

# Travel Survey Data Collection

Their use in Activity-based Models

August 25, 2023

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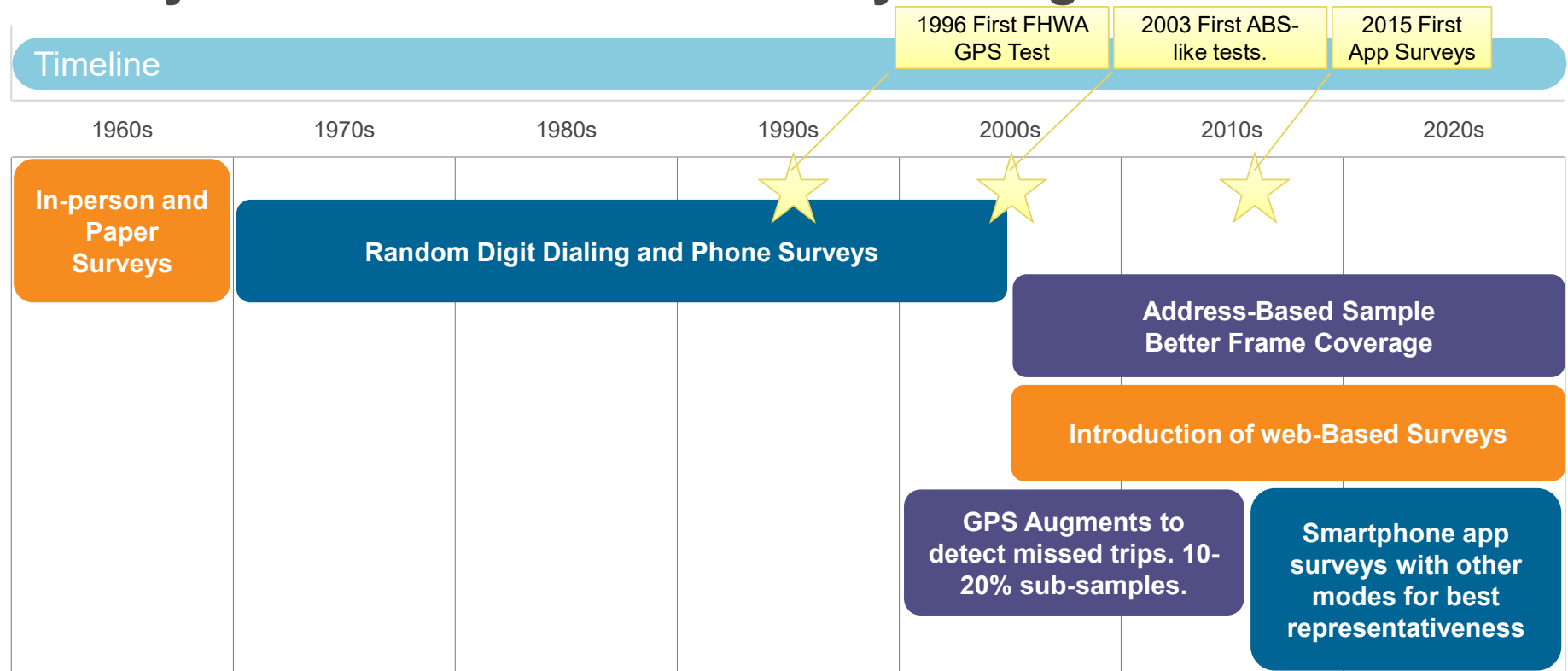
Ali Etezady



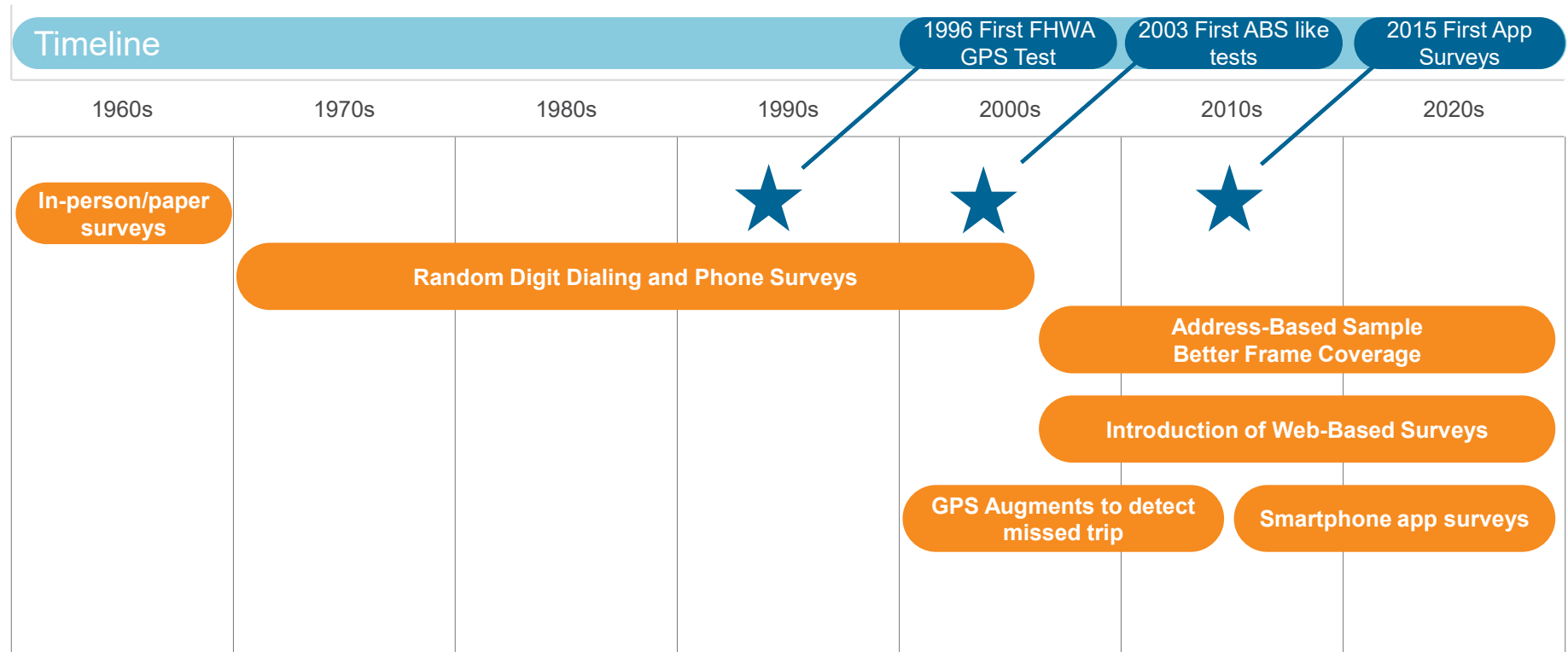
A grayscale map of the United States, including parts of southern Canada and northern Mexico. The map is overlaid with a dense network of white dots and thin lines, representing a data collection or network infrastructure. The dots are more concentrated in the eastern half of the country and along the West Coast, with lines connecting them across the entire landmass. The Great Lakes are visible in the upper central part of the map.

# Data Collection

# History of Household Travel Survey Changes



# History of Household Travel Survey Changes



# Primary HTS Uses

## Essential Inputs to Travel Demand Models

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## Potential Future Expansions to the Model Covered

- Additional model steps such as mode split
- Additional modes such as bike, walk, TNC, transit
- Additional time periods such as Daily, AM peak, midday, off peak

## Uses For Other Modelling/Planning Purpose

- Policy goals – Economic Vitality, Equity, Safety, Mobility, Environment, Stewardship
- Traditional automobile travel demand estimates
- Non-motorized travel demand estimates and new mobility services travel demand
- Teleworking and trip replacement behaviors

# Stages of the Survey

## RECRUITMENT



### Mailed Invitation Materials

- **Address-based sampling** used by drawing a random sample of addresses from all residential addresses in the survey region.
- Supplemental Non-Probability Sampling
- An invitation letter is sent followed by a reminder postcard(s).

## DATA COLLECTION



40-65%

SMARTPHONE



35-50%

ONLINE



5-10%

CALL CENTER

*Approximate shares by participation mode*

## DATA ANALYSIS

**Data from all three participation methods is combined into a single weighted dataset.**

- Weighting accounts for trip underreporting observed in online and call center participant diaries.
- Allows for the full sample to be used in all analysis.

## Efforts to improve equity and representation

1. **Outreach to community-based organizations** from underrepresented communities to build partnerships and communicate the importance of the survey
2. **Implement innovative sampling approaches**
  - Efficient use of oversampling using address-based sampling (ABS) and 3<sup>rd</sup> party data
  - Implement supplements to address-based sampling (ABS)
3. **Inclusion of language options** to reduce barriers to participation for limited-English speakers
4. **Smartphone “Opt-in”** option for those that complete the sign-up (recruit) survey online

# Example Recruitment Package

Invitation letter with FAQs

“Reminder” postcard

Survey website

Simplified communication

Inclusive modes and examples

Study to be conducted in multiple languages





# Summary of Household Travel Survey Data Collection

## Final Thoughts

Response rates continue to be a challenge in the post-pandemic era

Many Clients are seeking to move to 'continuous' survey designs to better detect remote work and other changes to travel behavior

Smartphone app collection continues to increase as clients are realizing the value of the additional days of data and the utility in accessing day-to-day variation

The industry is still debating if, when, and how it is ideal to incorporate non-probability samples



# Activity-based Modeling

The background of the slide features a dark gradient from black at the top to a lighter grey at the bottom. Overlaid on this gradient is a dense field of white binary digits (0s and 1s). The digits are arranged in a way that creates a sense of depth and movement, with some digits appearing sharper and more prominent than others, giving the impression of a digital rain or data stream.

## Why an Activity-based Model (ABM)?

- Compared to a traditional trip-based model, ABMs excel at several areas.



Pricing policies



Equity analysis



Active  
transportation



New emerging  
modes

An aerial, black-and-white photograph of a large crowd of people walking on a paved surface. The ground is marked with a grid pattern, and the numbers '0' and '1' are printed in a repeating, diagonal sequence across the entire area, resembling binary code. The people are scattered throughout the scene, moving in various directions. The text 'Activity Sim' is overlaid in the center-left.

# Activity Sim



# ActivitySim

A state-of-the-practice ABM  
platform that is **always**  
**improving.**



# ActivitySim

Open source, purpose-built,  
and grounded in the  
principles of collaboration  
and modern software  
engineering.



# ActivitySim

It is lead and supported by a consortium of MPOs and other transportation planning agencies.



# ActivitySim

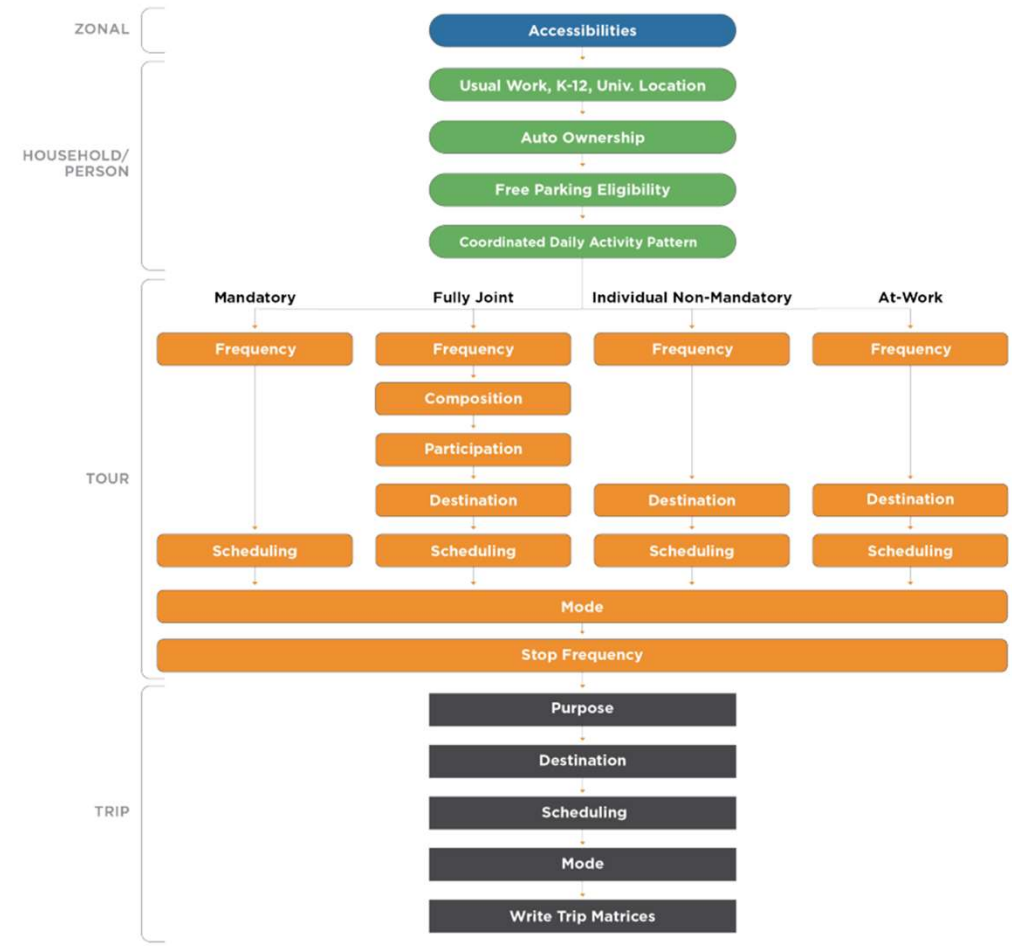
## Why ActivitySim?

|   |   |
|---|---|
| <b>Leverage Activity-Based Modeling</b> | ActivitySim models people and their choices—not just trips.<br>Answer important questions about active modes and new technology.                  |
| <b>Receive Continual Updates</b>        | ActivitySim is on GitHub, the industry standard for collaborative, open source software development. Members can contribute back to the platform. |
| <b>Save Time and Money</b>              | ActivitySim development costs are shared. ActivitySim is also performant; it is purpose-built to run faster than its predecessors.                |
| <b>Guide ActivitySim's Development</b>  | Join a collaborative, continually improving platform and help guide future enhancements and updates.* Learn from modeling industry experts/peers. |

*\*Requires membership in the ActivitySim consortium*



# ActivitySim Structure



## An Example Activity-Based Model and Sub-model Structure



# Data Needs

# ABMs: General Data Needs

- **Household Travel Survey**

Captures household, person, and full-day travel

- **Transit On-Board Survey**

Captures details of a single transit trip for each surveyed individual

- **Transit On-Board Survey ABM Subset**

Captures full-day travel pattern

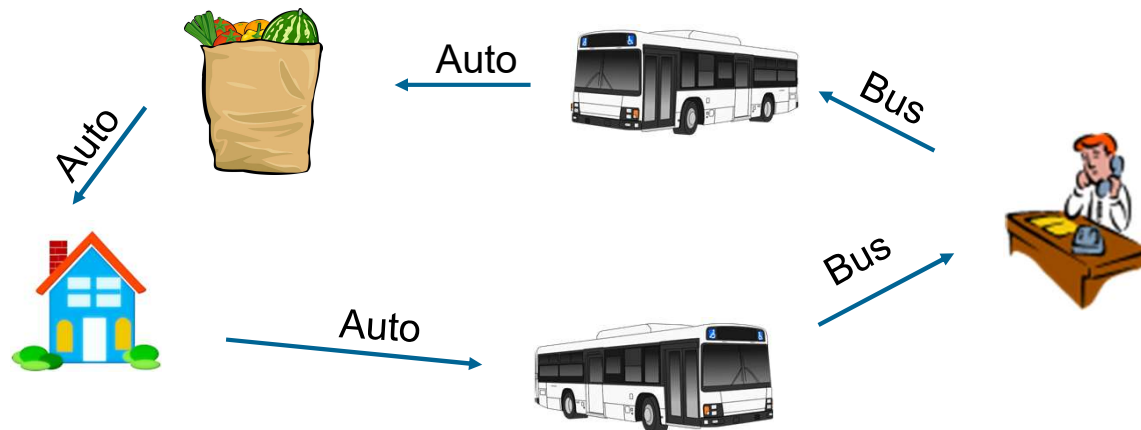
- **Census**

American Community Survey (ACS)

Provides checks / alternate data sources to compare to weighted survey statistics

## ABMs: Tours vs. Trips

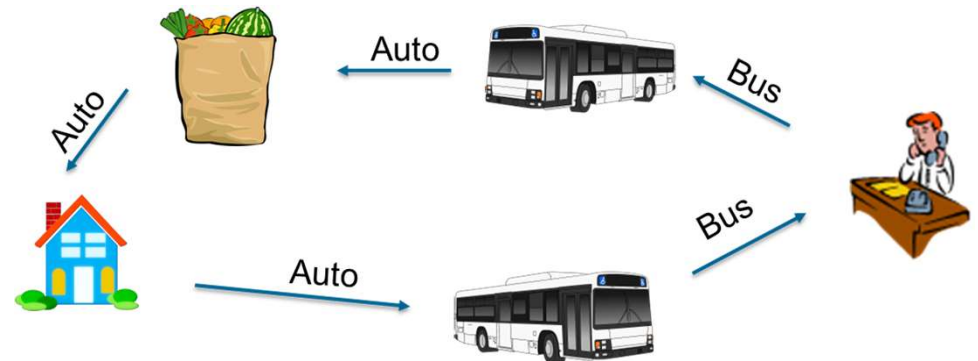
- Activity-based models use tours (instead of trips) as their travel unit, therefore considering the dependance among trips.



# How Different Surveys See The Same Tour

## Household Travel Survey collects every aspect:

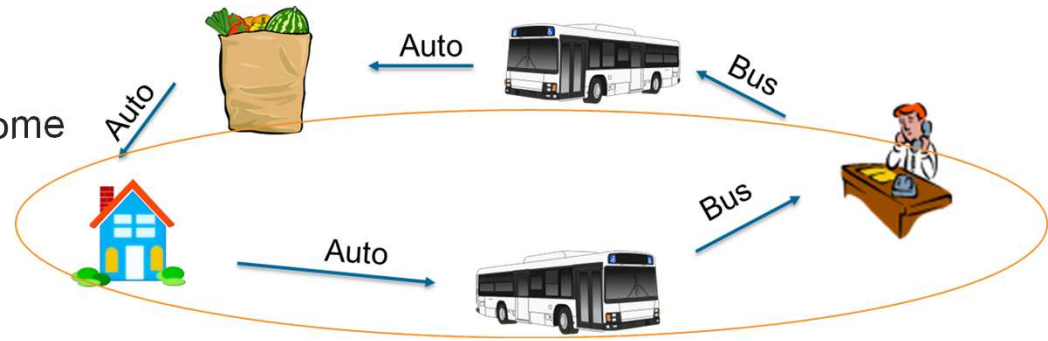
- Household characteristics:
  - Workers, vehicles, income, location, total inhabitants, ...
- Person characteristics:
  - Demographics, work & student status, educational attainment ...
- All Trips:
  - Mode, purpose, location ... of each trip
- **But, low statistics on transit. Need on-board transit survey!**



# How Different Surveys See The Same Tour

## On-Board Transit Survey Collects:

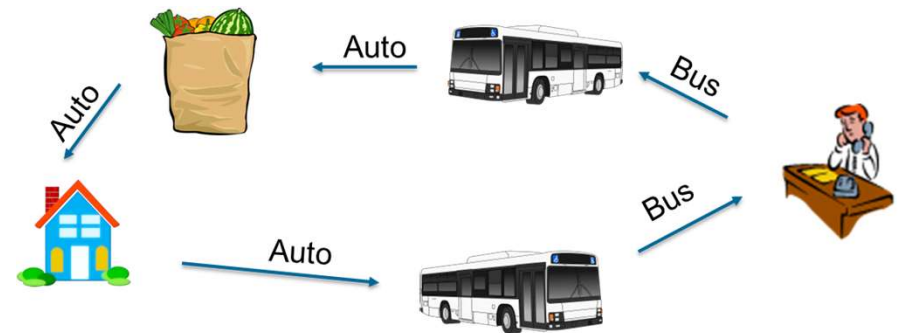
- Limited household & person information:
  - Number of workers & vehicles per household, home location
  - Person demographics, worker & student status
- Single transit trip characteristics:
  - Trip origin and destination
  - Access and egress mode, number of transfers, transit route
- **But, no information on other parts of tour. Need ABM transit survey!**



# How Different Surveys See The Same Tour

## On-Board ABM Transit Survey Collects:

- Limited household & person information
  - Household vehicles and workers
  - Person demographics, work & student status
- All Trips:
  - Mode, purpose, location... of each trip
  - Correlates transit trip characteristics to transit tour characteristics.



# ActivitySim Data Format

## Households:

- Size
- Income
- Workers
- Vehicles
- Number of children
- Home TAZ

## Persons:

- Age
- Employment status
- Student Status
- Work TAZ
- School TAZ
- Person Type

## Tours:

- Purpose
- Mode
- Type
- Origin TAZ
- Destination TAZ
- Start Time
- End Time
- Joint Status

## Joint Tours:

- Household members on tour

## Trips:

- Origin TAZ
- Destination TAZ
- Start Time
- End Time
- Purpose
- Mode

## Survey Processing Requires:

- Person Type Coding
- Grouping trips into tours
- Mode and purposes to match those in ActivitySim





# Survey Processing Application (SPA)

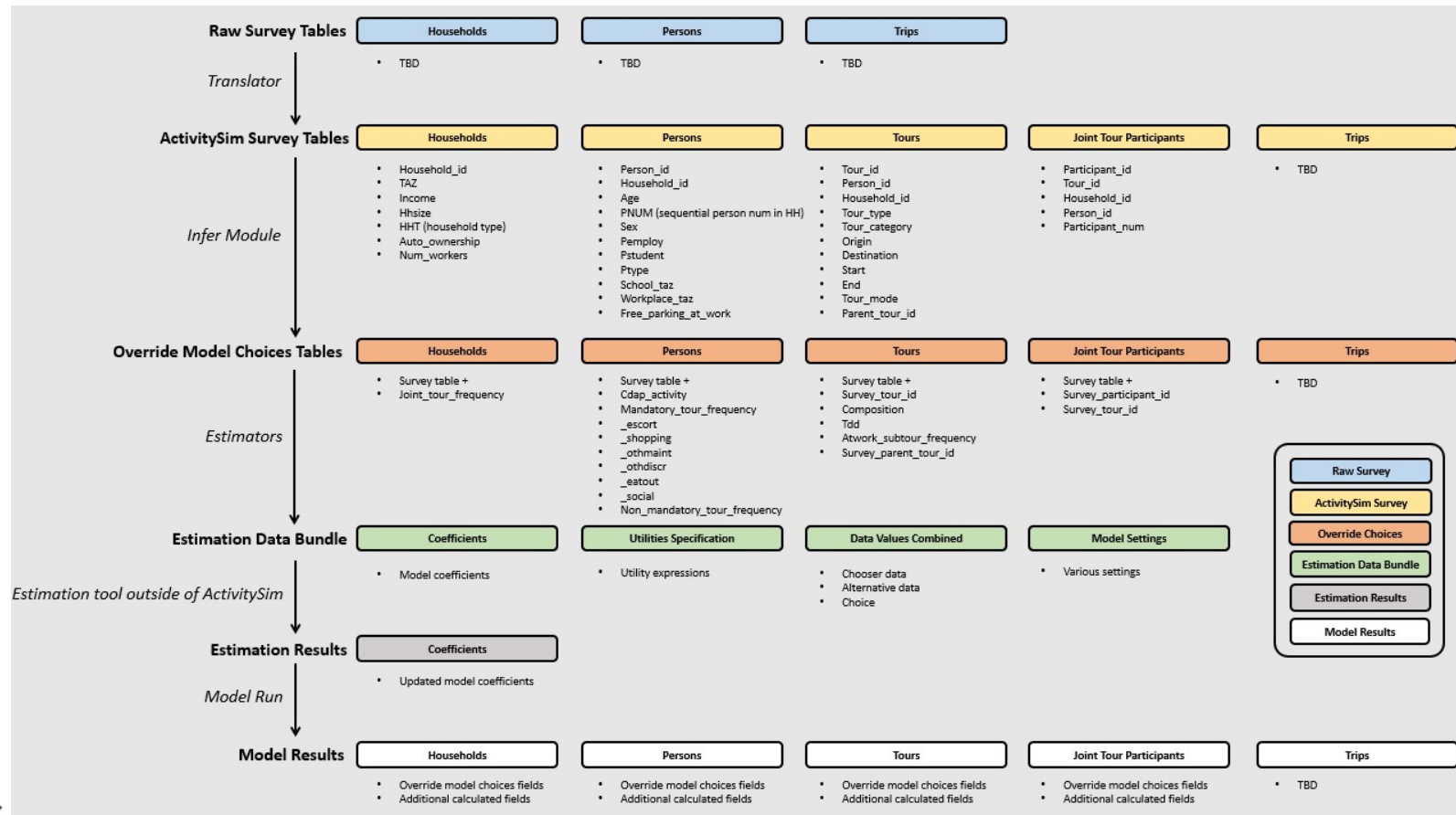
The SPA tool cleans and processes HTS's into ActivitySim format

## SPA Algorithm:

- ▶ For each observed household
- ▶ Create a HOUSEHOLD object
- ▶ For each observed person
  - ▶ Create a PERSON object for the HOUSEHOLD
  - ▶ Compute person type
  - ▶ For each series of observed place records that start and end at home
    - ▶ Create a TOUR object for the PERSON
    - ▶ For each series of observed place records that make up a linked trip within the tour
      - ▶ Create and attribute a TRIP object
      - ▶ For each leg of the trip involving joint travel
        - ▶ Create a JOINT\_ULTRIP object for the HOUSEHOLD
  - ▶ Populate tour attributes
  - ▶ Match JOINT\_ULTRIP objects into joint travel episodes
- ▶ Compute escort related attributes for TRIPs
- ▶ Create and attribute a JOINT\_TOUR object for each fully joint tour
- ▶ Compute escort related attributes for partially joint tours



# Survey Data Usage: Estimation



# Survey Data Usage: Calibration

## Auto Ownership

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

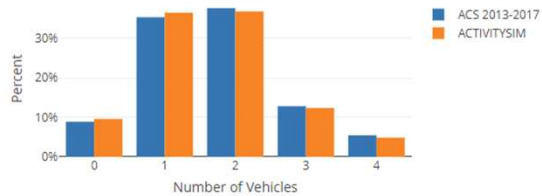
## Mandatory TLFD

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.

## Auto Ownership

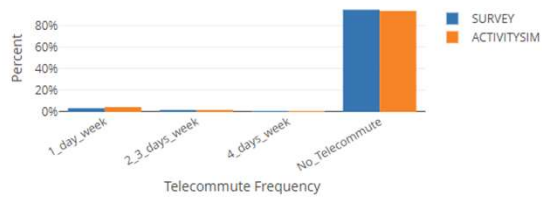
Census source: ACS 2013-2017



Working from home: SURVEY vs. ACTIVITYSIM



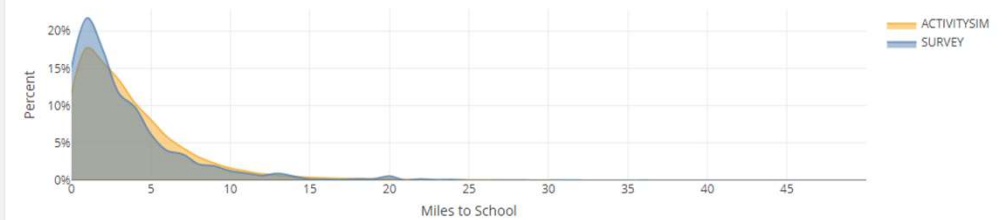
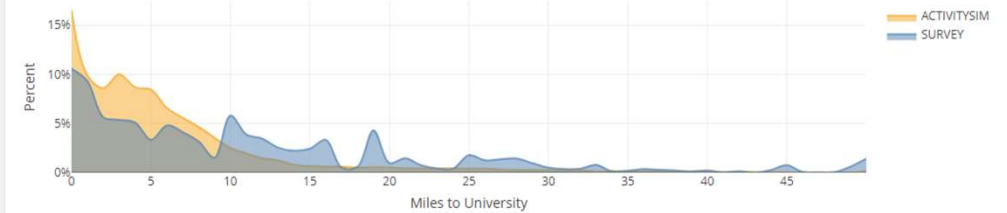
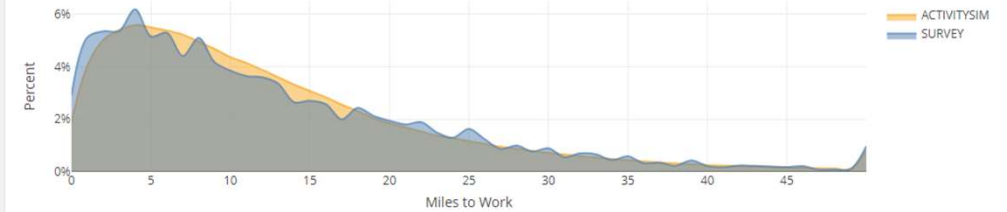
## Telecommute Frequency



## Mandatory TLFD

Select District

Total



# Thank you

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