

# **A Comparative Illustration of Activity-Based Modeling Techniques**

**PROSPECTUS**

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## **Introduction**

In the last decade, numerous peer regions and states have adopted a new approach to travel demand modeling by transitioning from traditional “trip based” methodologies to “activity-based” frameworks. While traditional trip-based models generate trips between zones based on aggregate productions and attractions, activity-based models simulate individual households and travelers seeking to access various destinations over the course of a day. Activity-based models capture peoples’ choices and constraints more realistically (Rasouli and Timmermans 2014), and therefore can better represent pricing (e.g. managed lanes), provide more realistic representation of non-home-based trip making, and give forecasters the ability to consider project benefits and impacts at a finer resolution than is possible with a trip-based model (Bills, Sall, and Walker 2012). Additionally, activity-based models are better able to represent or support innovative transportation modes, complex public transit path choices, the effects of travel time reliability in trip making and destination choices, and dynamic network assignment procedures.

Many transportation agencies have transitioned to activity-based models, including the Oregon and Idaho departments of transportation and the Denver, Portland, Seattle, and Phoenix metropolitan planning organizations. At the same time, the additional complication of methods and software implementations has reportedly created additional costs for agencies and their contractors in terms of staff training, computational resources, and model development and support contracts. This research seeks to illustrate the tradeoffs of these modeling approaches and understand relevant considerations an agency would need to make in potentially supporting an activity-based modeling framework.

## Proposed Methodology

In order to compare the differences in modeling approaches, this research will identify 2 to 3 scenarios to evaluate in the current WFRM trip-based model as well as with a research implementation of the ActivitySim activity-based model. The purpose of this analysis is not to compare accuracy of model results or to directly inform decision-making on those scenarios, but rather to illustrate the tradeoffs between the two methodologies in terms practical considerations— e.g. level of effort to encode and execute the scenarios—as well as considerations relating to the insights made possible by the different frameworks. The scenarios chosen for this illustrative analysis will be determined by a technical advisory committee selected for the project, but might include:

- **Land use and urbanization:** Activity-based models are fundamentally different in how they represent trips that do not have an end at the home zone. This means that sub-tour activities (like going to lunch while at work) might have substantially different predictions and findings in the two frameworks.
- **Transit equity impacts:** The ability to trace synthetic individuals through an activity-based model potentially unlocks more detailed analysis of who may or may not benefit from free fare policies or additional transit services like double-tracking the FrontRunner commuter rail system.
- **Pricing and managed lanes:** The ability to assign individual-level values of time in an activity-based model allows for greater sensitivity to congestion pricing in highway assignment and mode choice.

This research will perform a qualitative comparison of the model results for each scenario, including an analysis of the kinds of input data required for each modeling framework. This is not a comparison between raw results, but rather an illustration of methodological differences intended in part as a reference for agencies considering using an activity-based model. As many agencies are making this transition, it is crucial to have a full understanding of both the advantages and challenges of activity-based modelling frameworks.

## References

- Bills, Tierra S., Elizabeth A. Sall, and Joan L. Walker. 2012. “Activity-Based Travel Models and Transportation Equity Analysis: Research Directions and Exploration of Model Performance.” *Transportation Research Record* 2320 (1): 18–27. <https://doi.org/10.3141/2320-03>.
- Rasouli, Soora, and Harry Timmermans. 2014. “Activity-Based Models of Travel Demand: Promises, Progress and Prospects.” *International Journal of Urban Sciences* 18 (1): 31–60. <https://doi.org/10.1080/12265934.2013.835118>.