



# Gen3 Model Development Project

Travel Forecasting Subcommittee Meeting

July 16, 2021

IN PARTNERSHIP WITH



Metropolitan Washington  
Council of Governments

# Discussion Topics

- Gen3 Model Status
- Tool Demonstration – ABM Visualizer
  - Initial Gen3 Model results prior to any model estimation/calibration using local data
- Gen3 Phase 1 Model Development
  - Ongoing activities and next steps
  - ActivitySim estimation mode





## **Gen3 Model Status**

# Phase 1 Development (Task Order 3) Status

- Population Synthesis
  - Finalizing documentation
- Data Development
  - Preparing data development memorandum
- ActivitySim Deployment
  - Integrating ActivitySim with other Gen2 Model components
- Phase 1 Model Estimation
  - Estimating tour destination choice and tour mode choice models
- Phase 1 model development expected to be completed by November 2021

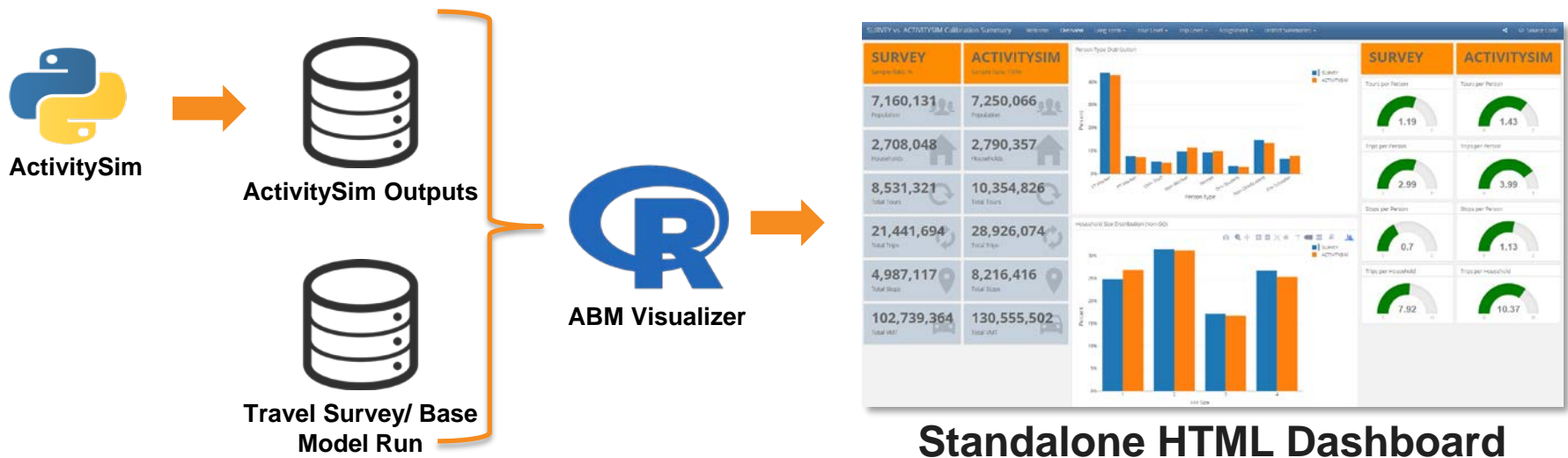




# ABM Visualizer

# ABM Visualizer

Visualization and diagnostic tool for ActivitySim models



Built in R using dplyr, Rmarkdown, flexdashboard, plotly, and ggplot libraries

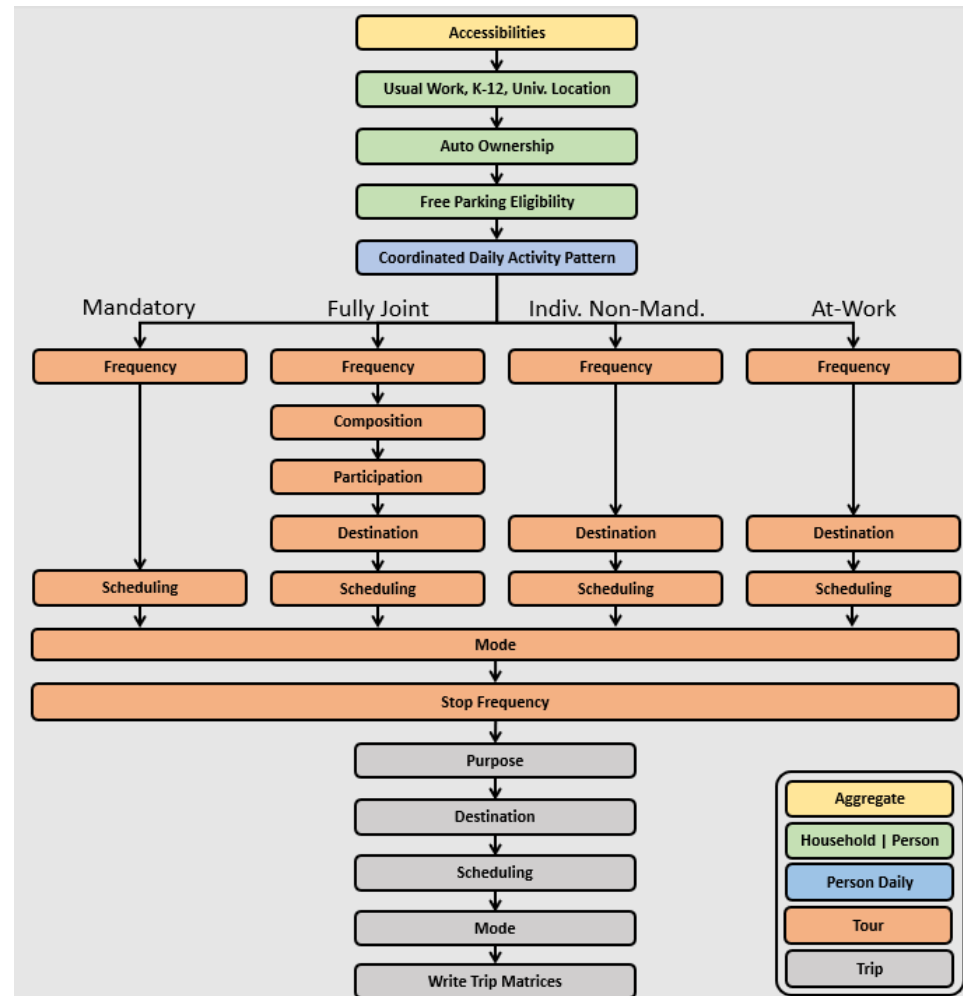
Two comparison modes are available:

- Model vs Survey
- Model\_base vs Model\_build



# Example Model Structure & Components

- Accessibilities
- Work and school location
- Auto ownership and parking
- Daily activity patterns (intra-HH)
- Individual tours, joint tours, and stops by activity purpose
  - Frequency
  - Composition
  - Participation
  - Scheduling
- Tour and trip destination choice
- Tour and trip mode choice
- Write trip matrices



# ABM Visualizer Data

- Survey
  - 2017-2018 COG Regional Travel Survey (RTS) and 2018-2019 Maryland Travel Survey (MTS) data, processed in ActivitySim format
- Model
  - Transferred SEMCOG ActivitySim implementation
    - SEMCOG survey was GPS adjusted
    - RTS/MTS data to be GPS adjusted in Phase 2
  - Asserted size terms
  - Uncalibrated, unvalidated
  - No adjustments to any model constants





# ABM Visualizer Demonstration...





## **Phase 1 Model Development**

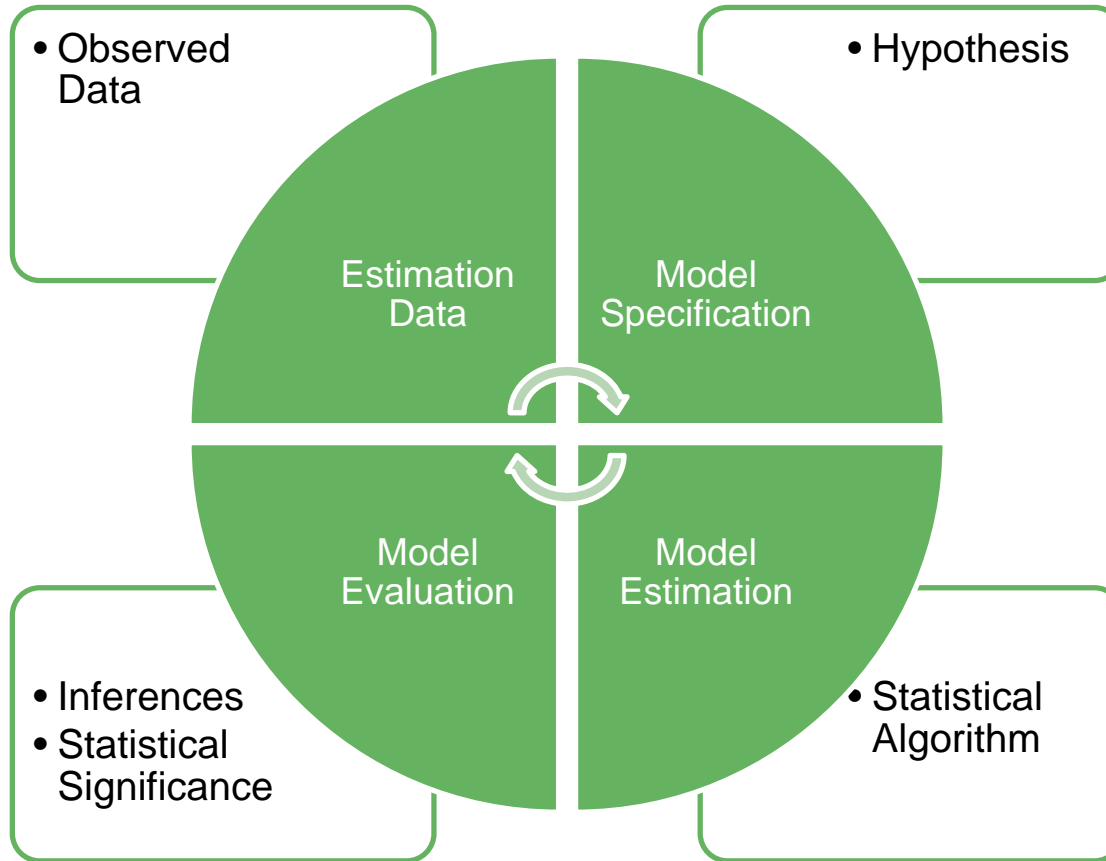
*Ongoing Activities and Next Steps*

# Phase 1: Ongoing Activities

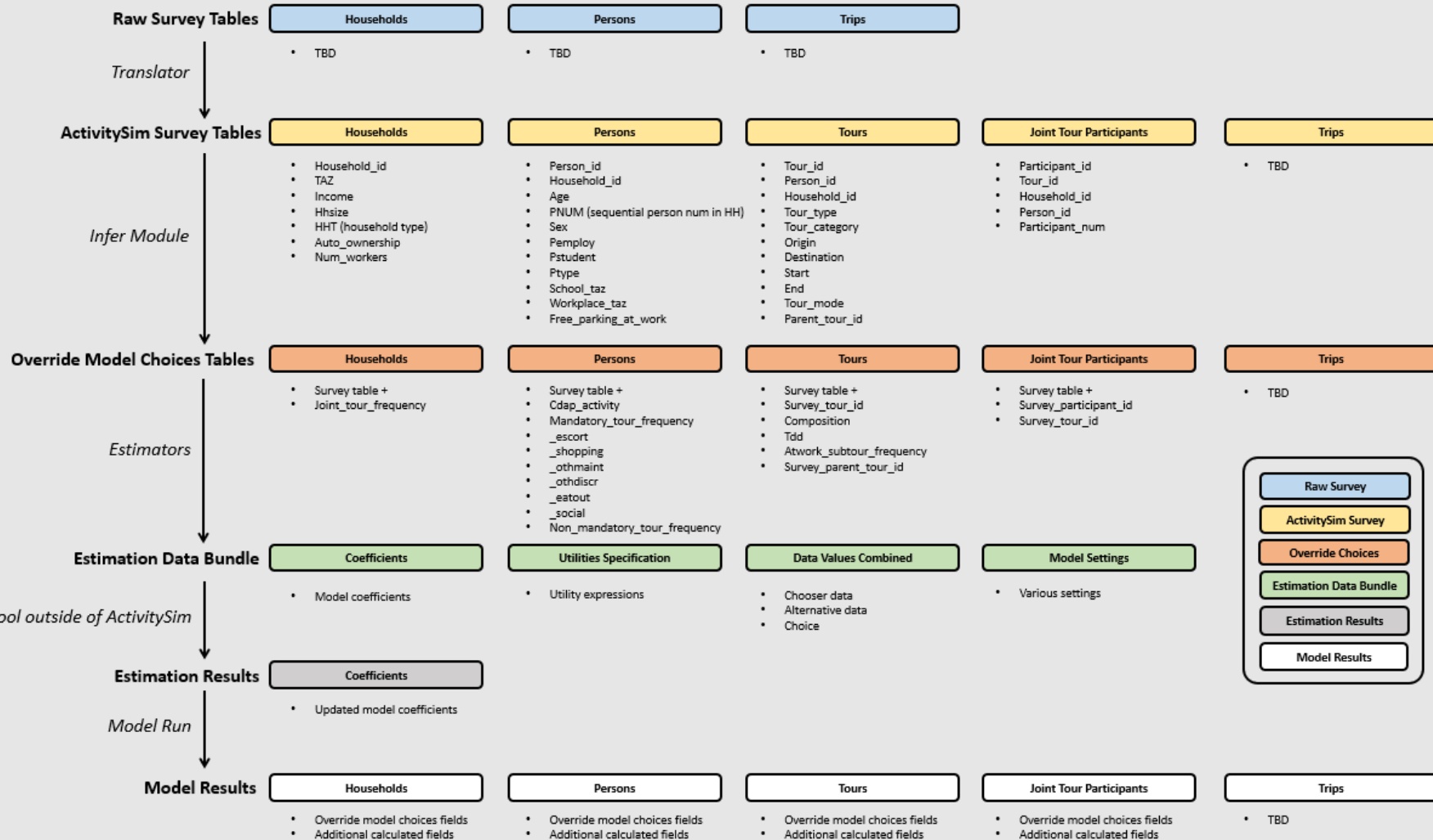
- ActivitySim integration with Gen2 model components
  - Integration is 95% complete
  - Incorporating external transit demand
  - Adding exogenous auto demand
- Model estimation
  - Prepared estimation data bundle (EDB)
  - Estimating tour mode choice and tour destination choice models



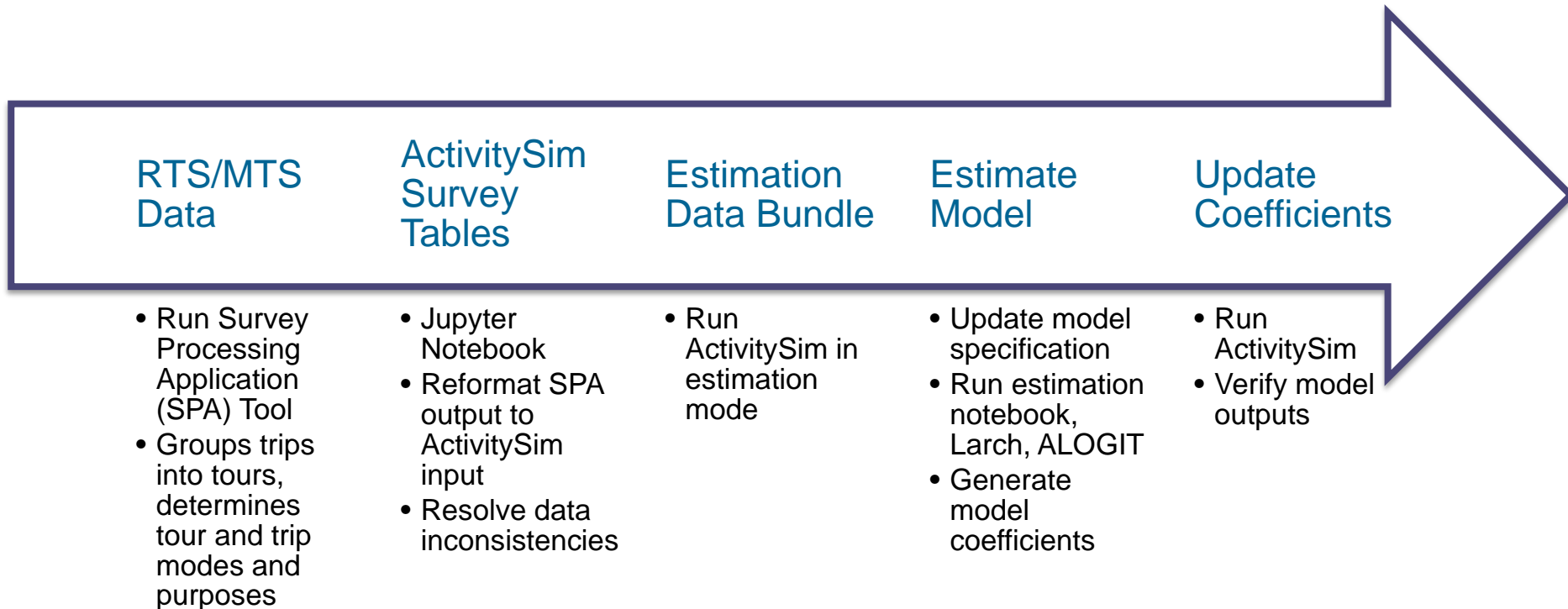
# Choice Model Estimation



# ActivitySim Estimation Mode Overview



# ActivitySim Model Estimation Process



*Jupyter Notebook: open-source web application that allows you to create and share documents that contain live code, equations, visualizations, and narrative text*



# Phase 1: Next Steps

- Model estimation and implementation
  - Tour destination choice
  - Tour mode choice
  - Implementation of revised coefficients
- Phase 1 Model calibration and validation
  - Calibrate ActivitySim to RTS/MTS data and on-board surveys
  - Validate Phase 1 model against observed traffic counts and transit ridership
- Sensitivity testing
  - Define sensitivity tests
  - Run three sensitivity tests
- Documentation





## Contacts

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# Welcome Page

## About this Document

This document is an interactive dashboard viewable from most modern internet browsers. The dashboard is a validation and diagnostics tool for Activity Based Models. Users can compare model performance against a household survey as part of a validation exercise or compare two model runs for sensitivity testing. All of the data, charts, and maps viewable in this dashboard are embedded directly into the HTML file. An internet connection is necessary for the best user experience, but is not required.

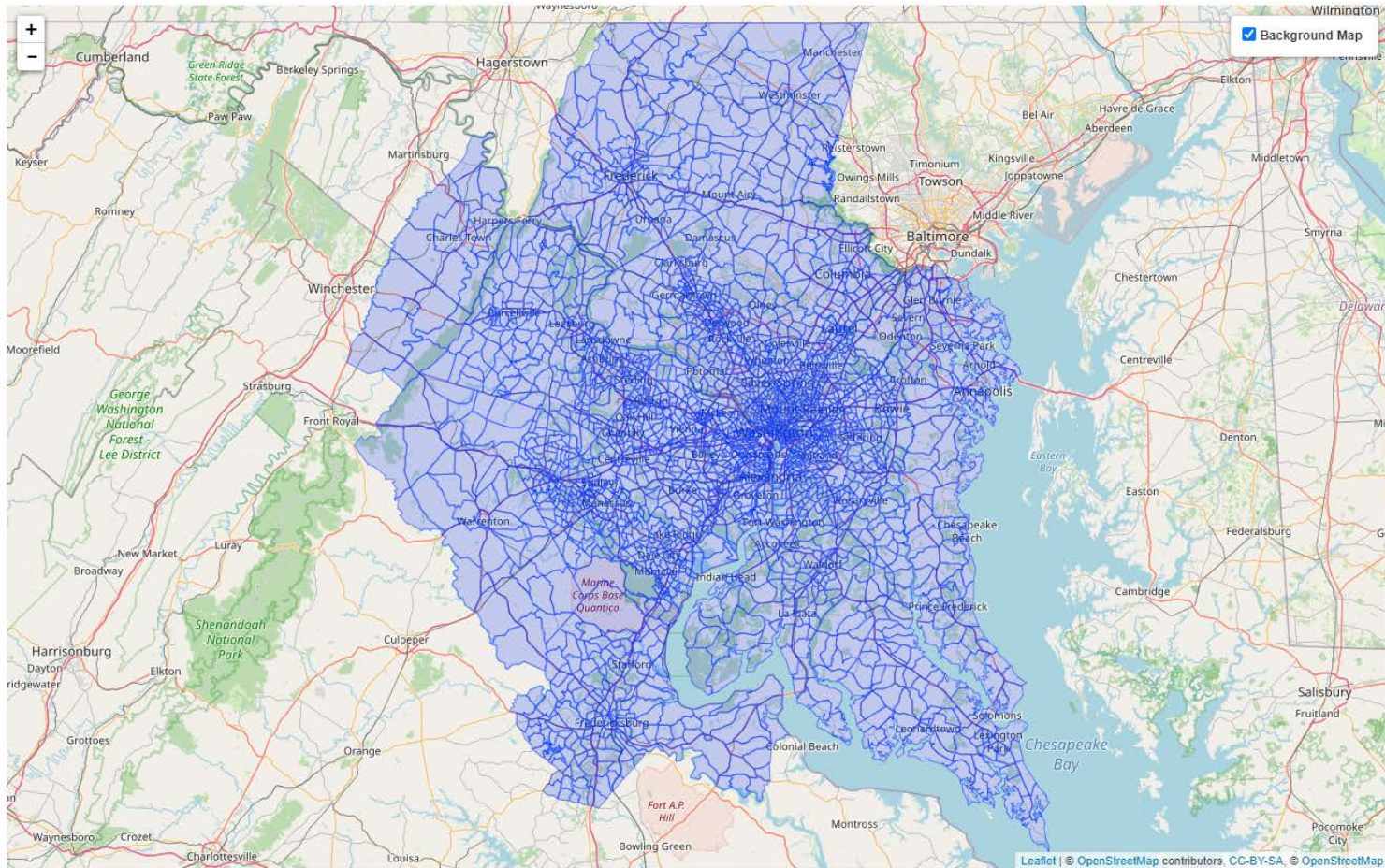
Users may navigate to different areas of the dashboard using the navigation bar at the top of the page, and may interact directly with most tables, charts, and maps.

This document is best viewed using the most recent versions of the following web browsers:

- [Google Chrome](#)
- [Microsoft Internet Explorer](#)

Note: Mozilla Firefox does not correctly render the images in this HTML file.

## Modeling Region



# Overview

## SURVEY

Sample Rate: %

7,160,131

Population

2,708,048

Households

8,531,321

Total Tours

21,441,694

Total Trips

4,987,117

Total Stops

102,739,364

Total VMT

## ACTIVITYSIM

Sample Rate: 100%

7,250,066

Population

2,790,357

Households

10,354,634

Total Tours

28,929,107

Total Trips

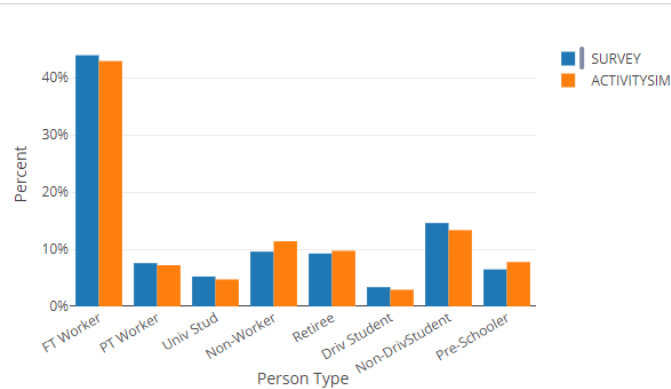
8,219,833

Total Stops

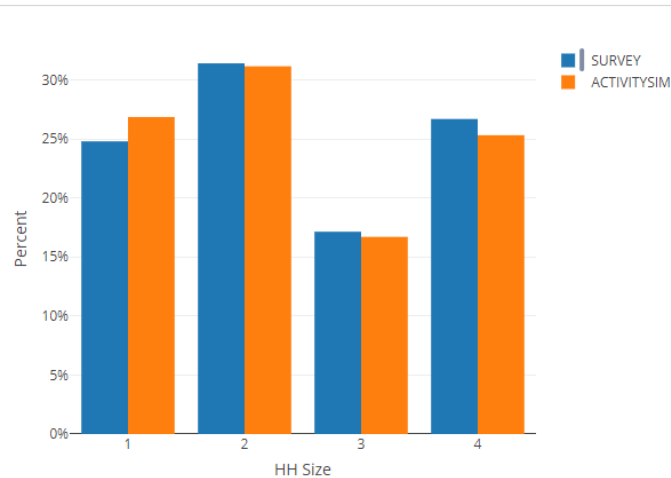
127,469,842

Total VMT

Person Type Distribution



Household Size Distribution (non-GQ)



## SURVEY

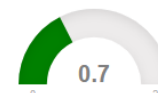
Tours per Person



Trips per Person



Stops per Person



Trips per Household



## ACTIVITYSIM

Tours per Person



Trips per Person



Stops per Person



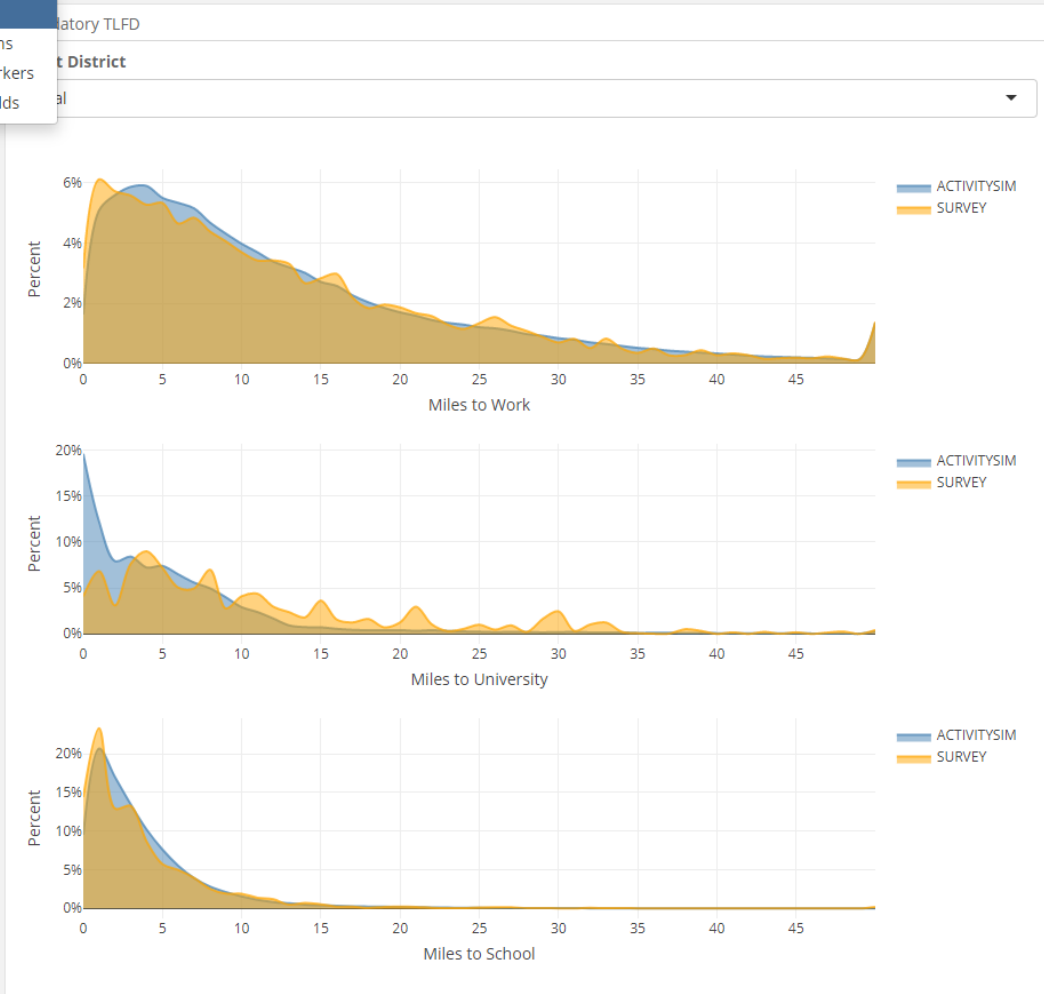
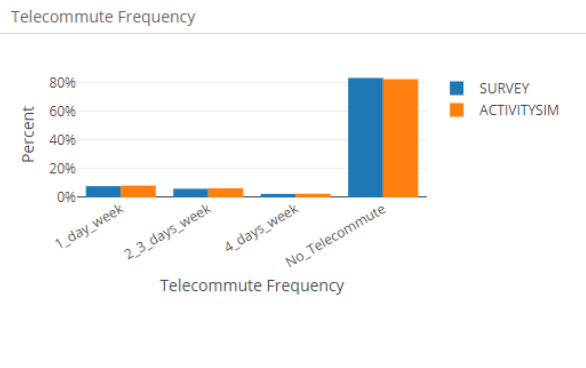
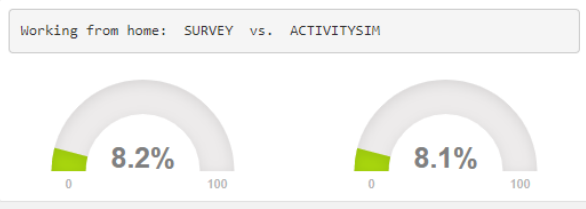
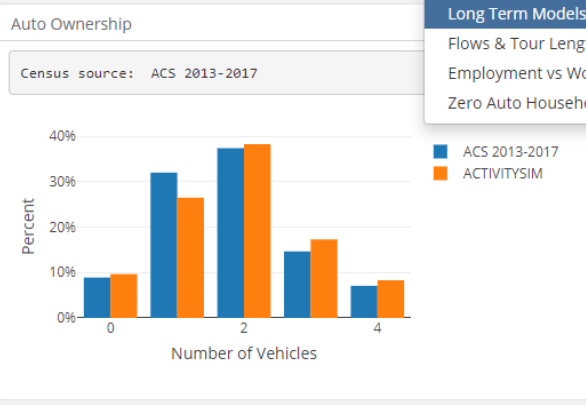
Trips per Household



# Long Term Models

**Auto Ownership**  
Results of household auto ownership model, which predicts number of vehicles per household.

**Mandatory TLFD**  
Results of work and school location choice models.  
Distribution of workers by distance between home and usual work place, and students by distance between home and school location.



# Employment vs Workers

## Employment vs Workers comparison at TAZ level

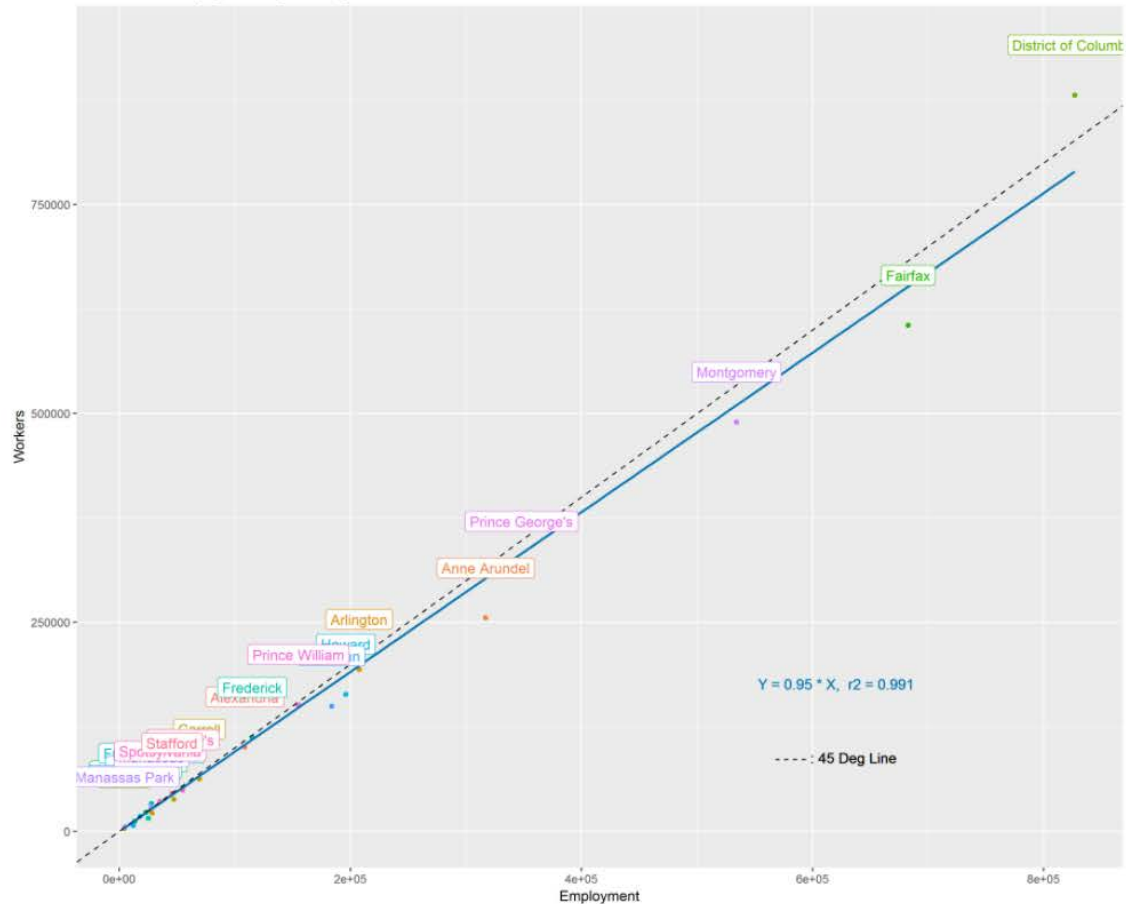
Results of work location model.

Comparison of assigned workers to available employment at TAZ level.

Only for build scenario.

By County By TAZ Low Income Medium Income High Income Very High Income Total

### Workers vs Employment by County



# Tour Level

This page summarizes day-pattern and tour generation model results.

### Daily Activity Pattern

Results of Coordinated Daily Activity Pattern (CDAP) model, summarized for each person.

*M*: One or more mandatory tours

*N*: No mandatory tours but one or more non-mandatory tours

*H*: No tours (either home all day or out of area)

### Percentage of Households with Joint Tour

Also the result of the CDAP model, summarized for each household.

### Mandatory Tour Frequency

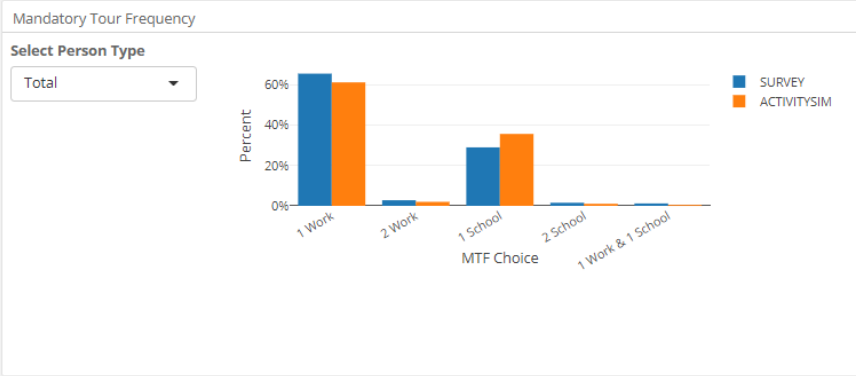
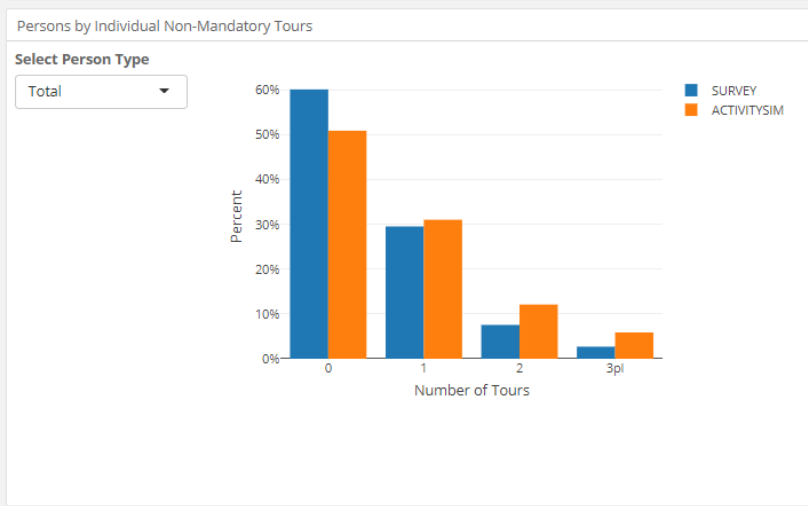
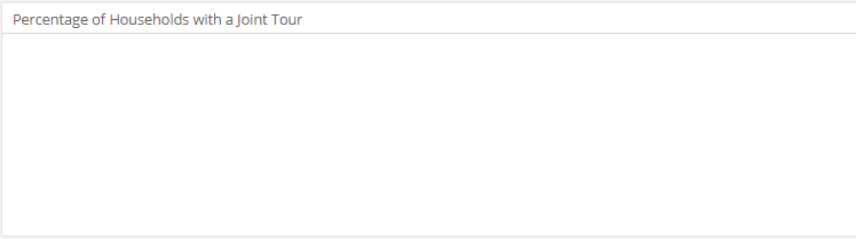
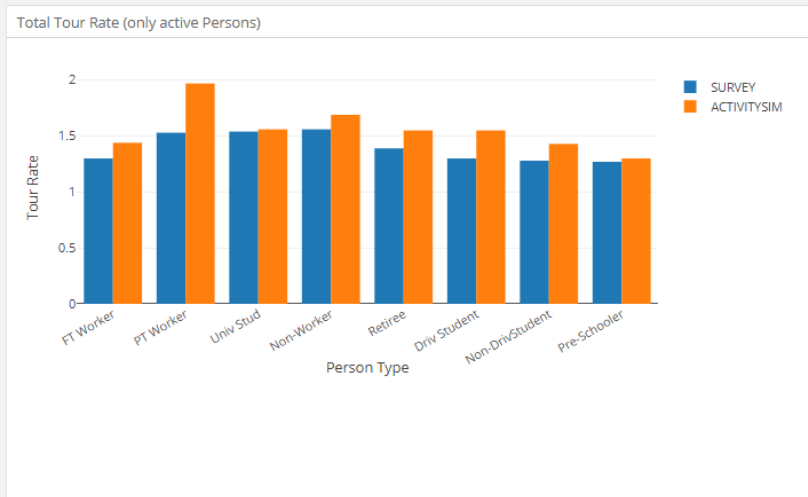
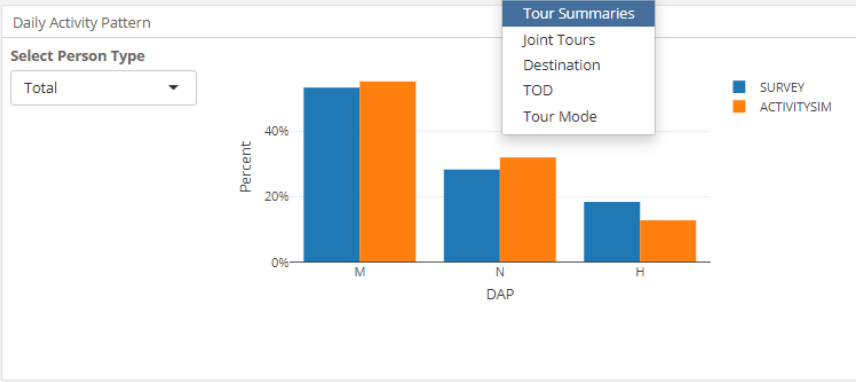
Result of the mandatory tour frequency model, summarized for each person with a daily activity pattern type *M*

### Tour rate by person type

Summary of tours per person resulting from all tour generation models. Joint tours are counted for each participant.

### Individual non-mandatory tour frequency

Results of individual non-mandatory tour frequency model, summarized for each person with a daily activity pattern type *M* or *N*.



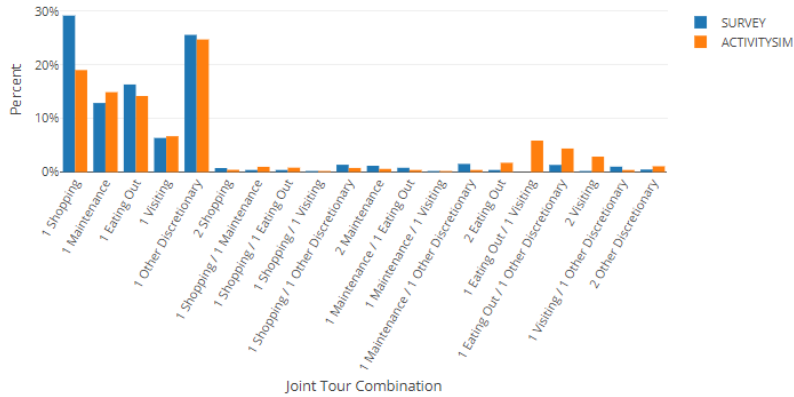
# Joint Tours

This page tabulates the results of the Joint Tour Frequency and Composition Model and the Joint Tour Person Participation Model.

### Joint Tour Frequency

The frequency of households by number and purpose of joint tours.

Joint Tour Frequency



### Joint Tour Composition

The frequency of tours by composition (Adults only, Children only, Adults + Children).

### Joint Tour Party Size

The frequency of joint tours by the number of household members participating in the tour.

### Joint Tours by HH Size

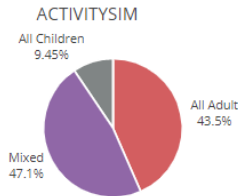
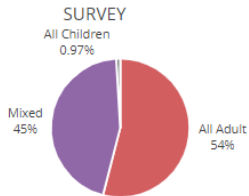
The frequency of households by household size and the number of joint tours per household.

### Joint Tours by HH Size

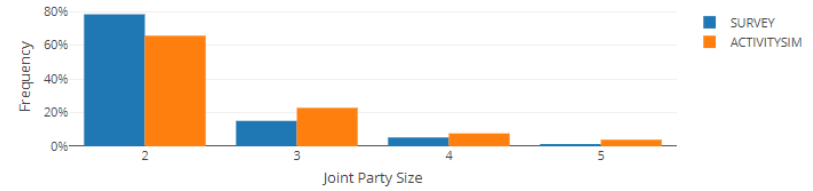
#### Tour Level

Distribution of joint tours by party size for each composition type.

Joint Tour Composition



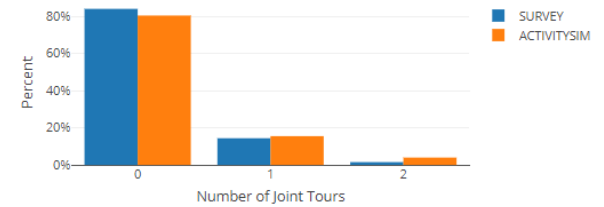
Joint Tours By Number of Household Members



Joint Tours by Household Size

#### Select HH Size Group

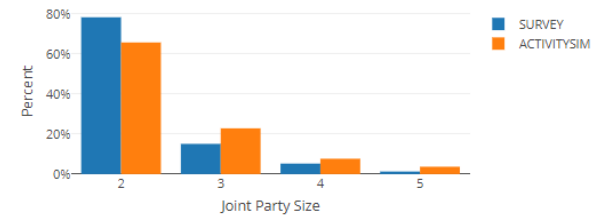
Total



Party Size Distribution by Joint Tour Composition

#### Select Party Composition

Total



# Tour Destination

## Non-Mandatory Tour Length Distribution

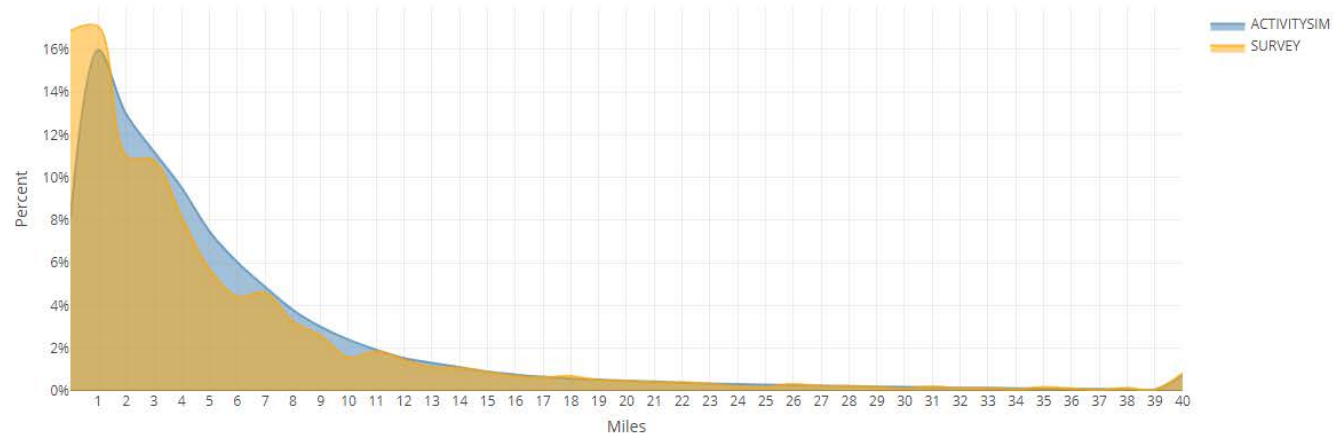
Results of non-mandatory tour destination choice models.

Distribution of tours by distance between tour origin and destination for each non-mandatory tour purpose.

### Non-Mandatory Tour Length Distribution

Select Tour Purpose

Total



### Average Non-Mandatory Tour Lengths (Miles)

Purpose	SURVEY	ACTIVITYSIM
Escorting	4.38	5.68
Indi-Maintenance	5.83	6.78
Indi-Discretionary	6.57	6.45
Joint-Maintenance	7.02	7.46
Joint-Discretionary	7.23	6.60
At-Work	5.49	5.01
Total	5.84	6.34



# Tour TOD

## Tour Departure Arrival & Duration

Tour Time-of-day Choice Model results.

Each tour is assigned a time period of departure (time leaving home or work) and arrival (time arriving back at home or work). The entire day is divided into 48 half-hour bins (the first bin includes 3:00 AM to 3:30 AM and the last bin includes 2:30 AM to 3:00 AM).

Tour duration is calculated as a function of departure and arrival period. It includes travel time and time spent at the primary destination and all intermediate stops.

Results are shown for tours, filtered by tour purpose.

## Aggregate Tour Arrival-Departure

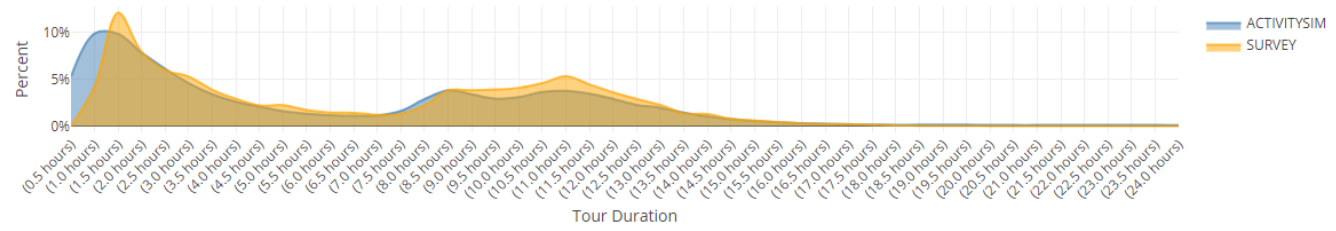
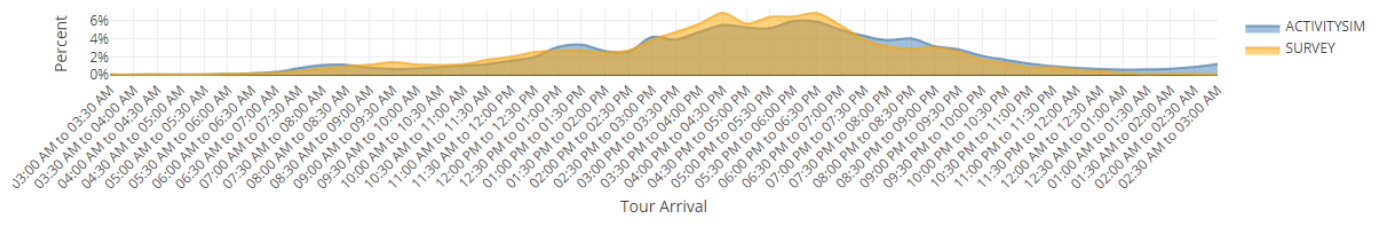
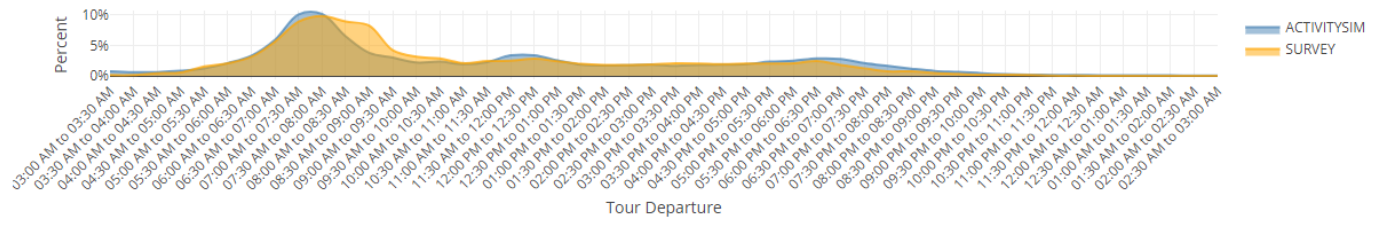
- NT1: 3:00 AM to 5:59 AM
- AM: 6:00 AM to 8:59 AM
- MD: 9:00 AM to 2:59 PM
- PM: 3:00 PM to 6:59 PM
- NT2: 7:00 PM to 2:59 AM

### Tour Departure-Arrival Profile

### Tour Aggregate Departure-Arrival Profile

Select Tour Purpose

Total



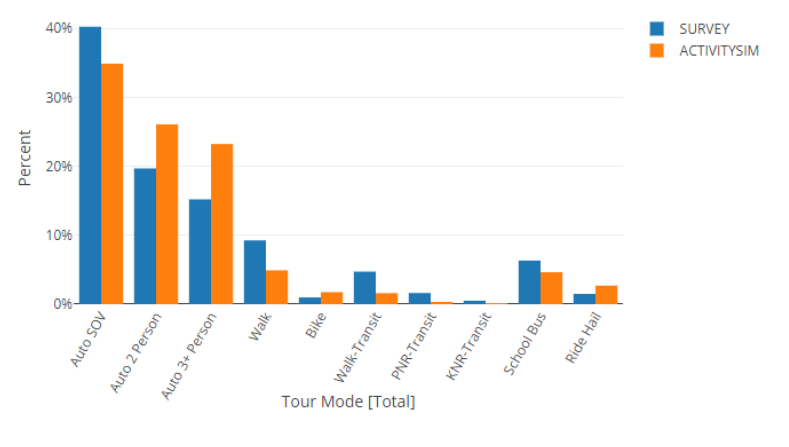
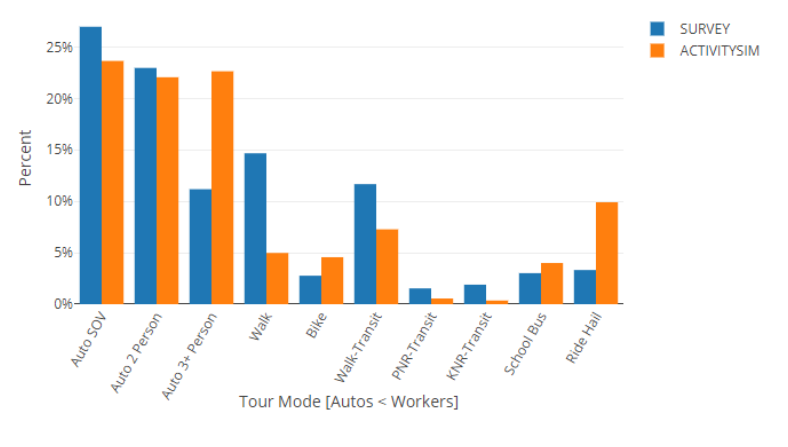
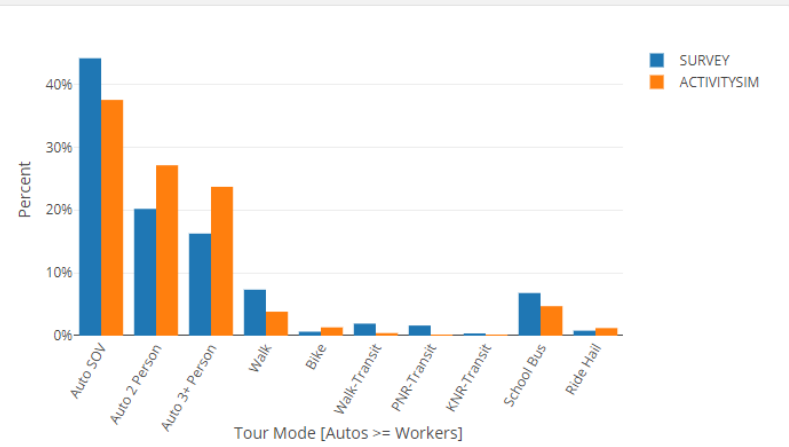
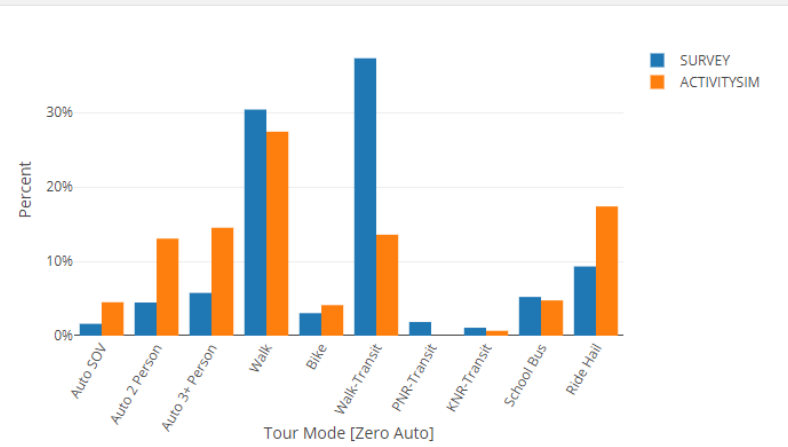


# Tour Mode

Tour Mode Choice

Select Tour Purpose

- Total
- Indi-Discretionary
- Indi-Maintenance
- Joint-Discretionary
- Joint-Maintenance
- School
- Total
- University
- Work



# Trip Frequency

## Stop Frequency

Results of the Intermediate Stop Frequency Model, which predicts the number of intermediate stops on each tour by tour direction (outbound versus inbound).

The summary shows percent of tours by number of stops on the tour and tour direction.

## Stop Purpose

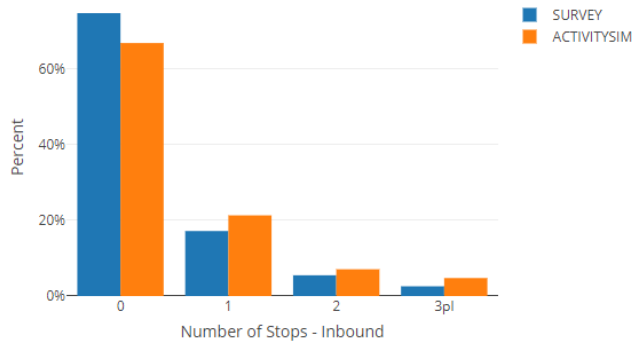
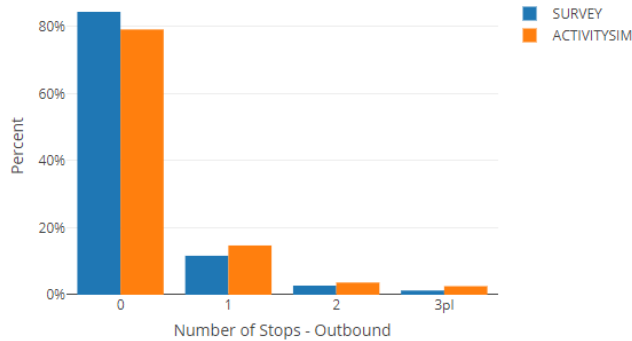
Results of the Intermediate Stop Purpose Model, which is currently implemented as a Monte Carlo choice according to probability distributions generated from survey data.

The summary shows the percent of intermediate stops by stop purpose and tour purpose.

Stop Frequency - Directional

Select Tour Purpose

Total

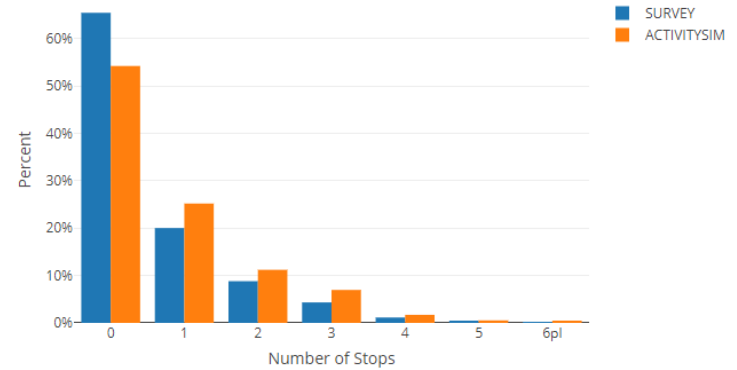


Stop Purpose by Tour Purpose

Select Tour Purpose

Total

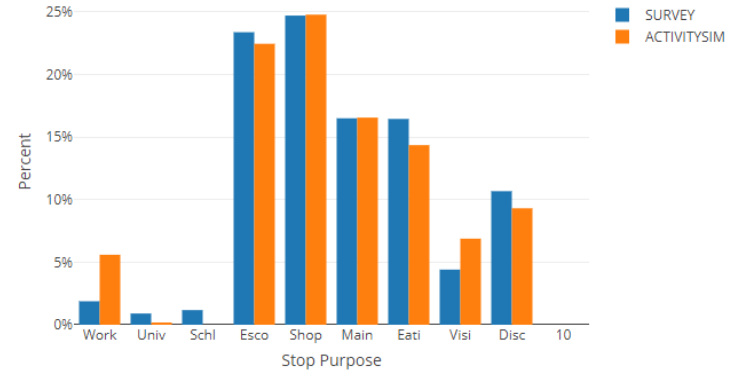
- Stop Frequency
- Location
- TOD
- Trip Mode



Stop Purpose by Tour Purpose

Select Tour Purpose

Total



# Stop Location

## Stop Location

Results of the Intermediate Stop Location Choice Model, which predicts the location of each intermediate stop.

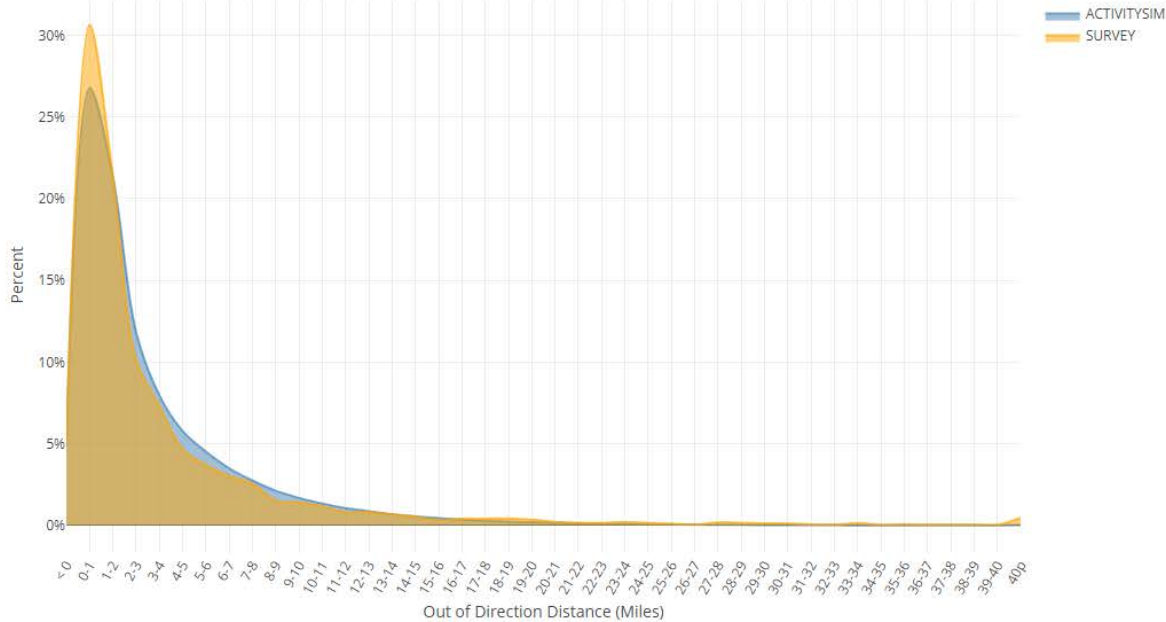
The summary shows the distribution of intermediate stops by out of direction distance and tour purpose.

Out of direction distance is defined as the extra distance to the destination as a result of traveling through the stop location. For stops in the outbound direction, it is based on the distance between the last known location (the tour origin or previous outbound stop) and the tour primary destination. For stops in the inbound direction, it is based on the distance between the last known location (the tour primary destination or previous inbound stop) and the tour origin.

Stop Location - Out of Direction Distance

Select Tour Purpose

Total



Average Out of Direction Distance (Miles)

Tour_Purpose	SURVEY	ACTIVITYSIM
Work	3.48	3.26
University	4.41	3.46
School	4.50	3.10
Escorting	3.37	3.31
Indi-Maintenance	3.21	3.30
Indi-Discretionary	3.47	3.10
Joint-Maintenance	3.14	3.34
Joint-Discretionary	3.41	3.44
At-Work	2.13	2.74
Total	3.35	3.20

