

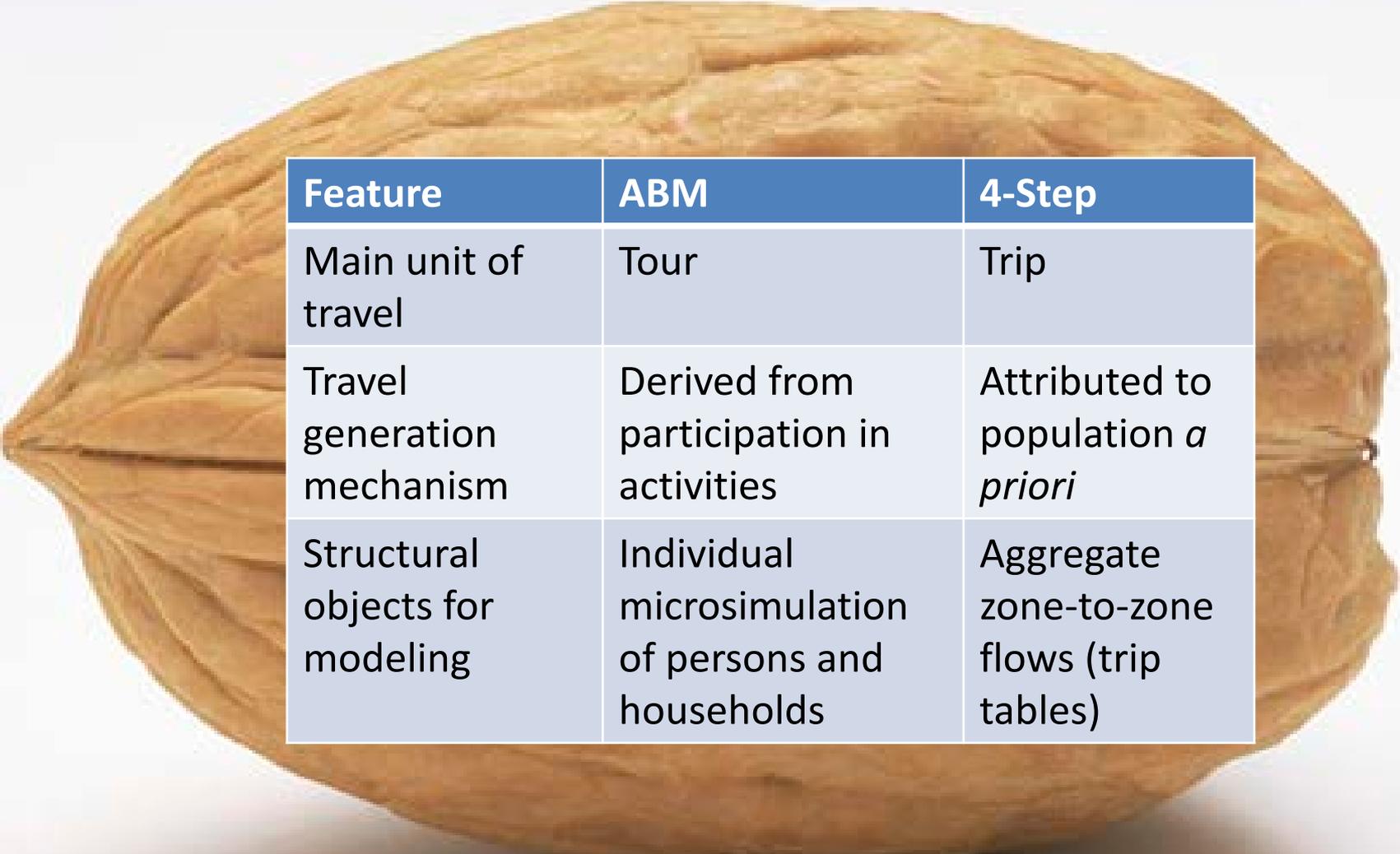
# MAG ABM

## Travel Forecasting Tool of New Generation

# Key Project Team Members

- MAG:
  - Vladimir Livshits
  - Kyunghwi Jeon
  - Petya Maneva
- PB:
  - Peter Vovsha
  - Jim Hicks
  - Surabhi Gupta
- INRO:
  - Dan Florian
  - Matthew Hodak
  - Kevin Bragg

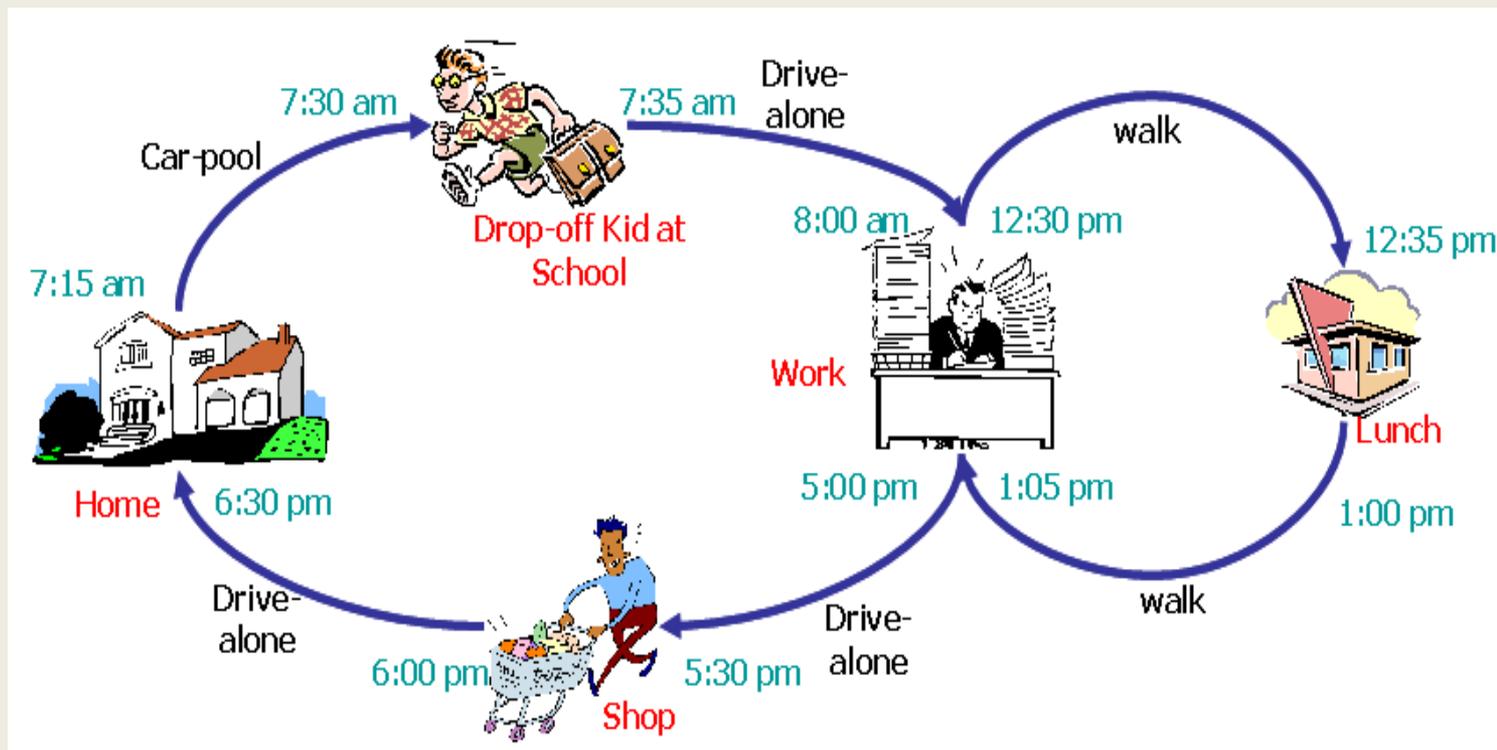
# ABM in a Nutshell: Standard Features of ABMs<sup>3</sup> in Practice in US (1<sup>st</sup> Generation), 2001-2016



Feature	ABM	4-Step
Main unit of travel	Tour	Trip
Travel generation mechanism	Derived from participation in activities	Attributed to population <i>a priori</i>
Structural objects for modeling	Individual microsimulation of persons and households	Aggregate zone-to-zone flows (trip tables)

# Activity-Based Tour-Based Modeling

- Daily activity patterns have related travel patterns, which are expressed as tours



# Signature Features of 2<sup>nd</sup> Generation, 2005-2016

- Explicit modeling of intra-household interactions and joint travel for shared activities
- Individual daily schedule consistency across travel tours with 30 min temporal resolution
- Enhanced spatial resolution (20,000-40,000 MAZs) for location choices

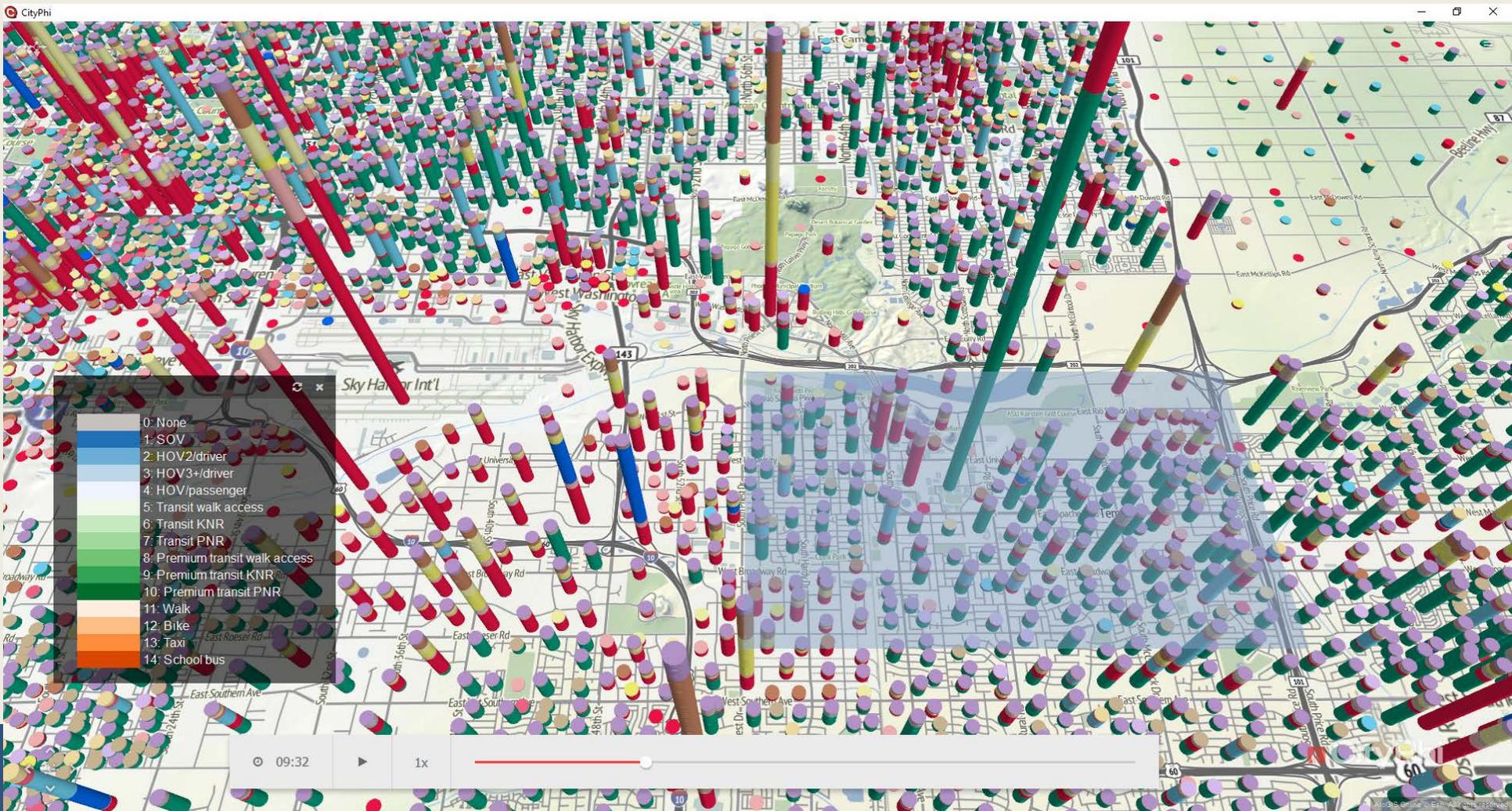
# New Features of 3<sup>rd</sup> Generation of ABMs (2011-2016)

- Continuous time and integration with DTA
- Activity generation & tour formation instead of tour generation & stop insertion
- Addressing supply side of activities like Special Events and major universities
- Time-use (activity-participation) analysis & dynamic visualizations

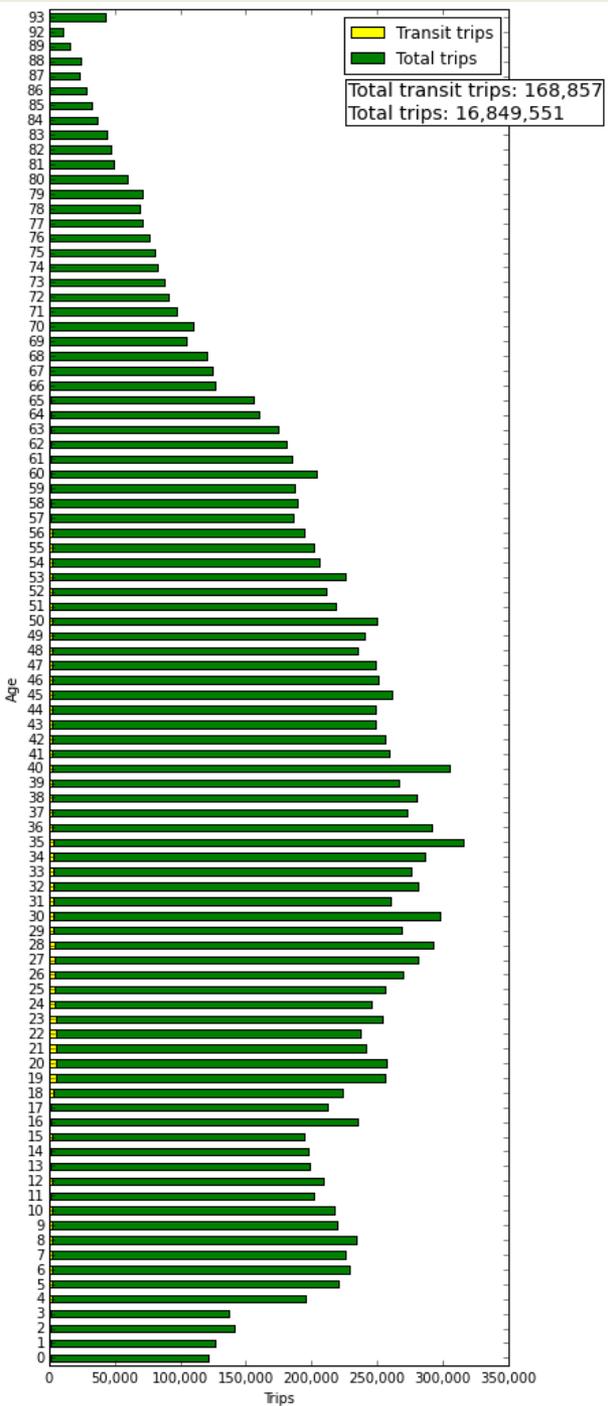
# Most Important Population Segments to Predict Travel Demand

Population segment	4-step	ABM
HH Income group	√	√
HH car ownership	√	√
HH size	√ (trip generation)	√
HH composition		√
Person type		√
Age		√
Gender		√

# Transit Users by Age: Region and ASU Sub-Area

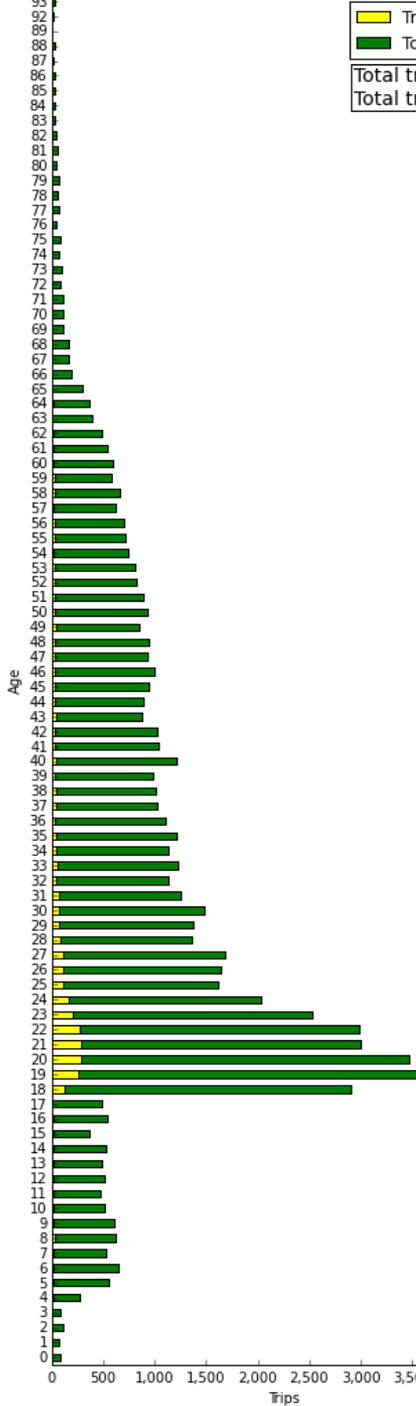


# Transit Users by Age

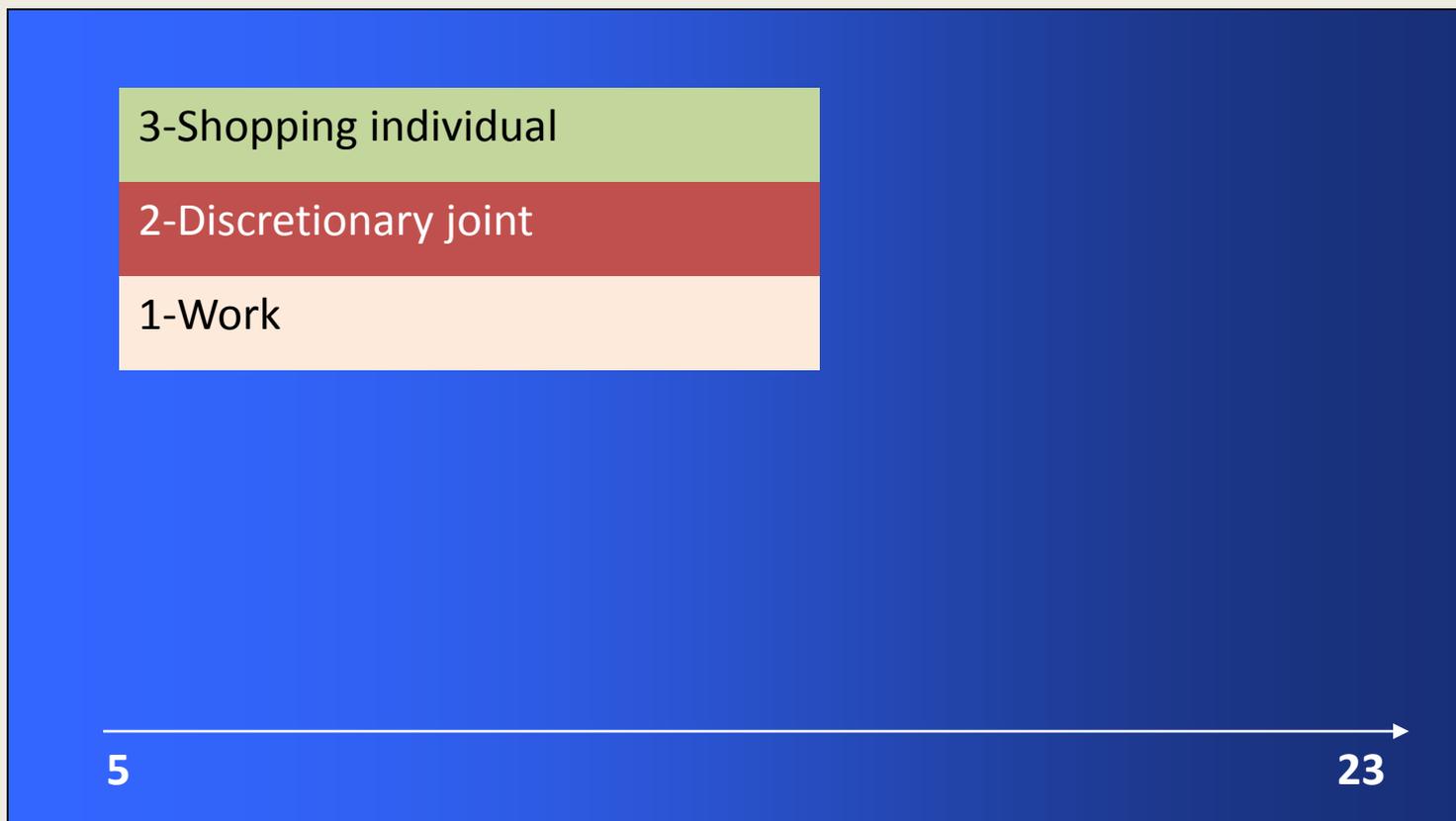


Entire region

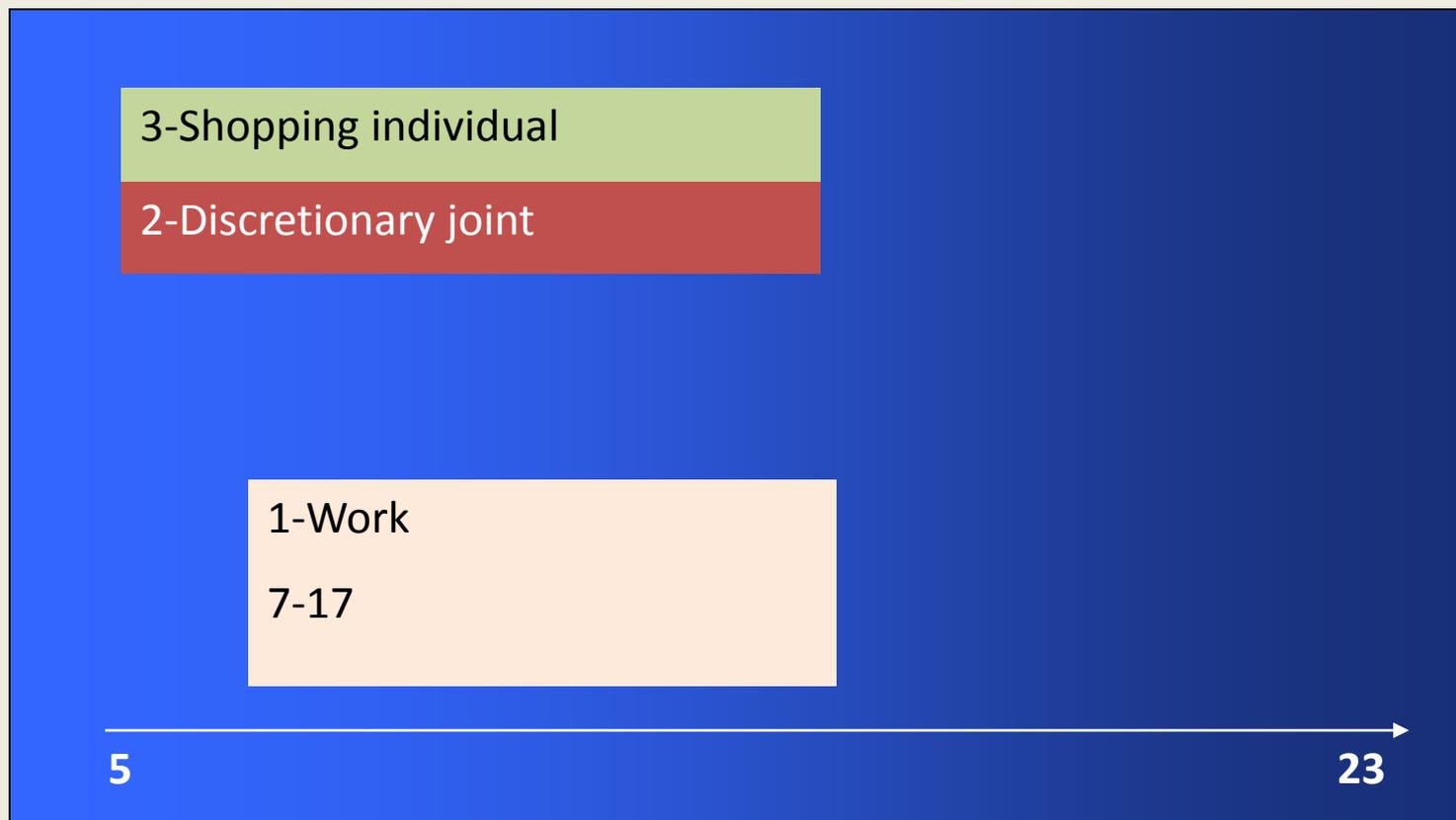
ASU area



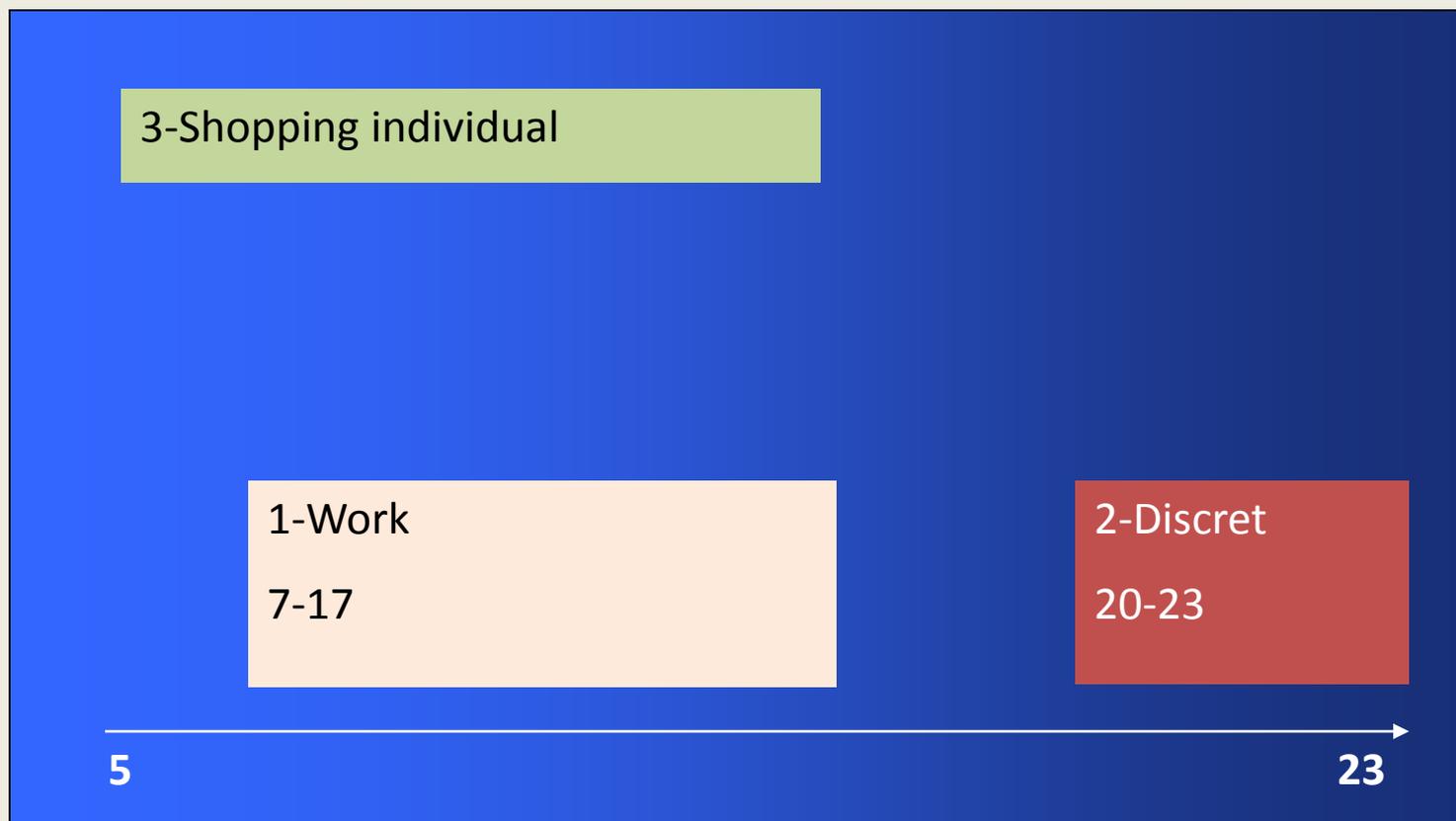
# Time-Use Concept: Activity & Travel for the Same Person



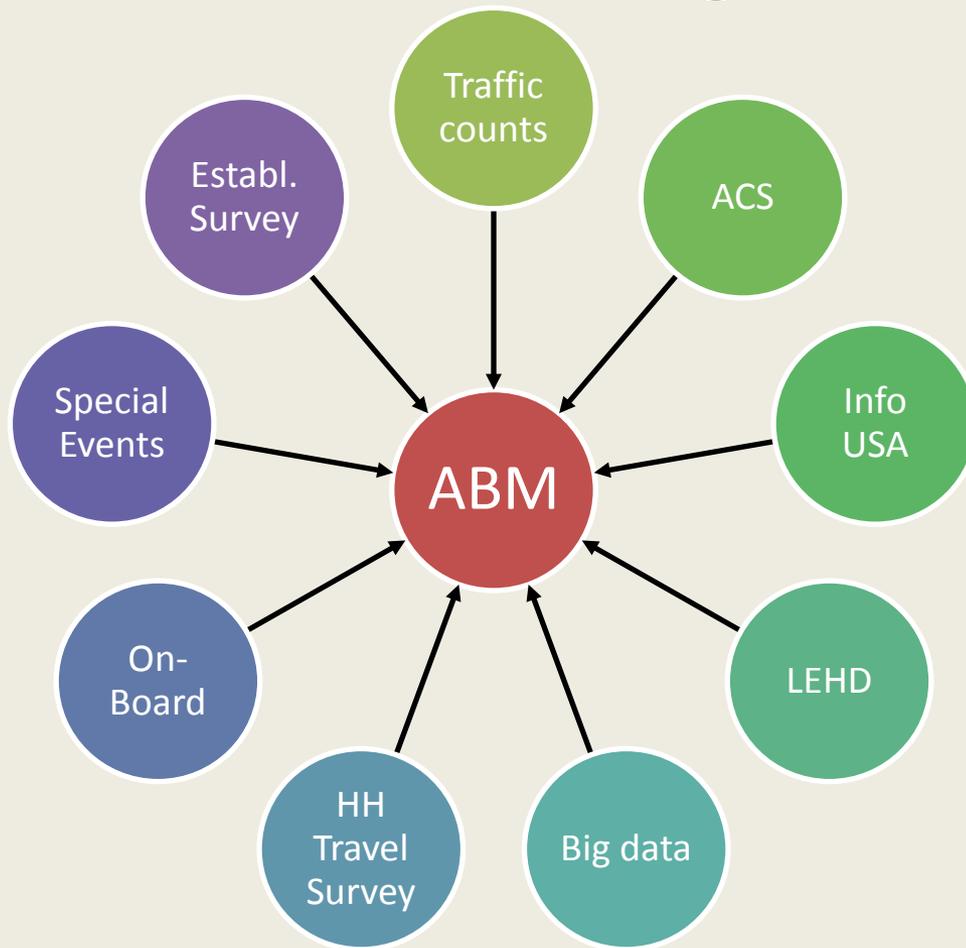
# Time-Use Concept: Activity & Travel for the Same Person



# Time-Use Concept: Activity & Travel for the Same Person



# New View on Travel Model as Data Integration Tool

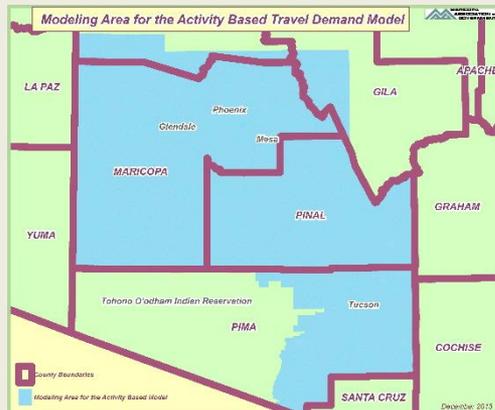
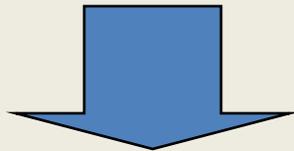


- MAG collects many different sources of data
- ABM is the lowest possible denominator
- ABM consolidates all surveys in one virtual 100% HTS

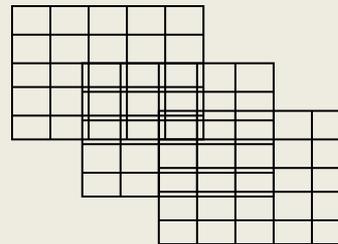
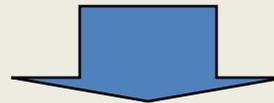
# ABM Primary Output as 100% HTS

## Household Data, Person Data, Tour/Trip List

hhid	pnum	tourNum	tourSubTourNum	personTripNum	tourTripNum	jointSpecEvtTour	origTaz	origMaz	destTaz	destMaz	origPurp	destPurp	mode	prelimDepartInterval	finalDepartMinute
0	1	1	0	1	1	0	101	1	991	10970	0	1	1	5	135
0	1	1	0	2	2	0	991	10970	101	1	1	0	1	30	885
1	1	1	0	1	1	0	101	1	101	3	0	9	2	6	164
1	1	1	0	2	2	0	101	3	101	1	9	0	2	6	166
1	1	2	0	3	1	0	101	1	101	1	0	71	1	8	225
1	1	2	0	4	2	0	101	1	1309	15329	71	2	1	8	232
1	1	2	0	5	3	0	1309	15329	101	1	2	0	1	17	495
1	1	3	0	6	1	0	101	1	1309	15329	0	2	1	31	915
1	1	3	0	7	2	0	1309	15329	101	1	2	0	1	34	1005
1	2	1	0	1	1	0	101	1	2777	24228	0	15	1	2	45



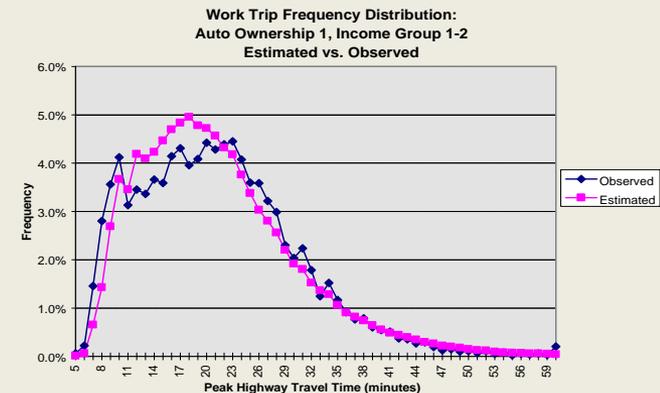
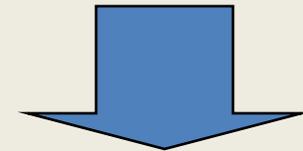
Maps, Graphics



Trip Tables

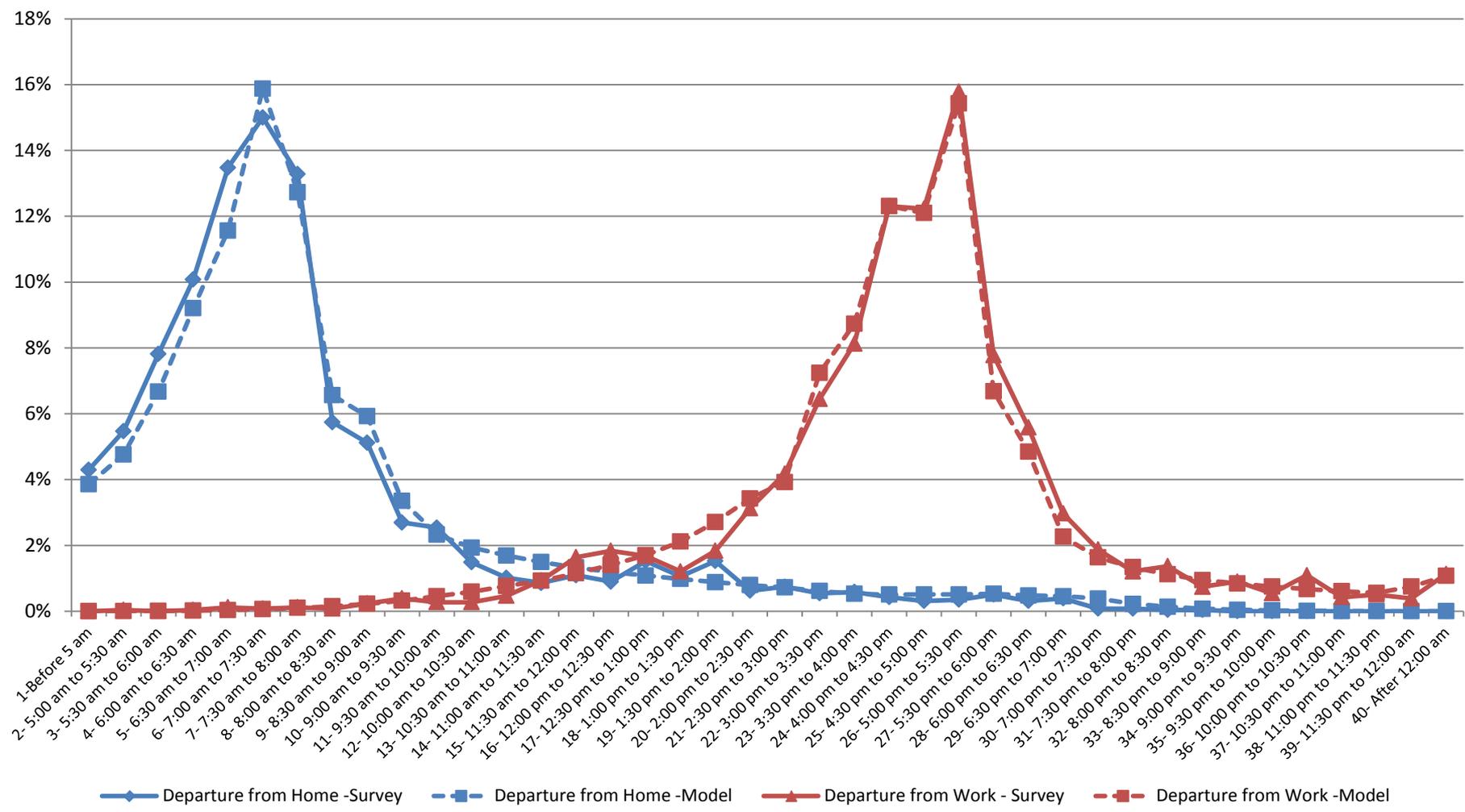


Assignment



Other Summaries

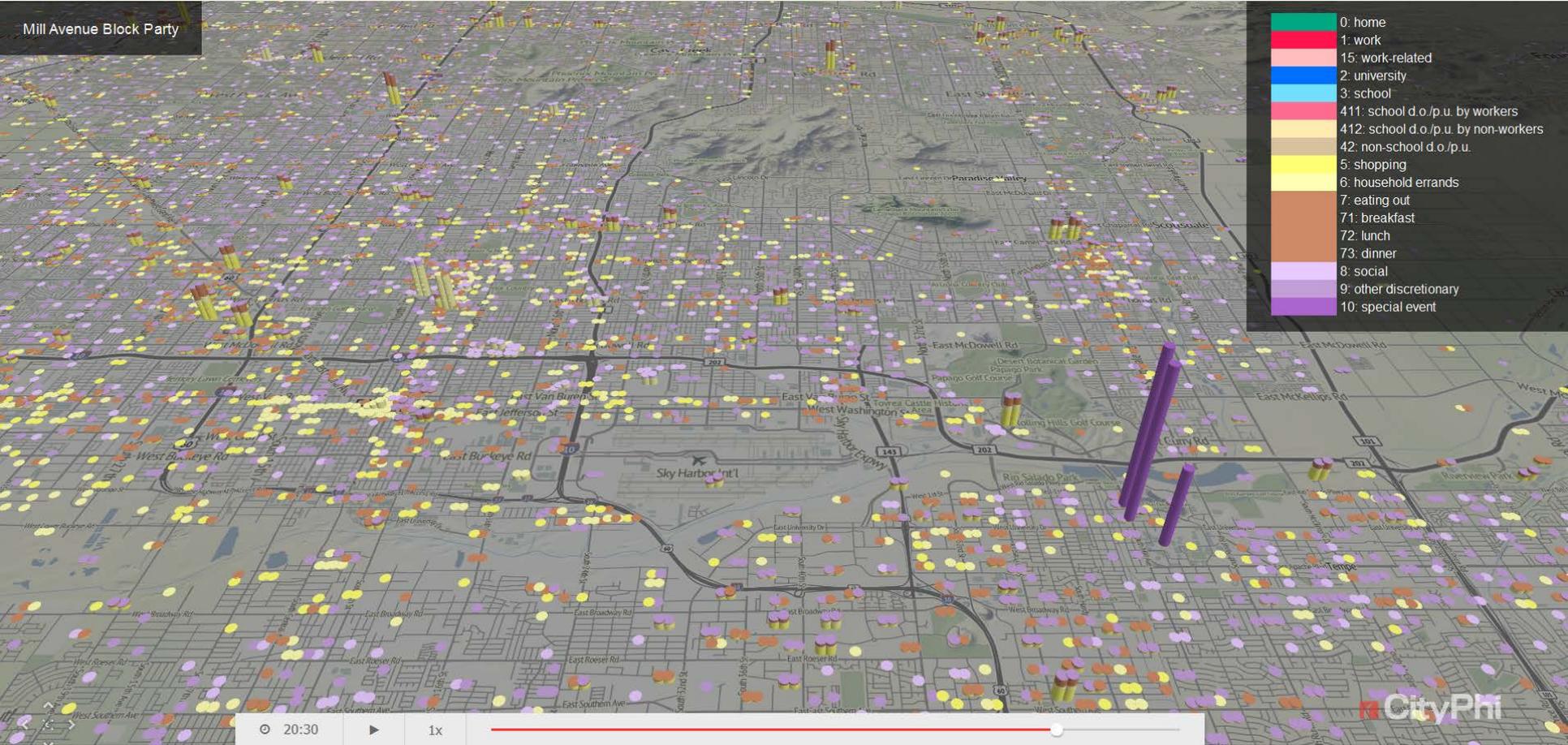
# Validation – Full-Time Worker: Departure from Home to Work and from Work back Home



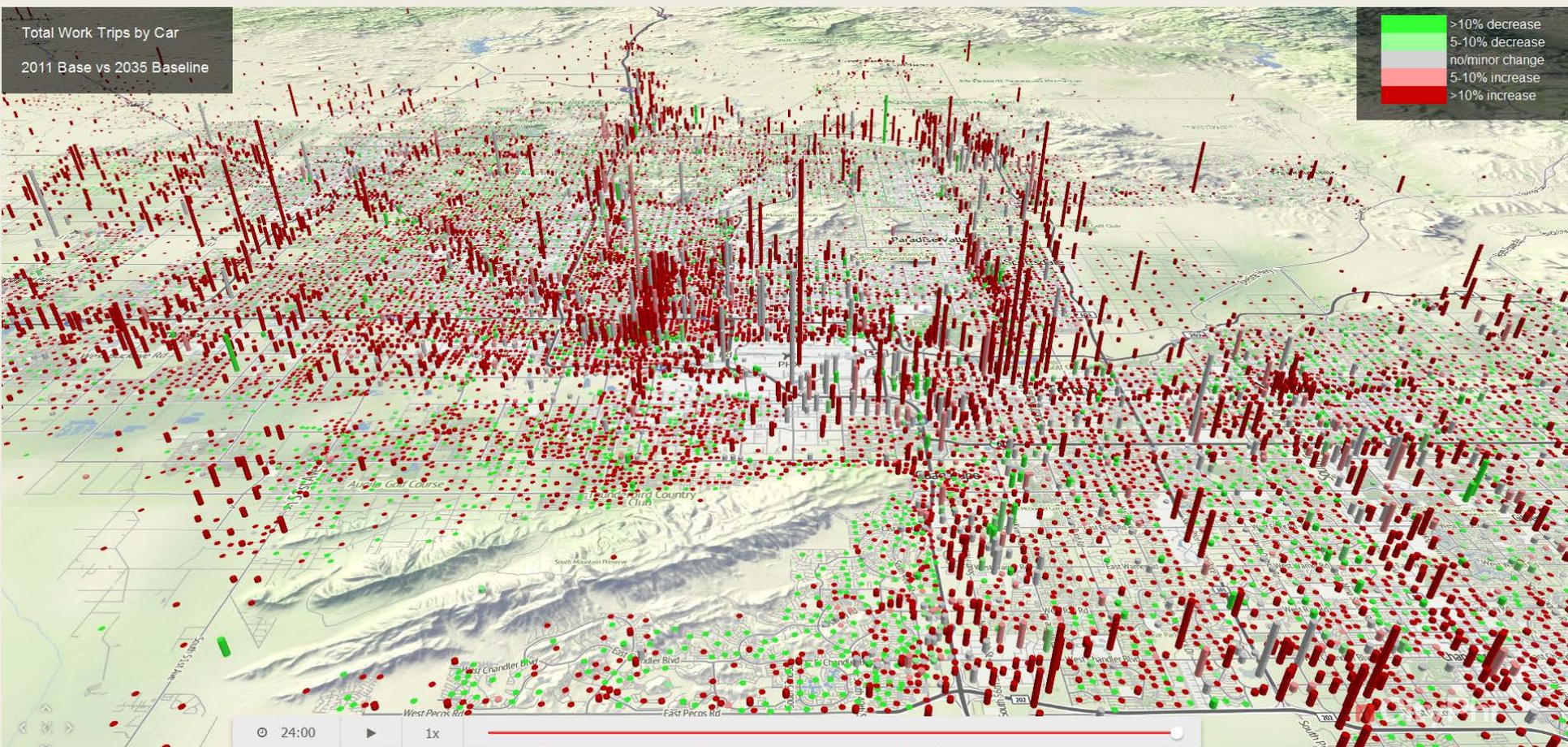
# Scenarios for Sensitivity Tests

- Base year 2011:
  - Base
  - With Special Event (Mill Avenue Block Party)
- Future year 2035:
  - Baseline
  - Commuter rail line
  - Conversion of HOV lanes to HOT lanes
  - 100% Penetration of Connected & Autonomous Vehicles (CAVs)

# Mill Avenue Party 2011 amongst other Non-Work Activities



# 2035 Baseline vs. 2011 Base: Auto Trips to Work

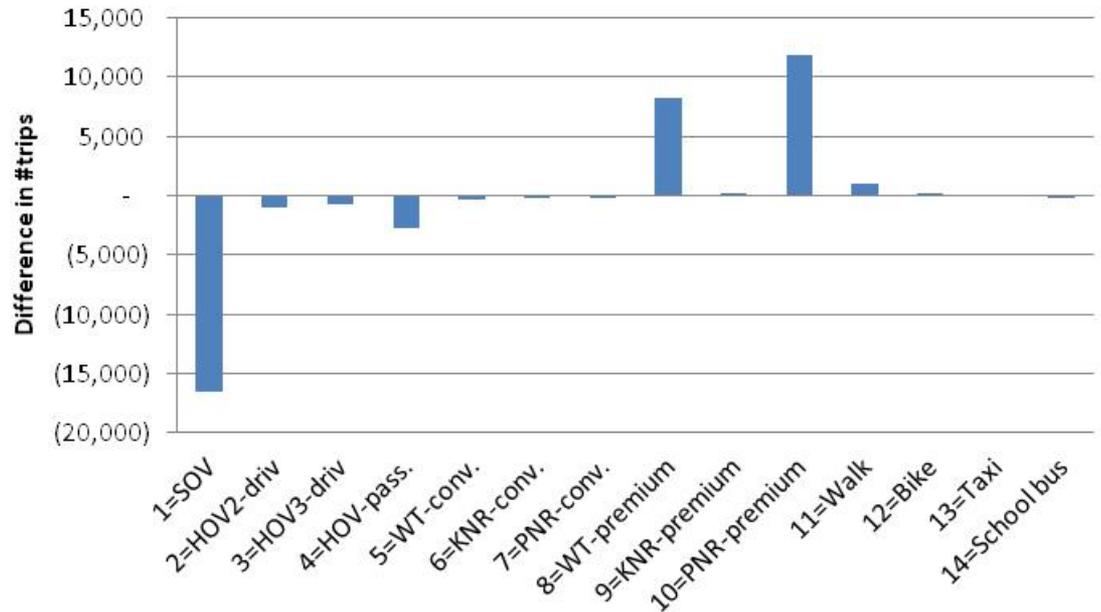


# Impact of Commuter Rail 2035



- Commuter Rail added 20,000 trips daily with more than a half by PNR taken primarily from SOV

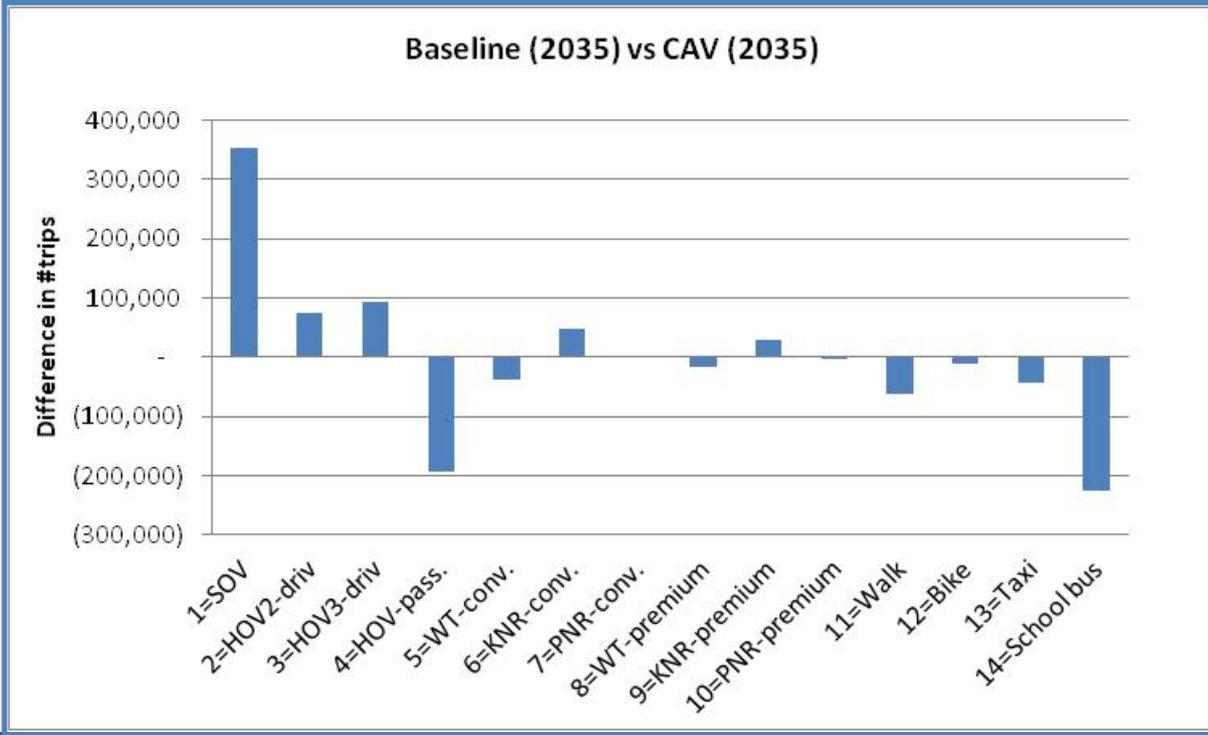
Baseline (2035) vs Tran (2035)



# Impact of Connected Autonomous Vehicles 2035



- Substantial growth in auto “driver” trips
- Elimination of many passenger, walk, taxi, and school bus trips
- Shift of transit users to “Kiss & Ride”



# What's Next?

- Application of the ABM for challenging planning projects, including autonomous vehicles, various road pricing scenarios, planning policy examinations and main regional planning tasks
- Implementation of additional special generators, travel time reliability measures, additional behavioral agent-based features
- Integration with regional Dynamic Traffic Assignment (DTA)
- Implementation of fleet composition models with behavioral modeling of fleet evolution
- Further development of visualization tools