,000 (\$ 42,000 FY2023/24 and \$121,000 FY2024/25).

IMPLEMENTATION

This project requires close coordination with ODOT-TPAU which is partnering with all 8 Oregon MPOs to implement the 2023-24 Oregon Travel Study (OTS) across the entire state of Oregon.

The researchers will work with ODOT-TPAU to finalize the e-commerce questionnaire and sampling plan (Tasks 1-3) and then ODOT-TPAU implements the follow-on survey in the field (Task 4). The researchers will continue with the remaining validation, analysis, and estimation tasks (Tasks 5-8).

ODOT TPAU is in the early stages of developing a new activity-based travel forecast modeling platform. The OTS data will be used to estimate this new platform, which makes the timing of this e-commerce enhancement perfectly aligned to fully implement the results of this research effort into the next generation of forecast models. In addition, insight gained by analyzing the e-commerce data can be used immediately to improve our understanding of the role of e-commerce in the Oregon economy and consider potential impacts of current public policy under development.

POTENTIAL BENEFITS

E-commerce is a topic of great interest at this time and of particular importance to Oregon, it relates to economic equity, efficient use of the transportation system, land use policy (Transportation Planning Rule), as well as the challenges of aging transportation infrastructure and uncertain revenue streams.

Positive outcomes related to e-commerce include providing households and businesses affordable access to goods and services, business access to larger consumer markets - which has equity implications for smaller firms in remote locations. Understanding e-commerce will assist ODOT in developing effective public policy in a way that can mitigate potential negative outcomes, such as potential increases in traffic congestion, potential for more crashes (medium truck drivers may not have commercial drivers' licenses), and higher emissions, including GHG. All of these potential impacts relate to goals and objectives identified by the Oregon Transportation Commission and ODOT, such as providing a safe and reliable transportation system, reducing traffic congestion, and delivering a modern and equitable transportation system.

Not carrying out this research at this time represents a missed opportunity to learn more about this specific aspect of transportation use, since the survey is conducted every 10 to 15 years. Prior to this proposal, ODOT negotiated the OTS contract to include the option of topic specific follow-on surveys and has funding to collect data related to new areas of behavior. Conducting a focused e-commerce survey now will leverage the ongoing data collection effort and provide new high-quality data at a substantially lower cost and statewide coverage. Competition for the topic specific follow-on survey is fierce, by linking a research study to an OTS follow-on survey will ensure data collection in this new area will be conducted.

This project is a unique opportunity to collect data funded under a different project in a manner that will inform the Agency on how to represent e-commerce impacts on travel in Oregon. Agency staff and travel survey consultant staff have not implemented an e-commerce focused survey before; this is a new field of study. This research project ensures the survey questions are designed correctly so that ODOT-TPAU can use the data to represent e-commerce. Without access to this expertise, the e-commerce follow-on survey is unlikely to occur. The follow-on survey will cost an estimated \$150,000, which is not worth the money if ODOT cannot ensure the questions are properly designed. E-commerce is growing fast and delaying e-commerce related data collection and the subsequent incorporation of key trends to the existing long-term forecasting tools will reduce the accuracy of existing tools and their ability to answer key policy questions.

PEOPLE

ODOT champion(s):

Becky Knudson, Senior Transportation Economist, ODOT TPAU; member of Oregon Travel Survey Leadership Team, Project manager for last survey (2009-2011 Oregon Household Travel Survey).

Problem Statement Contributors:

Becky Knudson, ODOT TPAU, Miguel Figliozzi, Professor, Portland State University

STAFF REVIEW PAGE

Literature Check

TRID&RIP

A review of TRID & RIP databases found no existing research that answers the research question

No research was found that corresponded to the proposal. There are many papers on travel surveys, and a few looking at e-commerce, but none address the issue put forward here.

Technology & Data assessment

No Identified T&D output

At the end of this project, the implementing unit(s) within ODOT will need to coordinate the adoption of new technology or data in order to realize the full potential of this research.

Cross-agency stakeholders

- List stakeholders or impacted units
- Identify any issues of concern raised by an ODOT stakeholder. Note expected mitigation