Please visit the link below for webinar recording

12/20/2017

Innovations in MAG Activity-based Model and Incorporation of Travel Time Reliability in Modeling Procedures

https://connectdot.connectsolutions.com/p3hivh4sc98/

TMIP Webinar Series

December 20, 2017

Innovations in MAG Activity-Based Model & Incorporation of Travel Time Reliability in Modeling Procedures

Presented by:

Vladimir Livshits, MAG
Shuyao Hong, MAG
Petya Maneva, MAG
Arup Dutta, MAG
Peter Vovsha, WSP
Jim Hicks, WSP
Kyunghwi Jeon, MAG

MARICOPA ASSOCIATION of GOVERNMENTS

wsp

Outline

- Introduction
- Visualization
- Input Data Preparation
- Incorporation of Travel Time Reliability
- Model Structure and Innovative Features
- Software and Implementation

Advances in Modeling: Trends and Needs

Introduction

Vladimir Livshits, Ph.D.

Fidelity and Complexity (Power vs. Simplicity)

- Increased model fidelity: increased simulation power and sensitivity
  - Advanced models structures and outputs resemble complexities of observed Big Data.
  - Disaggregation and behaviorism: advanced behavioral microsimulation and agent-based models (demand and supply).
  - Advanced model validations and calibrations: regional microsimulation vs. speed data, ABM vs. GPS surveys, modeled GPS trajectories vs. GPS or TLAP data (ITM).
- Increased data and model complexity
  - Need for a specialized expertise for model and software development and data analysis and management (division of labor).
  - Architecture and methods of data analysis, modeling tools and results processing depart from uniform commonly accepted state-of-the-practice structures and methods.

“There is no reason for any individual to have a computer in his home.”

- Ken Olsen. Digital Equipment Corporation founder. 1977.

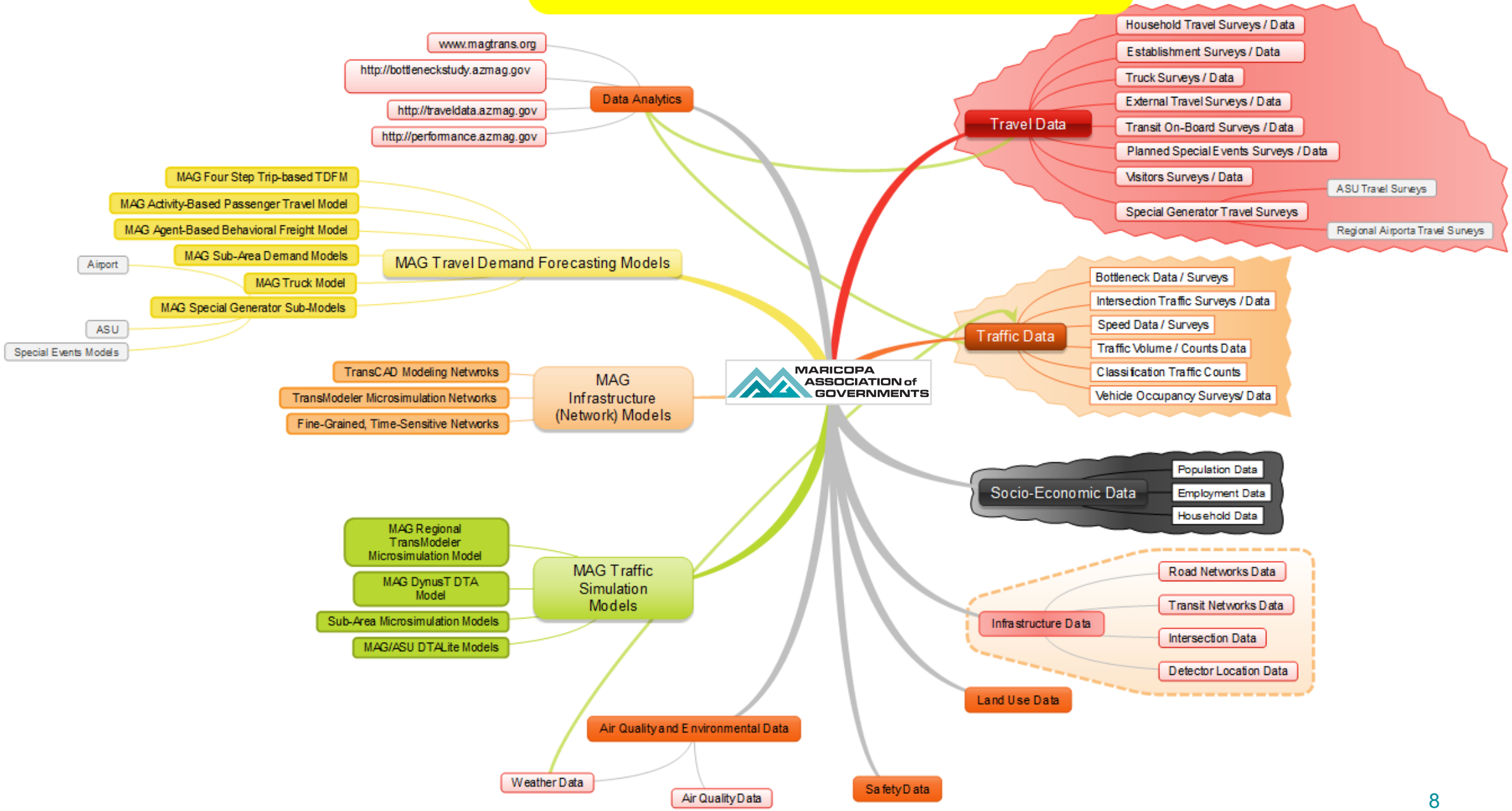
Implementation, Deployment and Application

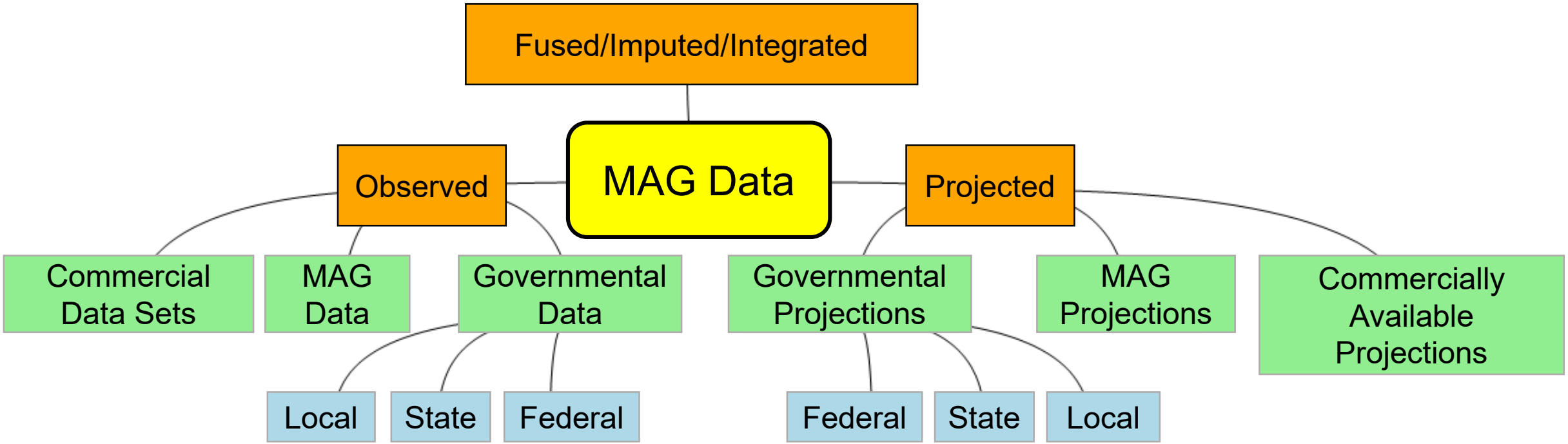
- Data and computing power drives model design and application together with emerging planning needs.
- Big Data applications became State-of-the-Practice in Transportation Analysis, Modeling and Performance Measurement for many MPOs and DOTs.
- Cloud computing and SaaS becomes ubiquitous.
- Data value is being maximized with Data Lakes.
- Visualization and advanced analytics became a must have for interfacing with Big Data or state-of-the-art transportation models.

Integration – Vertical and Horizontal

- Integration between economic models, LU, ABM and DTA/Microsimulation, freight and passenger models.
- Integration between data and models in structure, interfaces, applications and methods of analysis, visualization and processing.
- Advanced models become major data integrators.
- Next generation analytical tools and models are tailored to Big Data both observed and simulated in terms of data integration, data visualization and data processing.

Transportation Data and Models: MAG Example




Fused/Imputed/Integrated
MAG Data
Observed
Projected
Commercial Data Sets
MAG Data
Governmental Data
Governmental Projections
MAG Projections
Commercially Available Projections
Local
State
Federal
Federal
State
Local

Visualization

Shuyao Hong

Glimpse at Key ABM Outputs

Disaggregate file for households

Column
hhid
pumsSerialNo
homeTaz
homeMaz
hhsize
numFtWorkers
numPtWorkers
numUnivStuds
numNonWorkers
nunmRetired
numDrivAgeStuds
numPreDrivStuds
numPreshcool
hhIncomeDollars
hhNumAutos
dwellingType

Disaggregate file for persons

Column	Definition
hhid	
pnum	
pumsSerialNo	
persType	
persTypeDetailed	
age	
gender	
industry	
schlGrade	
educLevel	
workPlaceType	
workPlaceTaz	
workPlaceMaz	
schoolType	
schoolTaz	
schoolMaz	
dailyActivityPattern	
specEvtParticipant	
jointTour1Role	
jointTour2role	
obPeChauffBund1	
obPeChauffBund2	
obPeChauffBund3	
obRsChauffBund	25. Outbound ride
obPePassBund	26. Outbound pur
obRsPassBund	27. Outbound ride
ibPeChauffBund1	28. Inbound pure
ibPeChauffBund2	29. Inbound pure
ibPeChauffBund3	30. Inbound pure
ibRsChauffBund	31. Inbound rides
ibPePassBund	32. Inbound pure
ibRsPassBund	33. Inbound rides
studentDorm	34. Student dorm
studentRent	35. Student rent i
activityString	36. Daily activity s
transitPass	

Disaggregate file for fully joint tours

Column	Definition
hhid	
jointTourNum	
chauffPnum	
passPnums	
partySize	
partyType	
party	
origTaz	
origMaz	
primaryDestTaz	
primaryDestMaz	
tourPurpose	
chauffTourMode	
passTourMode	
prelimDepartInterval	
finalDepartMinute	
prelimArriveInterval	
finalArriveMinute	
totalObStops	
totalIbStops	
obStopSeq	
ibStopSeq	

Disaggregate file for partially joint tours / school escort bundles (csv)

Column	Definition
hhid	1. Household ID
direction	
obBundleNum	
obBundleType	
ibBundleNum	
ibBundleType	
chauffPnum	
child1Pnum	
child2Pnum	
child2Pnum	
partySize	
party	
homeTaz	
homeMaz	
chauffTourNum	
chauffTourPurp	
chauffPrimDestTaz	
chauffPrimDestMaz	
child1TourId	
child2TourId	
child3TourId	
child1PersTripId	
child1SchoolTaz	
child1SchoolMaz	
child2PersTripId	
child2SchoolTaz	
child2SchoolMaz	
child3PersTripId	
child3SchoolTaz	
child3SchoolMaz	30. School stop 3 MA
obBundelDepMin	31. Outbound bundle
obStop1Min	32. Outbound stop 1
obStop2Min	33. Outbound stop 2
obStop3Min	34. Outbound stop 3
ibStop1Min	35. Inbound stop 1 pr
ibStop2Min	36. Inbound stop 2 pr
ibStop3Min	37. Inbound stop 3 pr
ibBundelerrMin	38. Inbound bundle p
obBundelDepInt	39. Outbound bundle
obStop1Int	40. Outbound stop 1

Disaggregate file for individual at-work sub-tours

Column	Definition
hhid	1. Household ID
pnum	
parentTourNum	
tourSubTourNum	
personSubTourNum	
parentTourMode	
carAvailability	
origTaz	
origMaz	
primDestTaz	
primDestMaz	
subTourPurp	
subTourMode	
prelimStartInt	
finalStartMin	
prelimArriveInt	
finalArriveMin	
totObStops	
totIbStops	
obStopSeq	
ibStopSeq	

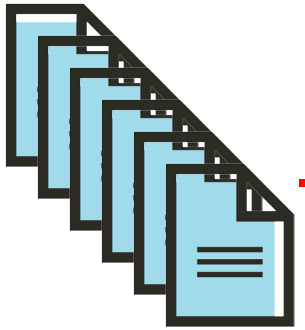
Disaggregate file for individual tours and joint tour participations

Column	Definition
hhid	1. Household ID
pnum	2. Within-the-household person ID
tourNum	
numTourTrips	
numSubTours	
jointTourNum	
fullyJointTourRole	
obBundleNum	
ibBundleNum	
obEscorRole	
ibEscorRole	
jointSpecEvtTour	
origTaz	
origMaz	
primaryDestTaz	
primaryDestMaz	
tourPurpose	
tourMode	
prelimDepartInterv	
finalDepartMinute	
prelimArriveInterv	
finalArriveMinute	
totalObStops	
obSchEscStops	
totalIbStops	
ibSchEscStops	
linkedSpecEv	
obStopSeq	
ibStopSeq	

Disaggregate trip file:

Column	Definition
uniqueid	1. Within-the-household trip ID
jointTripNum	2. Within-the-household joint trip ID
hhid	3. Household ID
pnum	4. Within-the-household person ID
tourNum	5. Within-the-person tour ID (chronological for each person)
tourSubTourNum	6. Within-the-tour sub-tour ID (chronological for each tour)
personTripNum	7. Within-the-person trip ID (chronological for each person)
tourTripNum	8. Within-the-tour trip ID including sub-tours
mainTourTripNum	9. Within-the-tour trip ID excluding sub-tours
subTourTripNum	10. Within the-sub-tour trip ID
jointTourNum	11. Household fully-joint tour ID (0 if individual)
jointTripRole	12. Fully-joint-tour role indicator (1-chauffeur, 2=passenger)
direction	13. Trip direction (1=outbound, 2=inbound)
obBundleNum	14. Household outbound school escorting bundle ID (0 if individual)
ibBundleNum	15. Household inbound school escorting bundle ID (0 if individual)
escortingRole	16. School escorting role indicator in outbound bundle (1=chauffeur, 2=passenger)
jointSpecEvtTour	17. Special event trip indicator (1 if special event trip, 0 otherwise)
party	18. Trip party (comma separated person ids in the party)
origTaz	19. Trip origin TAZ
origMaz	20. Trip origin MAZ
destTaz	21. Trip destination TAZ
destMaz	22. Trip destination MAZ

Complex Data | Effective Visualization | Diverse Audiences



Interactive Visual Analytics Tool → Exploratory Data Analysis → "Power Users"

- Modelers
- Programmers
- Data Analysts

Tailored Video Clips & Images → Targeted message based on model outputs → Everyone else

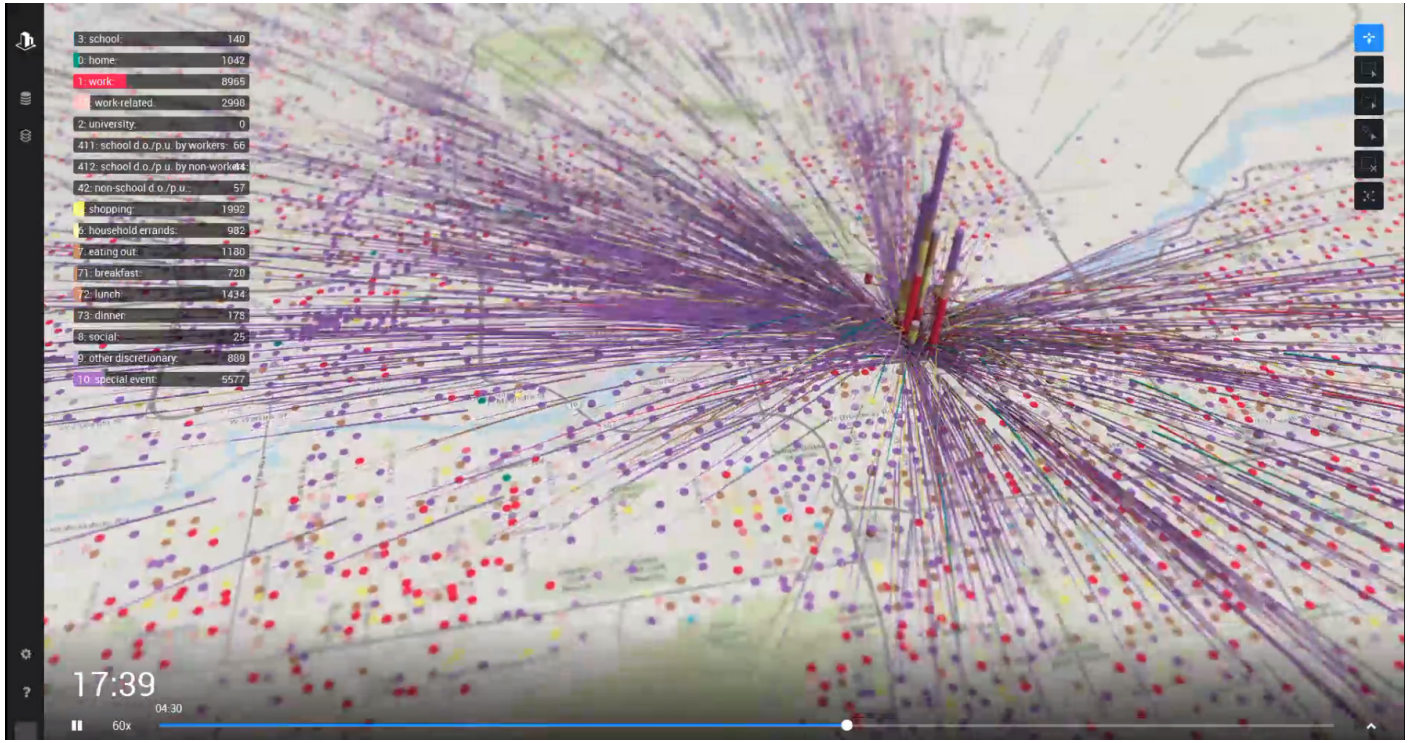
- Planners
- Decision makers
- Stakeholders
- The general public

Clip 1 – MAG ABM Dashboard

- Dash by plotly
  - Python Framework for building visual analytical web applications
  - Back-end: Flask
  - Front-end: React + plotly.js
- Open Source (MIT License)
- Make customized exploratory data analysis easier without relying on off-the-shelf BI software.

Clip 2 – Example: Special Event Movement

- CityPhi *by* INRO
- CityPhi + Python + Jupyter
- Utilize the power of GPU to visualize large amount of data dynamically.



Clip 3 – Example: Worker by Education Attainment

- Mapbox GL JS *by* mapbox
  - JavaScript library that uses WebGL to render interactive maps on web browser.
- Open Source (BSD 3-Clause)
- Actively maintained and developed library with greater control over UI and styling mapping features.

Input Data Preparation

Petya Maneva

Types of Data Needed by MAG ABM

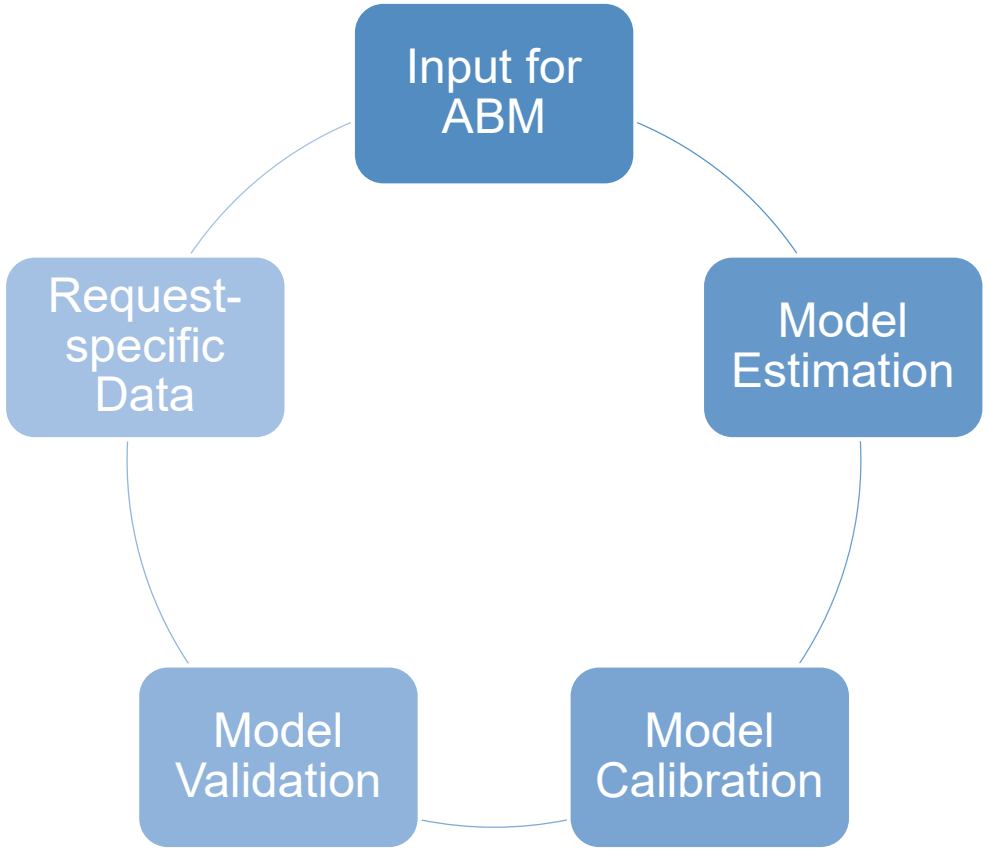


Image courtesy of WiseGeek.com

Roadway Network

Transit Network

Socio-economic Data

Employment Data

Child Care Facilities

K-12 Schools

Area Type for Schools

School Attendance Boundaries

Arizona State University

Other Higher Education Institutes

Public Use Microdata Sample (PUMS)

Special Event

Transit Travel Survey

Household Travel Survey

Business Establishments

Request-specific Data

Traffic Counts

Speed

Roadway Network

Transit Network

Sources

Roadway Network:

- Transportation Improvement Program
- Freeway Program
- Arterial Life Cycle Program

Transit Network:

- The Regional Transit Planning Agency – Valley Metro
- City of Phoenix

Processing

Coded and Maintained in-House

Usage

Inputs for Network Skimming and Assignment

Socio-economic Data

Sources

A Non-Exhaustive List:

County Assessor's Data, Existing and Projected Land Use, General Plans, Amendment to General Plans, Real Estate Developments, Residential Completions, Apartments and Mobile Homes, Retirement Zones from MAG Member Agencies, Decennial US Census, American Community Survey, Population Projections of the State Demographer's Office, MAG Employment Database, Bureau of Labor Statistics, US and Arizona Departments of Education, Arizona Department of Human Services, Arizona State University (ASU), Arizona Office of Tourism

Processing

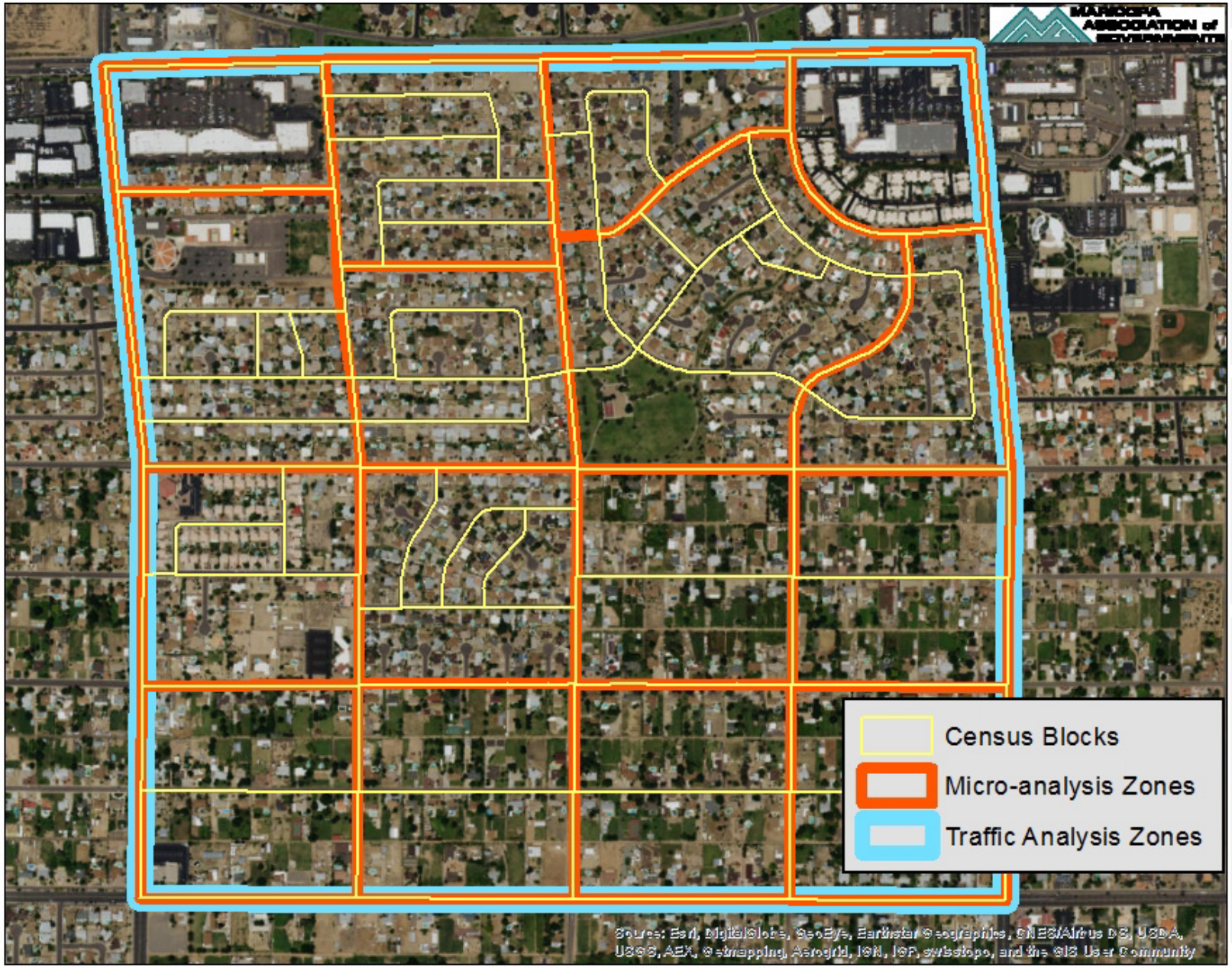
Compiled In-House from the Above Data Sources at Micro-Analysis Zone Level to provide higher spatial resolution compared to Traffic Analysis Zones (TAZ)-level.

Usage

Input for the Accessibility Calculator, Population Synthesis, Location Choice Sub-models

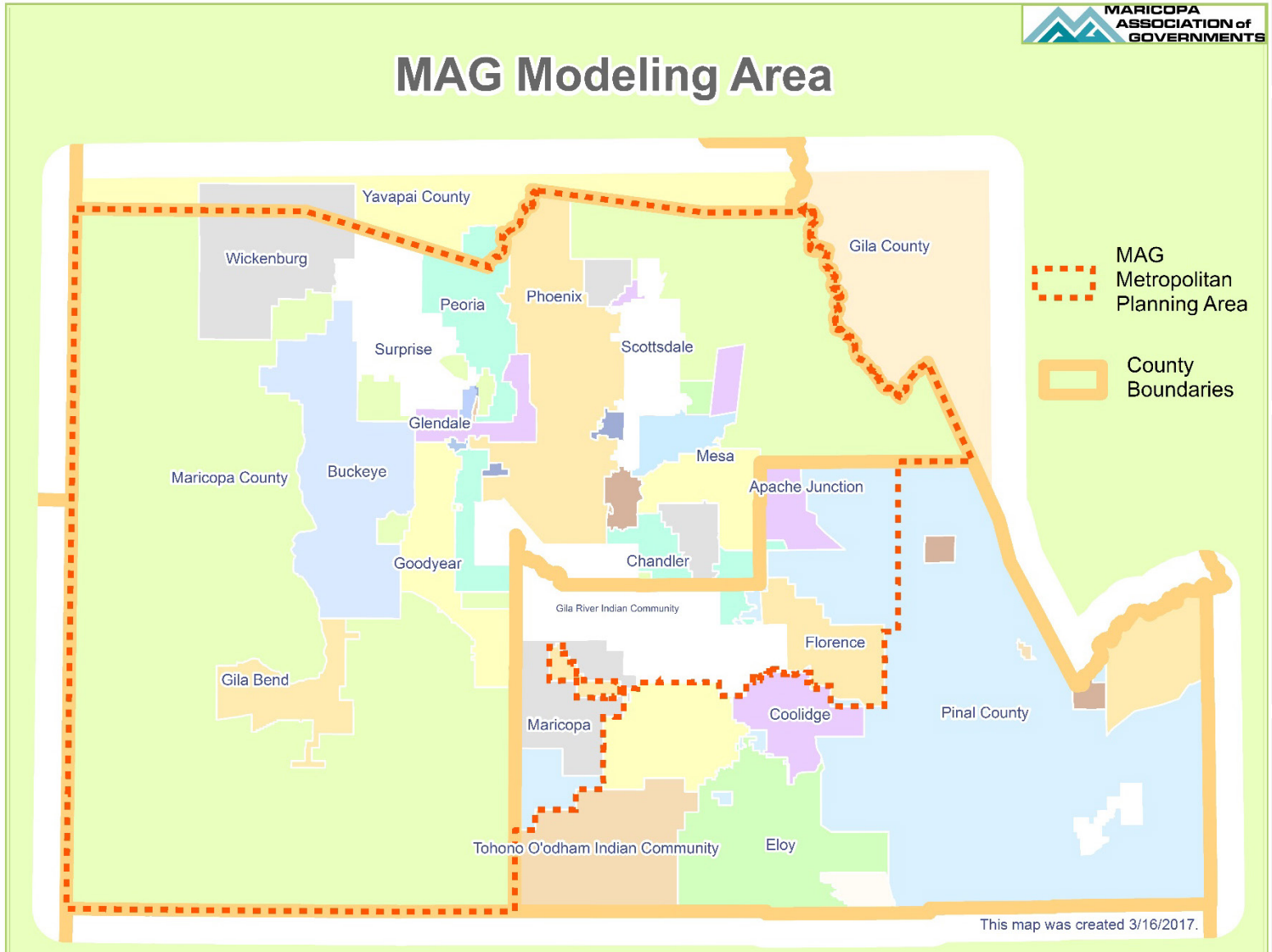
Census Blocks – The Building Blocks For MAZ

- Census Blocks Are Grouped in MAZs Based on their Population.
- MAZs Nest in TAZs.
- Aerial Photography and Online Mapping Services Inform Boundary Delineations.



Other Data to Consider when Delineating MAZs

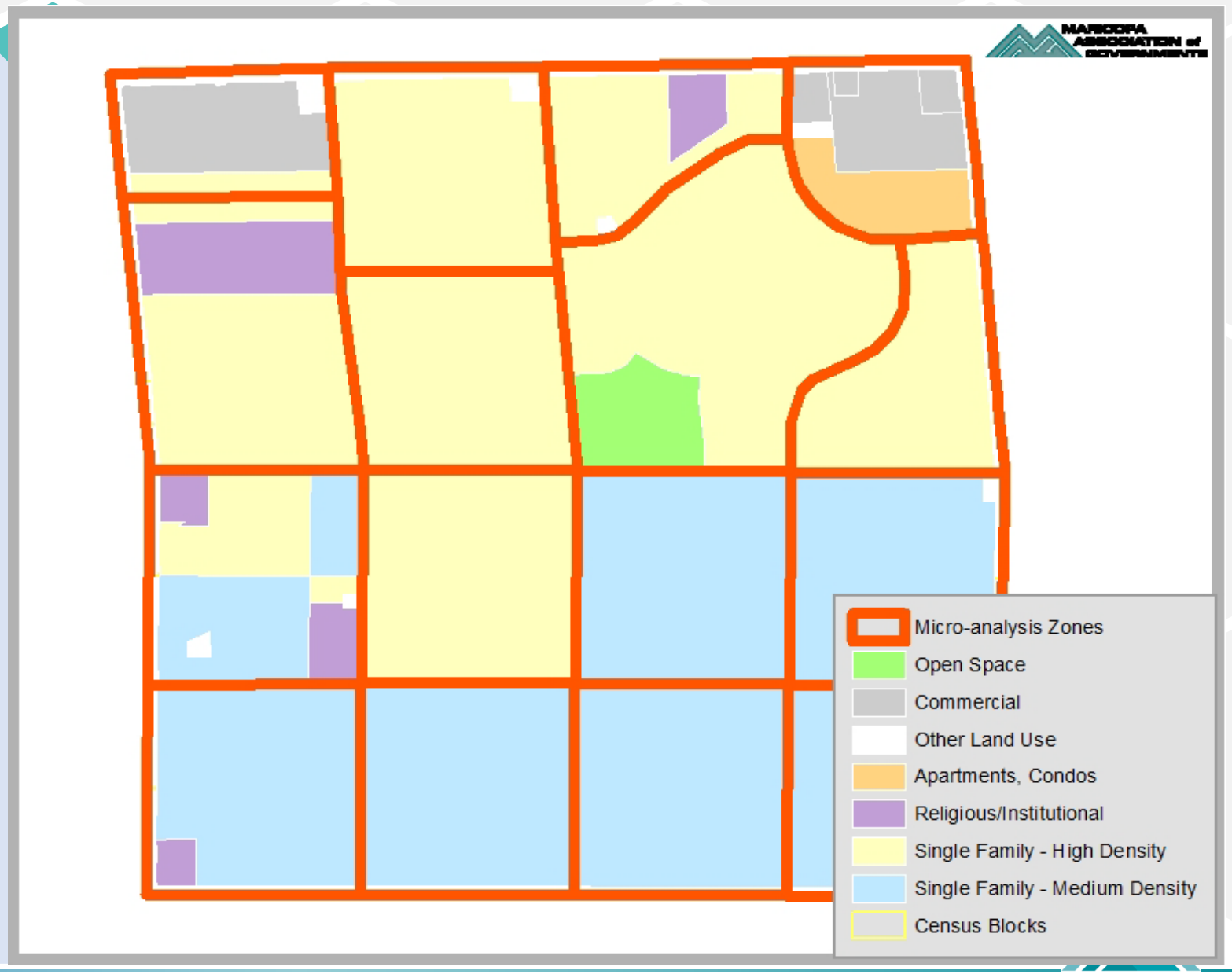
- County Boundaries, Municipal Planning Boundaries Are of High Priority.
- Highways and Roadways Split the Block Groups.
- MAZs Are Smaller Alongside Transit Corridors.

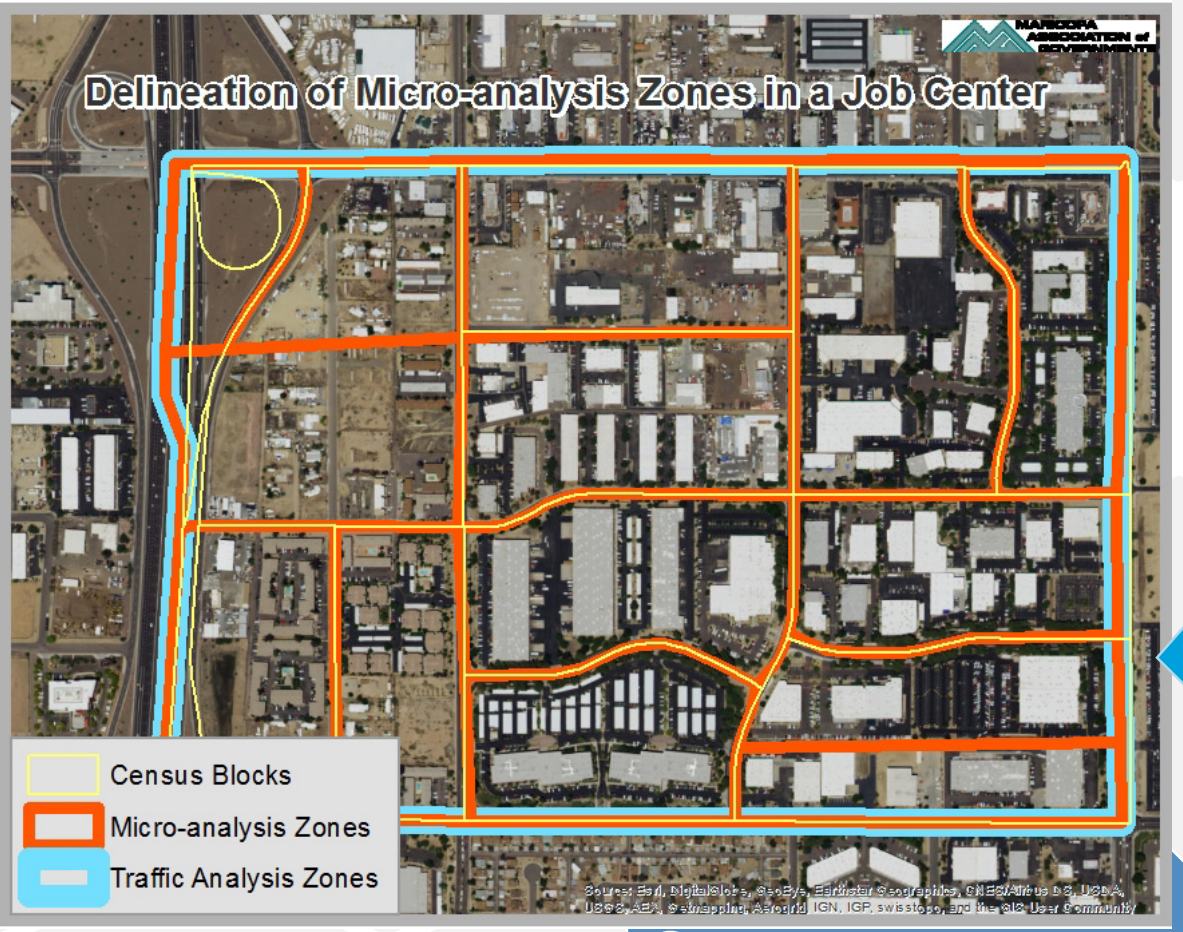


Area: 16,080 Square Miles Population: 4,916,000 Employment: 2,050,000

More requirements for MAZ Boundaries

- Land Use Is a Factor in Shaping MAZ Boundaries.
- Special Events Venues Can Be Separate MAZs.
- Topographic Features Play a Role as Well.





Employment Data

Impact of Employment Data:
- Higher Concentration of Jobs Leads to Smaller Size of MAZs.
- Census Block Can Be Split Based on Employment Characteristics

Sources

- InfoGroup
- Dun & Bradstreet Databases
- MAG Member Agencies
- US Bureau of Labor Statistics

Processing

Compiled In-House

Usage

Input for the Accessibility Calculator, Population Synthesis, Location Choice Sub-models

Child Care Facilities

K-12 Schools

Sources

Child Care Facilities - Locations and Capacities: Arizona Department of Human Services, Child and Family Resources

Schools K-12 – Location and Enrollment: Arizona Department of Education, School Districts

Processing

Compiled In-House

Usage

Modeling Escorting Trips to Child Care Facilities and Schools in the Long-Term Work/School Location and Arrangements

Area Type for Schools

Sources

Urbanized Areas by the US Census Bureau, MAG Population Projections, Administrative Boundaries

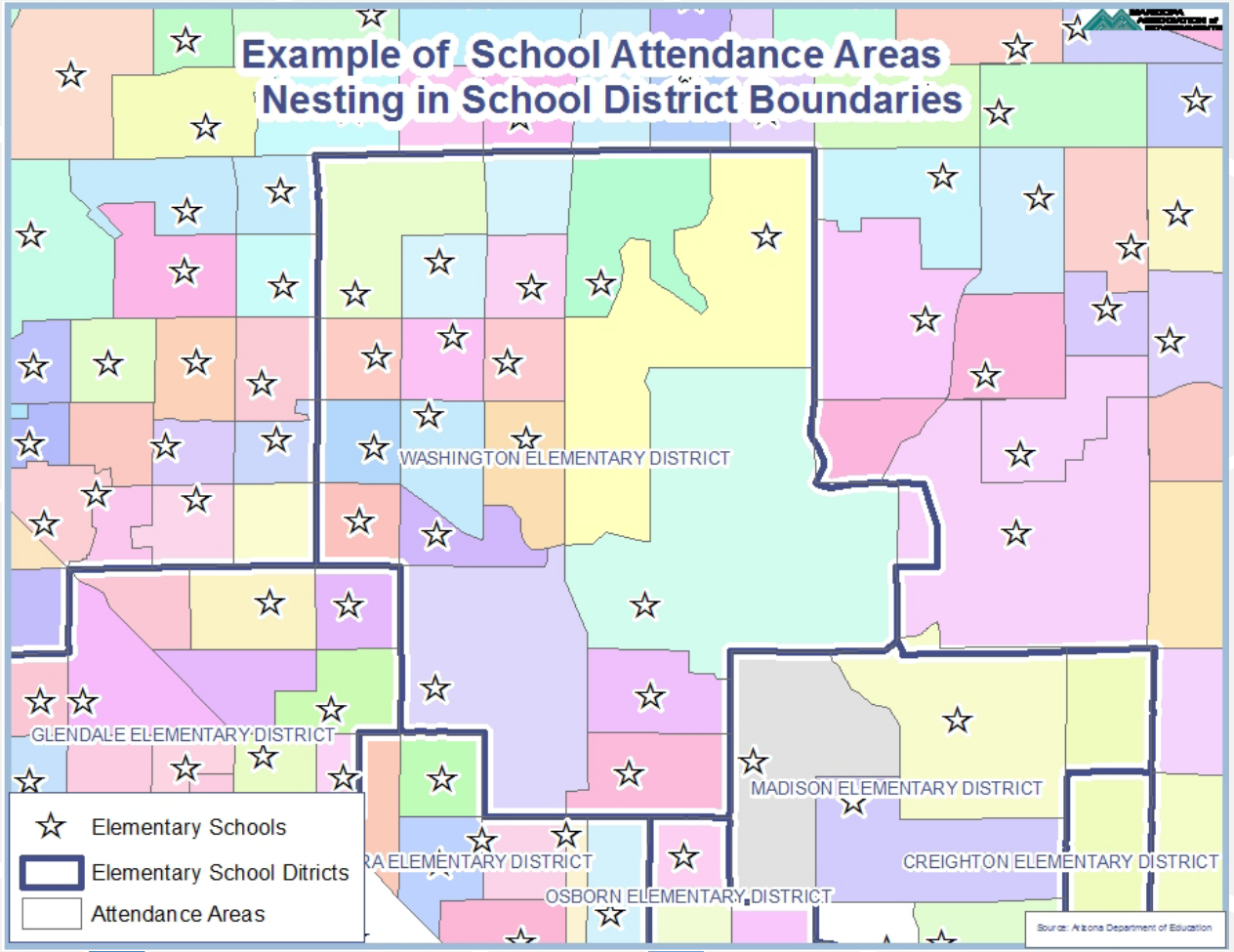
Processing

Generated In-House, Automatic Procedure

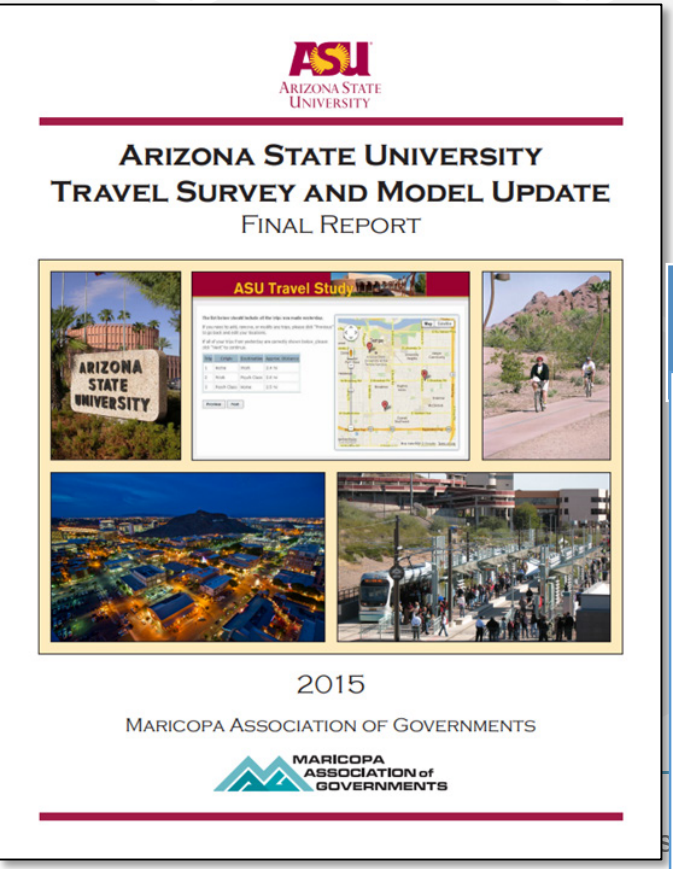
Usage

To Assess the Trip Length and Duration of Escort Trips to School In the Long-Term Work/School Location and Arrangements Sub Model

School Attendance Boundaries



Sources	Processing	Usage
Arizona Department of Education, School Districts	Compiled In-House	Input to the Long-Term Work/School Location and Arrangements Sub- Model



Arizona State University

Other Higher Education Institutes

Sources

For ASU: ASU Travel Survey, Arizona Board of Regents, ASU Faculty, US Department of Education

For other colleges: From the Institutions Themselves

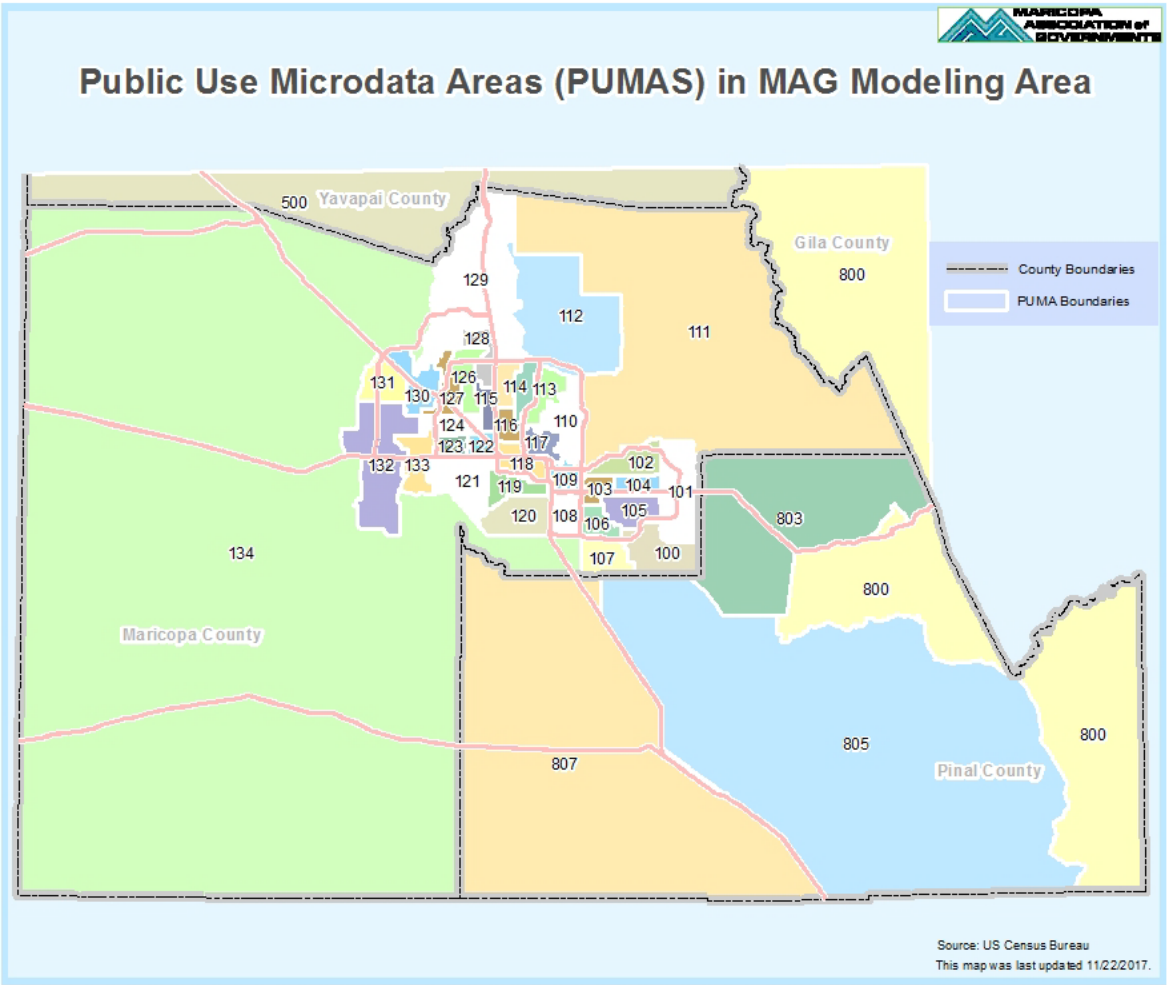
Processing

Raw survey files were cleaned up and processed in-house.

Usage

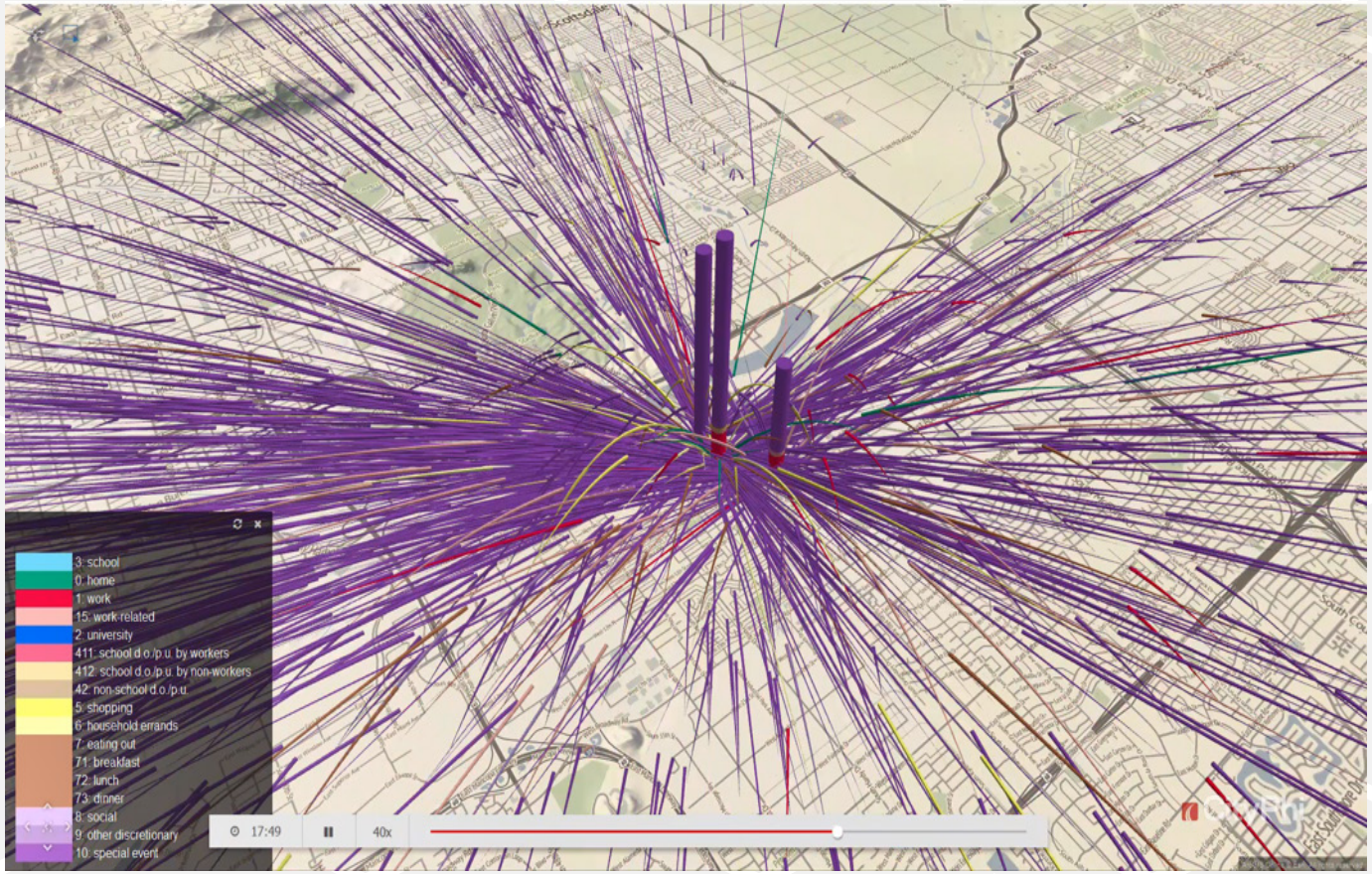
For ASU: Seed Table for the ASU Sub-Model, Input to the Population Synthesis Sub-Model.

For other colleges: University Choice Sub-Model



Public Use Microdata Sample (PUMS)

Sources	Processing	Usage
U.S. Census Bureau	Processed In-House, Automatic Procedure	Seed Table for the Population Synthesis Sub-Model



Special Events

Sources

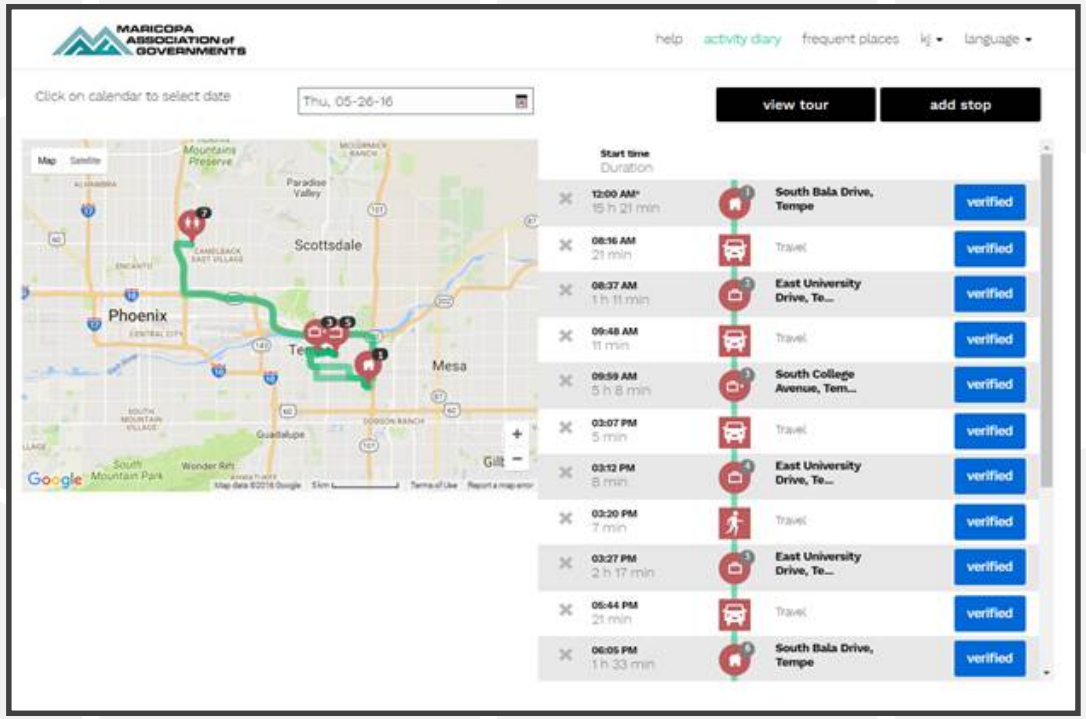
MAG Special Events Survey

Processing

In-House Data Processing and Cleanup of the Raw Survey Files

Usage

Seed Table for the Special Events Sub-Model, Input to the Population Synthesis Sub-Model



Household Travel Survey

Sources

100% GPS Based Household Travel Survey

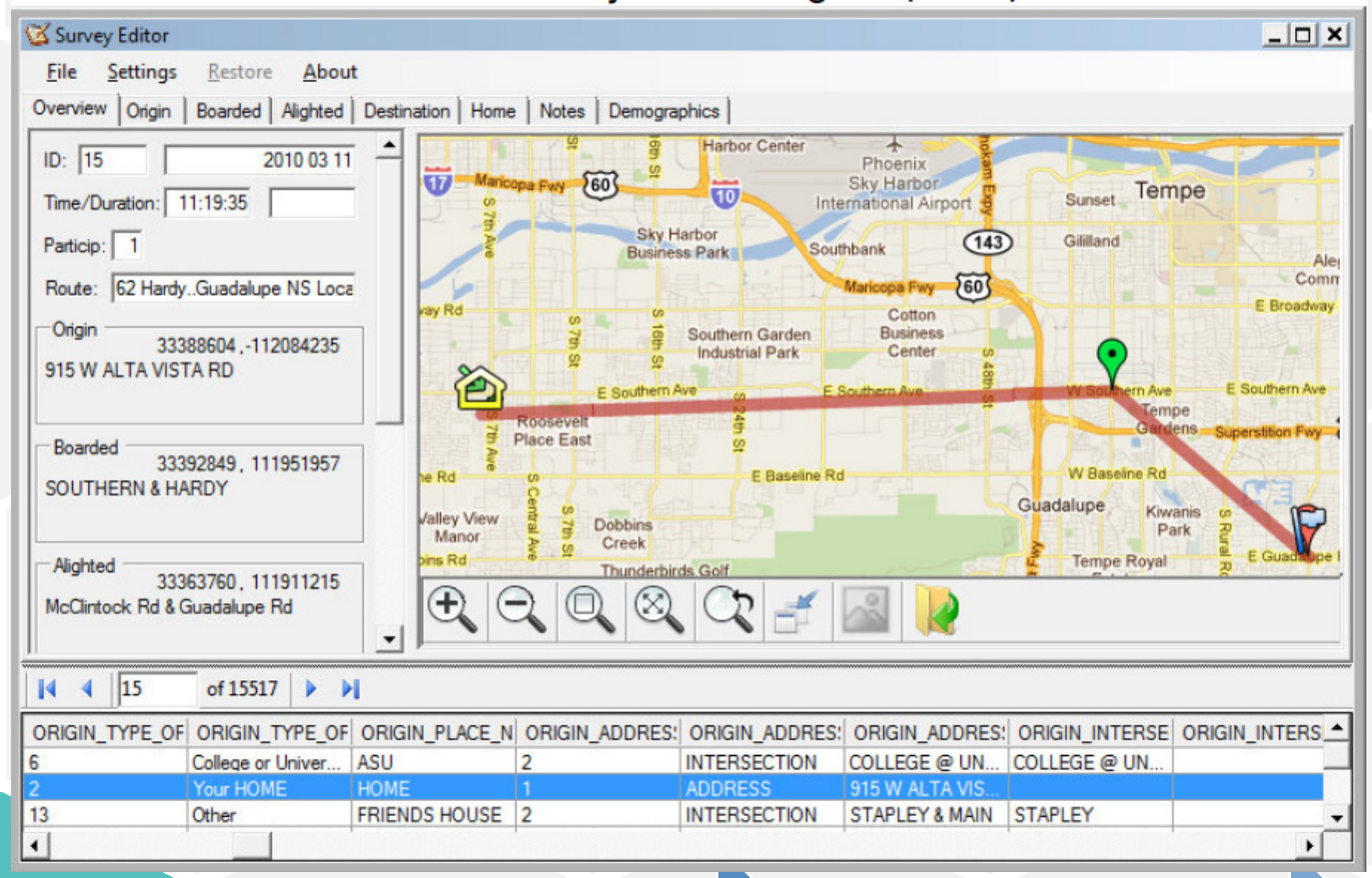
Processing

In-House Data Processing of GPS Files, Travel Diaries, Data Cleanup and Aggregation, Numerous Quality Checks

Usage

Model Estimation, Calibration and Validation and the Individual Schedule Adjustment Module (iSAM)

Visual Survey Editor Program (VSEP)



Transit Travel Survey

Sources

Transit On-board Survey from Valley Metro

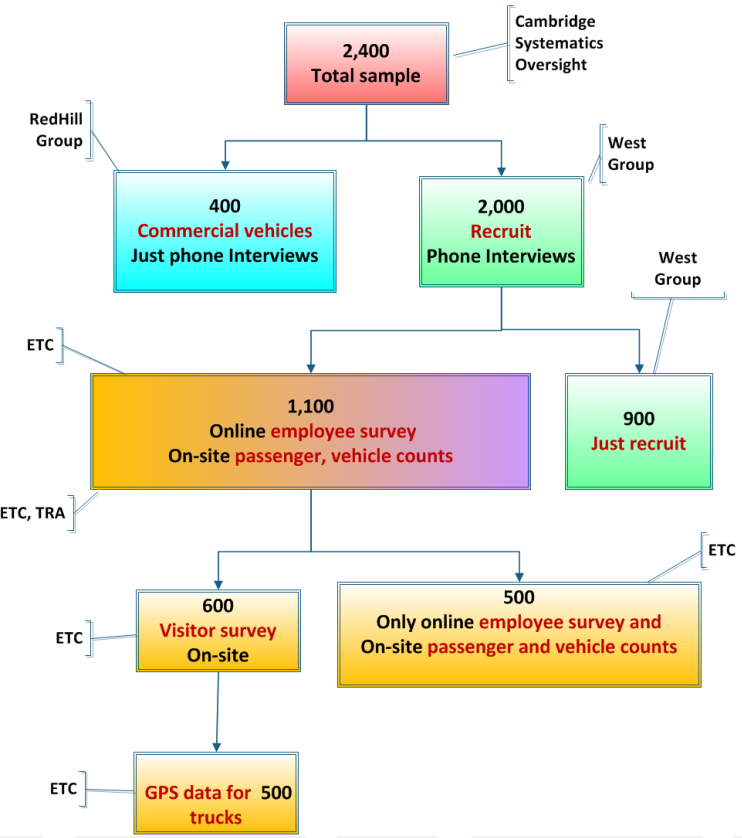
Processing

Data Processing and Cleanup of Survey Results

Usage

Main source of model validation on the transit side

Sampling Plan for MAG 2016 Establishments Survey



Sources

Establishment Survey: Visitors Intercept Survey, On-line Employees Survey, Truck GPS File, Commercial Vehicles Phone Survey

Processing

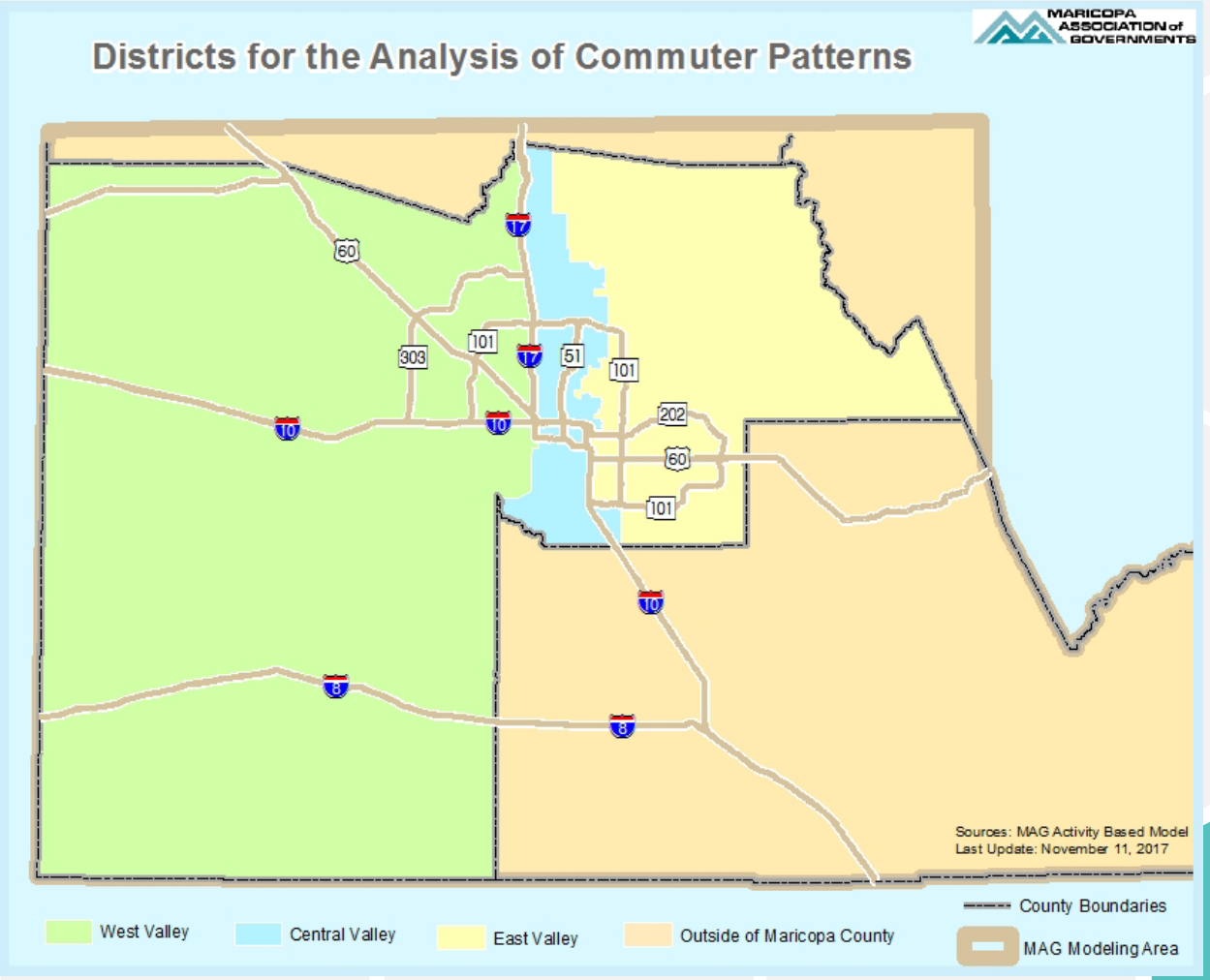
Data Processing and Cleanup of Raw Survey Files, Truck GPS Files and All Other Survey Deliverables

Usage

Model Estimation and Calibration in the Long Term Work Location Choice Sub Model;

Improvement of the location choice models and better addressing supply side of activities

Business Establish-ments



An Example:

Request-specific Data

Sources

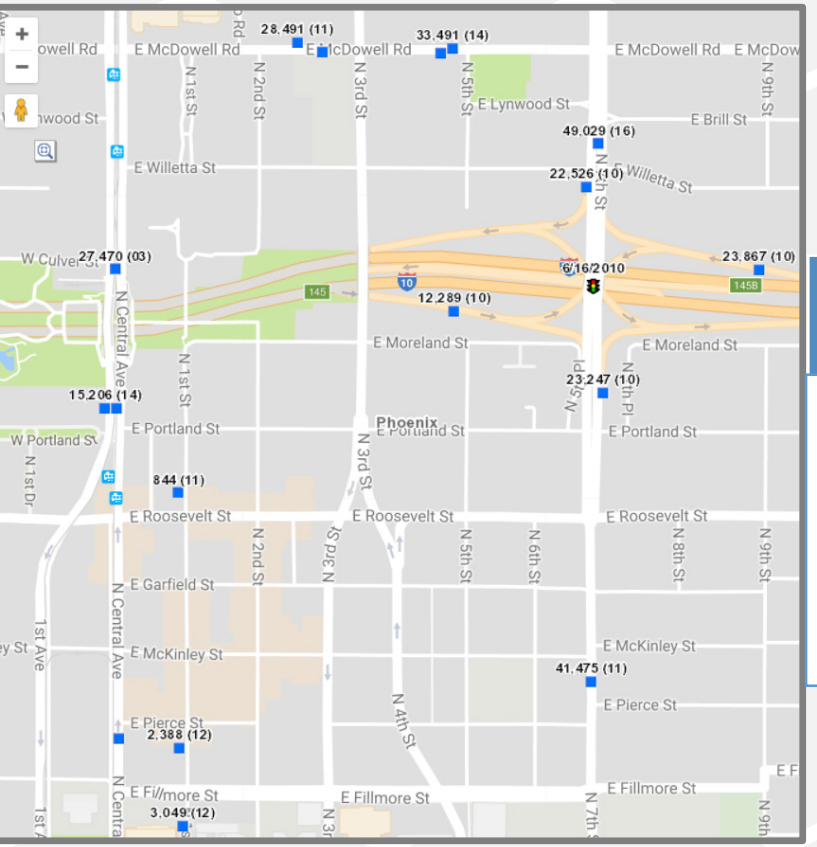
Provided by the Client

Processing

Delineated In-House

Usage

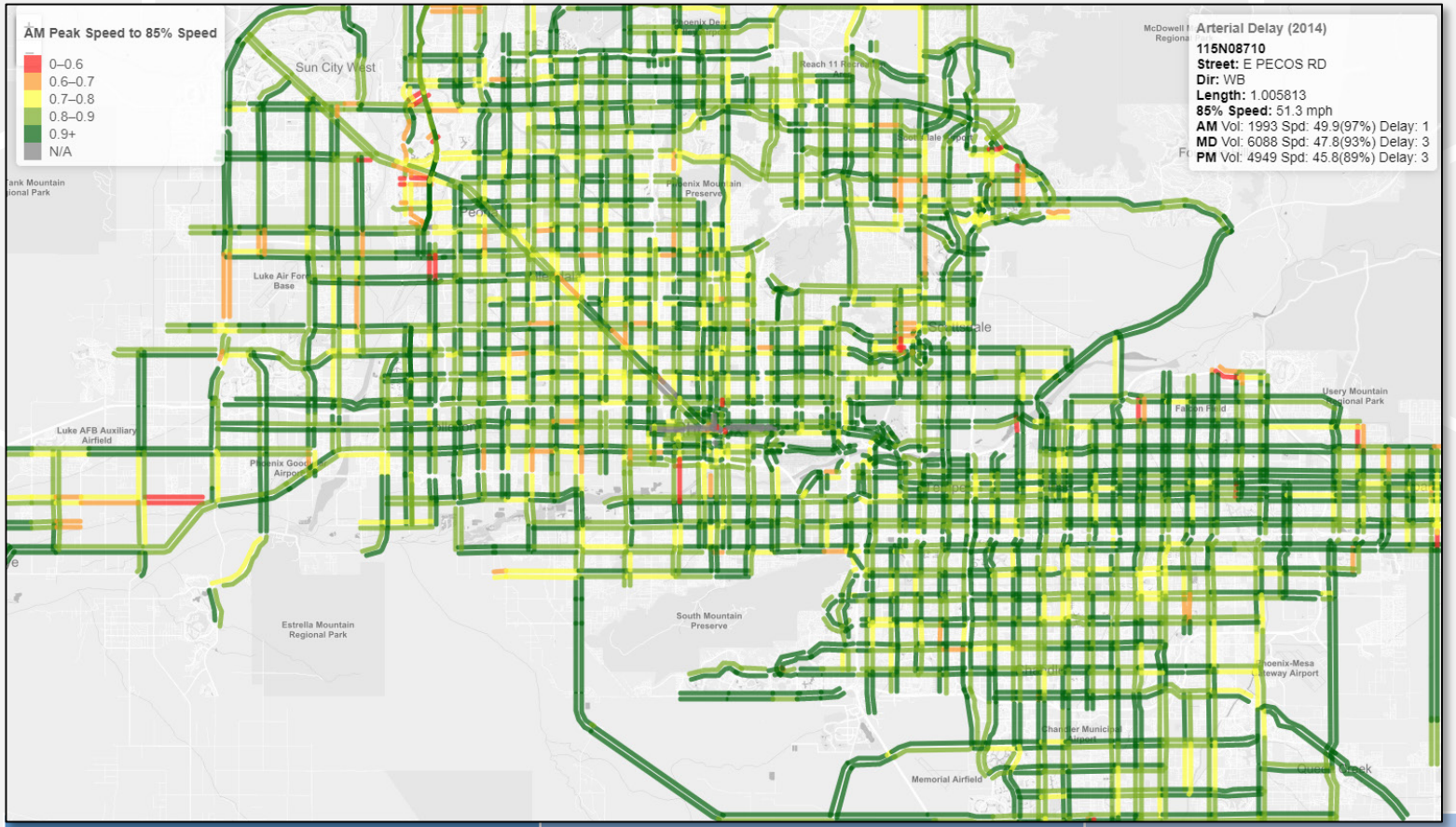
Analysis and Visualization of Commuter Pattern of West Valley Residents



[MAG Transportation Data Management System]

Sources	Processing	Usage
Collected by MAG and MAG Member Agencies	Data Processing of the Raw Traffic Counts Files, Statistical Analysis, Numerous Quality Checks	Model Validation

Traffic Counts



Sources	Processing	Usage
Purchased Commercial Speed Databases & NPMRDS Data	In-House Processing for Average Weekday Speed during Peak Months; Network Conflation.	Model Calibration and Validation, Trend Analysis

Speed

The Challenges

- Quality Checks of Large Databases
- How to Extract Insights from the Data
- Producing Concise, Easy to Manage Datasets from Big Data
- Effective Visualization of Both Raw Data and Model Results

"The Big Thing about Big Data is Big Redundancy"

– Author Unknown

THE DATABASES USED IN ABM ARE INCREASING IN SIZE

How Big Can MAG Data Be:

- Household Travel Survey: 60 GB
- ABM Results: 60 – 80 GB
- 1-yr Speed Data, TMC Based: 26 GB
- 1-yr Speed Data, Link Based: 3.1 TB

How to Handle Large Databases:

- New Procedures and Software Platforms
- New Hardware Architecture, Can Cloud Computing Be a Viable Option?
- Leveraging the Functionality of the Open Source Software

Incorporation of Travel Time Reliability

How can travel time reliability be incorporated in ABM?

Project Team:

Peter Vovsha, Surabhi Gupta

Arup Dutta (Presenter), Vladimir Livshits, Wang Zhang, Haidong Zhu

What is Travel Time Reliability?

- FHWA website defines Travel Time Reliability as:
  - “The consistency or dependability in travel times, as measured from day-to-day and/or across different times of the day”

- Travel Time Reliability in MAG ABM Model
  - Incorporated into path building in static assignment
  - Similar methodology for four step as well as activity based model

Methodology

(1) Construction of link level reliability measures

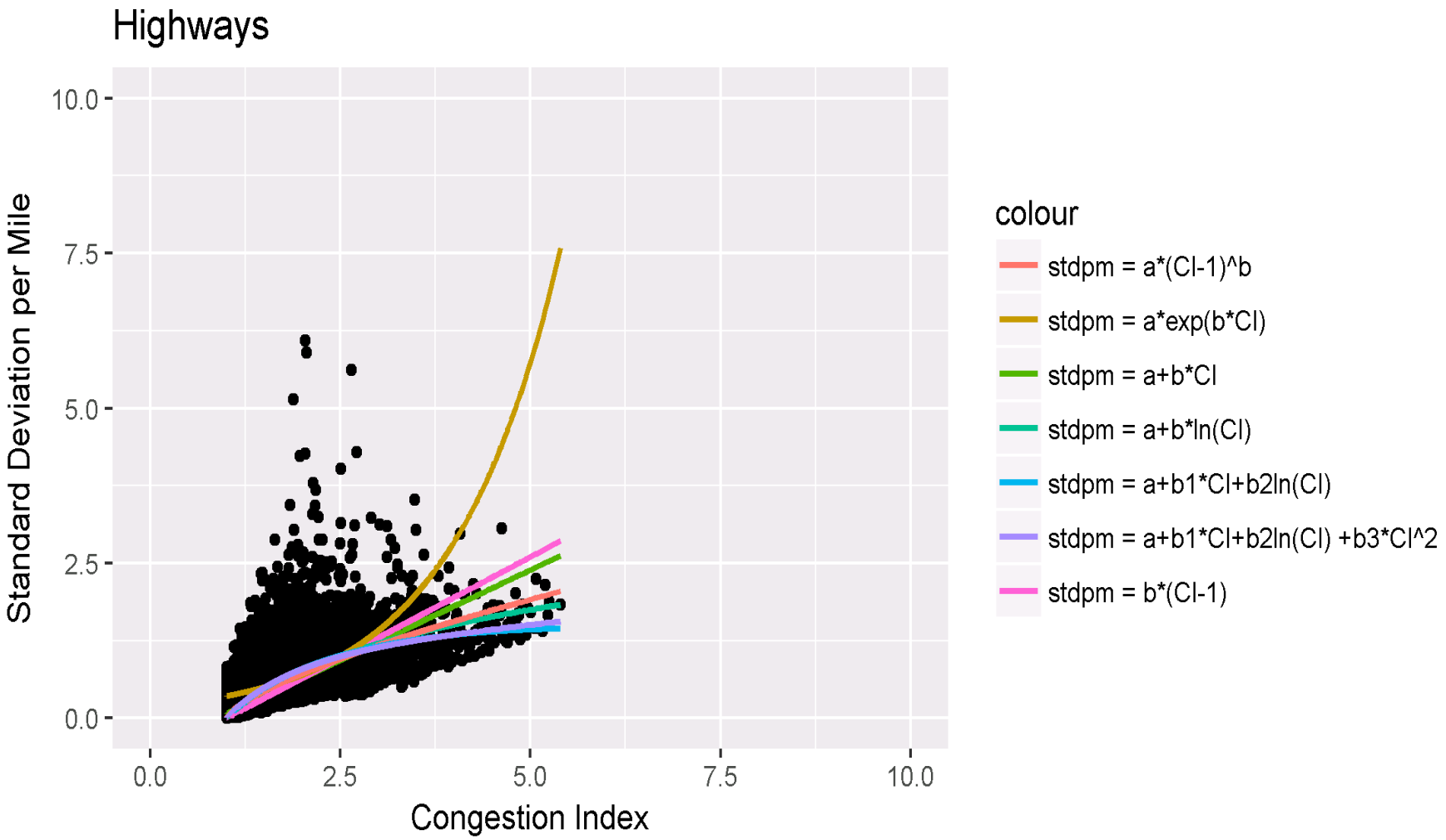
(2) Construction of Origin-Destination (OD) trip reliability estimates based on the link level reliability measures

(3) Update link generalized cost function with OD trip reliability estimate (Volume Delay Reliability Function-VDRF)

Link Level Reliability Measures

- Adopted form:
  - SD per mile as function of Congestion Index (CI)
  - CI = Mean congested time / free-flow time
- Data Sources:
  - 2015 HERE Data
    - 18,000 links in Phoenix metropolitan area
    - Travel time and speeds averaged with 15 minute intervals (epochs) for entire day
    - Regular weekdays for 6 representative months in Fall and Spring were used (>100 days)
  - MAG regional planning network used for additional variables

MAG Link-Level Functions for Highways



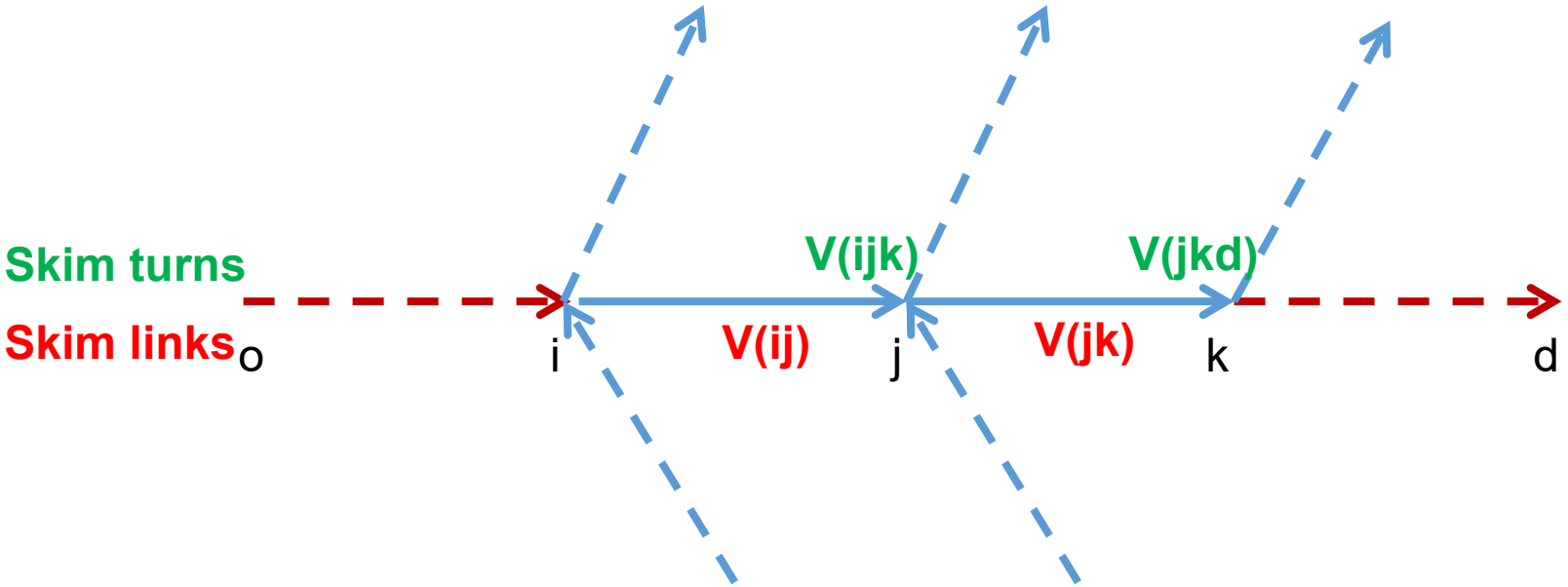
Regression Models for Link SD per mile

Variable	Freeways		Arterials		Collectors		Ramps	
	Coeff.	T-stat	Coeff.	T-stat	Coeff.	T-stat	Coeff.	T-stat
R^2	0.663		0.606		0.463		0.523	
Intercept	0.026	0.8	-0.016	-0.4	-3.750	-64.8	-0.1000	-0.7
CI	0.092	2.6	0.054	0.8	4.267	71.6	0.241	1.5
LN(CI)	1.201	36.9	0.677	16.0	-3.760	-46.2	0.322	2.4
CI^2	-0.017	-3.9	0.243	29.8			0.202	8.1
CI×Lanes	-0.030	-98.6	-0.015	-46.5				
CI×LaneChange	-0.003	-7.3						
CI×SignalDown			-0.004	-8.3			-0.022	-14.3
CI×StopDown			-0.008	-2.0			0.034	7.6
CI×RoundAbtDown			-0.020	-3.6			-0.067	-4.2
CI×SignalUp			-0.018	-39.9			-0.046	-32.3
CI×StopUp			-0.013	-3.4			0.088	23.2
CI×RoundAbtUp			-0.035	-6.4			0.031	1.9

Main theoretical and practical issue

- Link-level VDRF is only a first step
- OD SD is not additive by link in general case:
  - OD SD is additive by link only if link travel times are perfectly correlated:
    - Greatest theoretical OD SD
  - OD Variance is additive by link if travel times are independent:
    - Smallest theoretical OD SD
  - General case:
    - Somewhere in between these two extremes
    - Requires a measure of demand correlation along the path
- Our contribution is the OD level analysis

Demand Commonality Skims (between consecutive links)



$$\text{(Independent) } 0 \leq \frac{\sum V(ijk)}{\sum V(ij)} \leq 1 \text{ (Perfect correlation)}$$

Data Source for OD Level Estimations

- OD reliability database
  - Skimming of HERE data between OD pairs for OD level reliability measures
  - 100 TAZ's uniformly distributed across region for statistical estimation
    - ~10,000 OD pairs
  - Skim same epoch across multiple days for HERE link travel time data
  - Calculate mean and SD

Construction of OD Reliability Measure

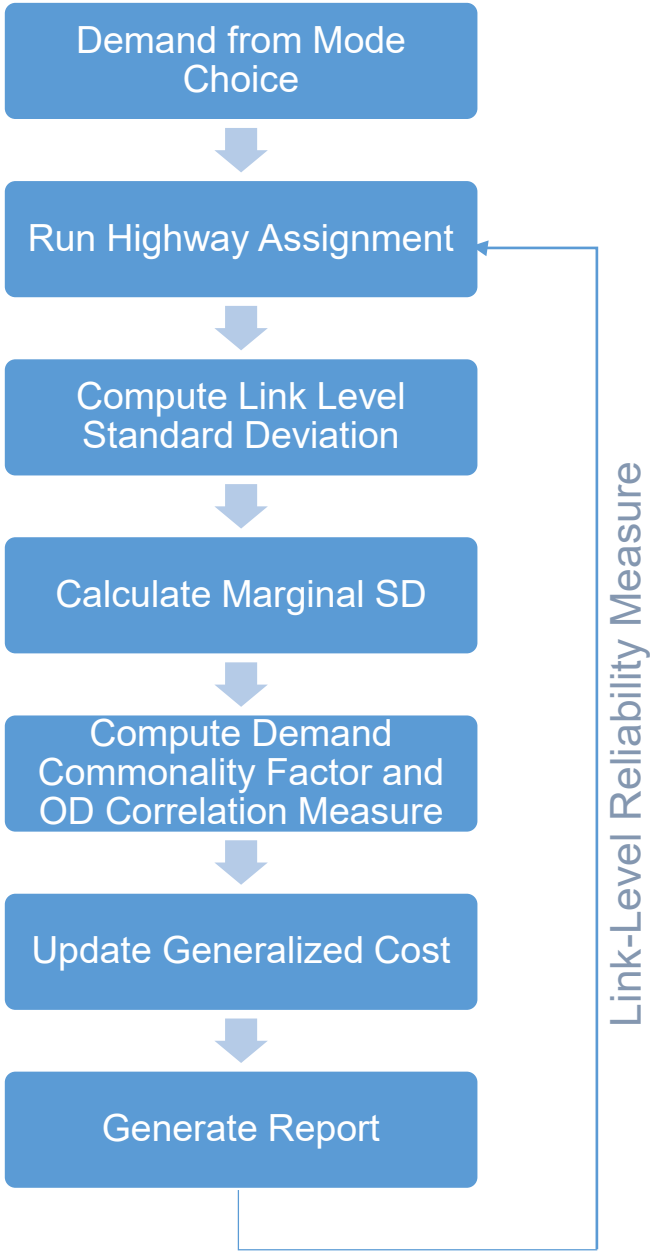
- SD_OD = α*SD_skim + β*VAR_skim^0.5
  - Measure of link correlation
  - β=1 - α
- Factors affecting α, β :
  - (D) Demand commonality (0-1): Higher correlation, bigger α, smaller β
  - (L) Trip length: Lower correlation, smaller α , bigger β
  - (F) Freeway proportion (0-1): Higher correlation, bigger α, smaller β
- α = D*(b – c*L + d*F) and β=1 - α

Estimated Constrained Model for OD SD

Variable	Notation for variable	Notation for coefficient	Coefficient value	T-stat for coefficients and R^2 for model
Constrained Model				R^2=0.938
Square root (SQRT) of OD skim of Variance (VAR)	$\underline{\sigma}_{od}$		1.0 by specification	N/A
Difference between OD skim of SD and SQRT of OD skim of VAR multiplied by demand commonality	$(\bar{\sigma}_{od} - \underline{\sigma}_{od}) \times D_{od}$	b	0.2438	363.4
Difference between OD skim of SD and SQRT of OD skim of VAR multiplied by trip length and demand commonality	$L_{od} \times (\bar{\sigma}_{od} - \underline{\sigma}_{od}) \times D_{od}$	$-c$	-0.0008	-127.7
Difference between OD skim of SD and SQRT of OD skim of VAR multiplied by freeway proportion and demand commonality	$F_{od} \times (\bar{\sigma}_{od} - \underline{\sigma}_{od}) \times D_{od}$	d	0.1792	208.8

Implementation

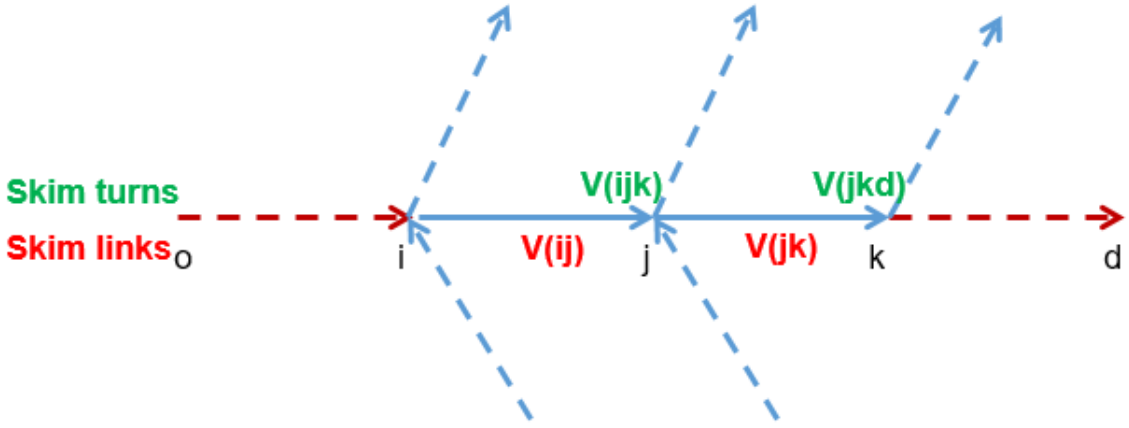
- VDRF and OD reliability regressions:
  - Hard Coded in the Script
- Additional Inputs:
  - Highway Network for Turn Volume Skimming (Created during initialization step)



Turn Volume Skimming

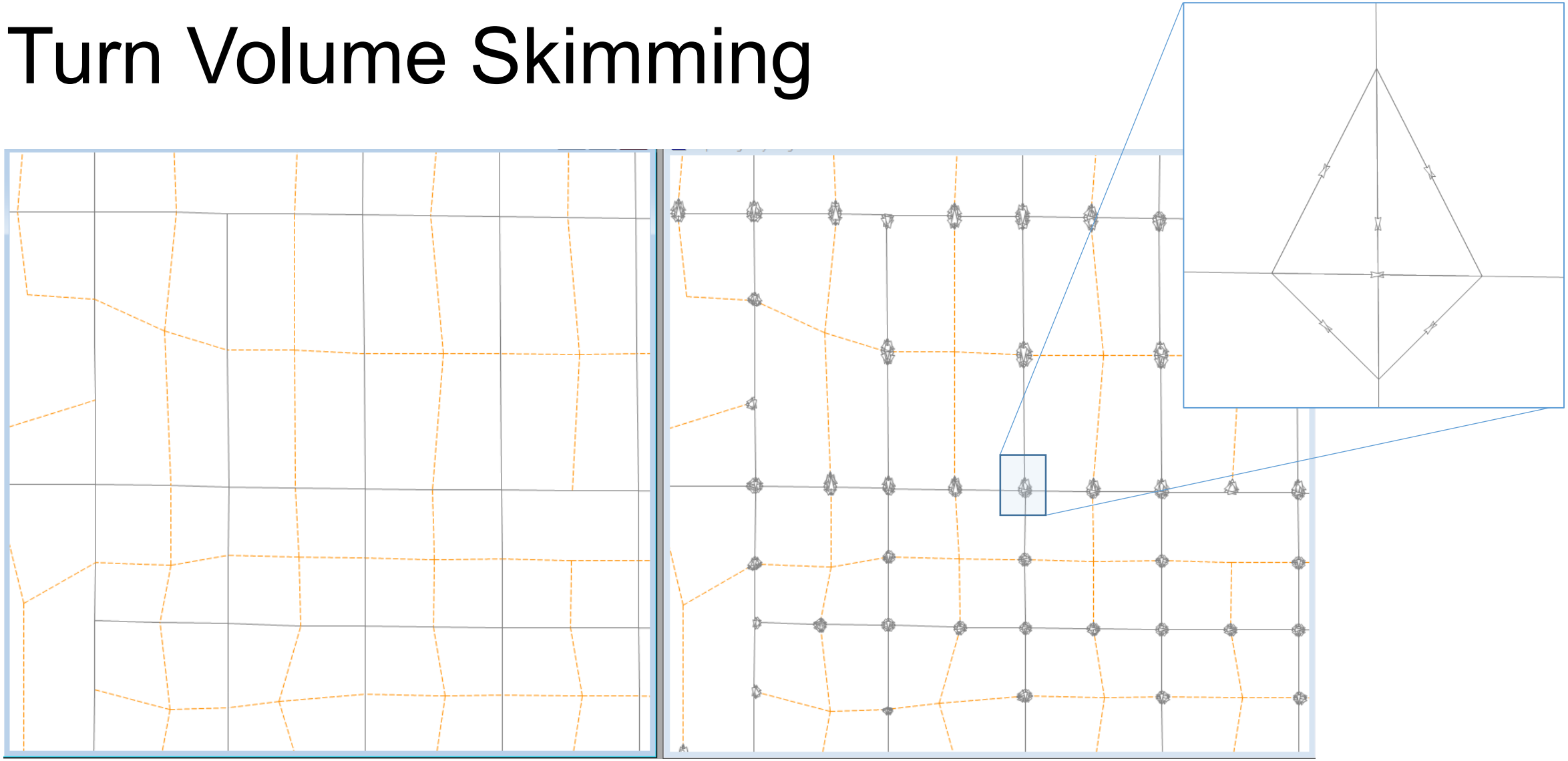
- Recap:

Demand Commonality Skims (between consecutive links)

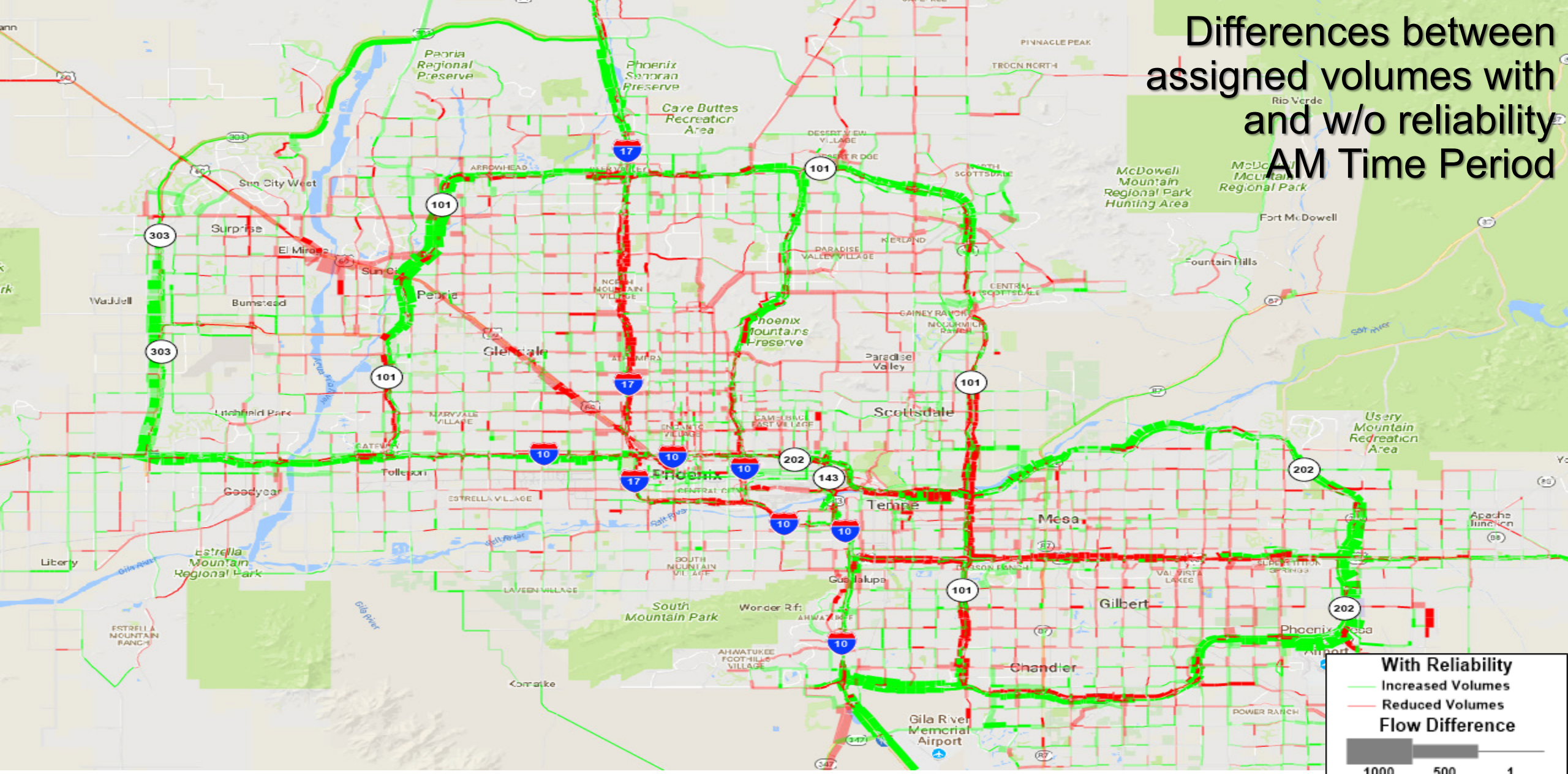


(Independent) $0 \leq \frac{\sum V(ijk)}{\sum V(ij)} \leq 1$ (Perfect correlation)

Turn Volume Skimming



Differences between assigned volumes with and w/o reliability AM Time Period



Validation Statistics

- Inclusion of reliability neither destroyed nor improved validation statistics
  - Without reliability: R^2 = 97.20%; RMSE=27.98%
  - With reliability: R^2 = 97.31%; RMSE=28.41%
- Reasons
  - Network topology: Lower congestion levels
  - More impact with future growth and congestion
- What is the primary purpose to include reliability?
  - Improve model sensitivity for projects that benefit travel time reliability

Reference

- See forthcoming TRB publication [*Gupta, Vovsha, Dutta, Livshits, Zhang, Zhu (2018) Incorporation of Travel Time Reliability in Regional Travel Model*]

Model Structure & Innovative Features

Peter Vovsha
wsp

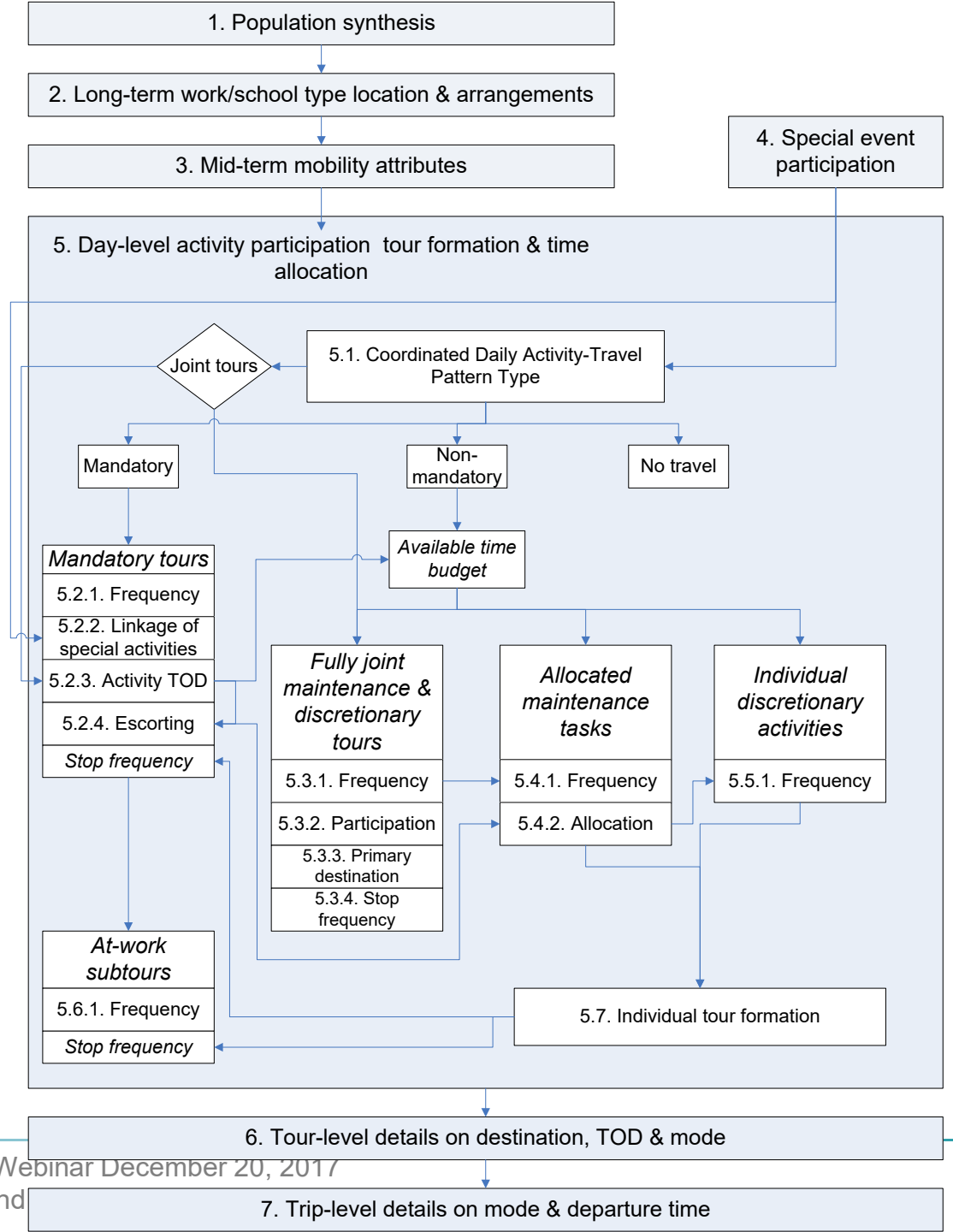
Standard Features of ABMs in Practice in US

- From 2000:
  - Tour-based structure of mode, time-of-day, and destination choices
  - Activity-based platform (individual daily pattern) for travel generation
  - Microsimulation implementation with synthetic population
- From 2010:
  - Explicit modeling of intra-household interactions and joint travel
  - Enhanced spatial resolution (20,000-40,000 MAZs nested within TAZs)
  - Individual schedule consistency across travel tours with 30 min resolution

New features incorporated in MAG ABM

- Flexible population synthesis
- Extended analysis of work arrangements and business chains
- Addressing supply side of activities like Special Events and major universities
- Additional intra-household interactions like escorting children to school
- Activity generation & tour formation instead of tour generation & stop insertion
- Combinatorial tour mode choice
- Continuous time and provisions for integration with DTA

Overall Model Structure



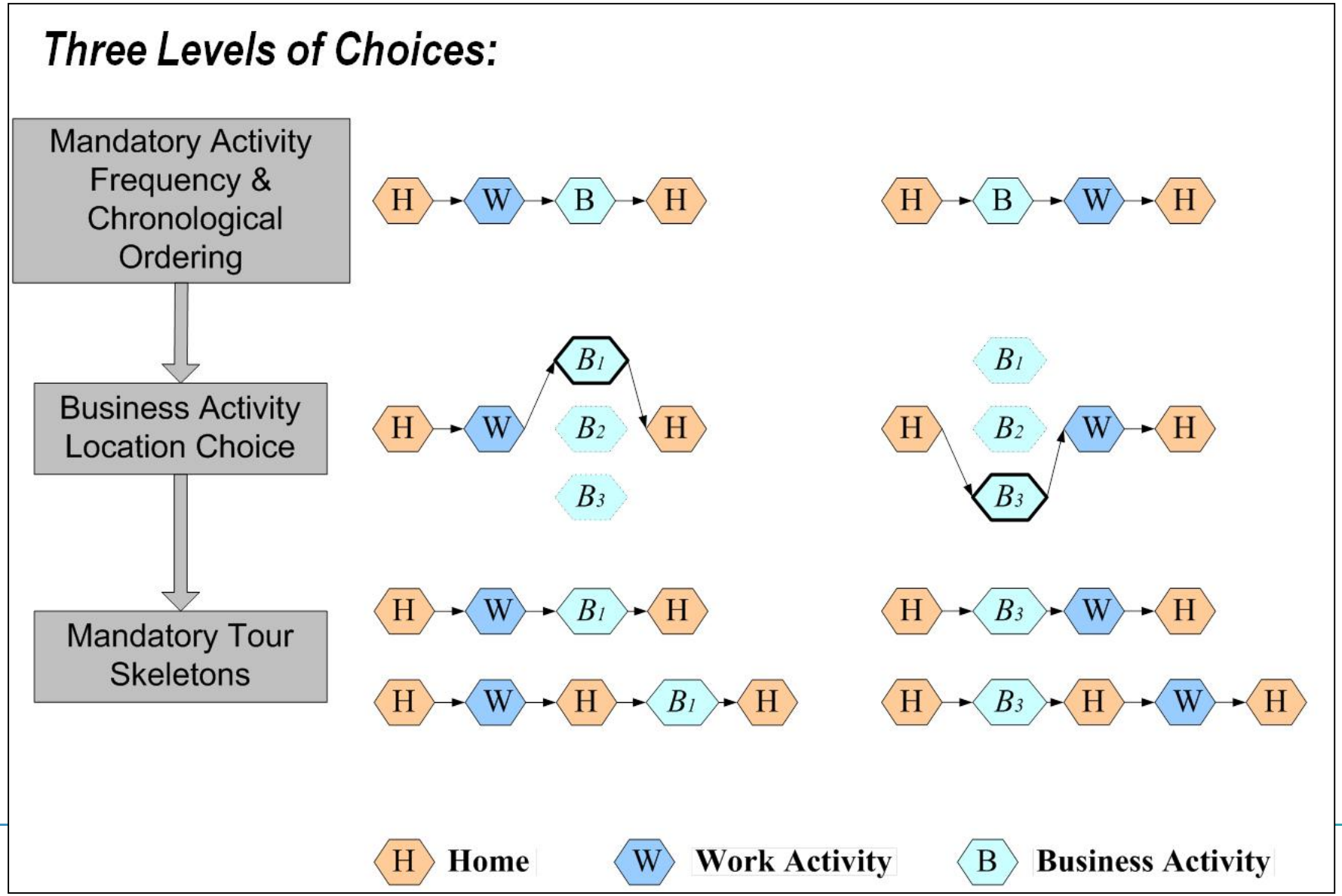
MAG PopSyn3

- Innovative theoretically consistent algorithm based on maximum entropy principle:
  - List balancing core procedure:
    - Any number of HH-level and person-level controls at different levels of geography
    - Handles imperfectness and inconsistencies of controls; user can specify differential weights reflecting relative importance and reliability of controls
    - Preserves uniformity of HH expansions as much as possible
  - LP discretizing method to convert fractional HH weights to discrete numbers:
    - Eliminates Monte-Carlo simulation error, all procedures are analytical and repeatable
- Transferred to more than 30 ABMs and hybrid models elsewhere:
  - See TRB publication [*Vovsha, Hicks, Paul, Livshits, Maneva, Jeon (2015) New Features of Population Synthesis*]

Improved Models for Work Arrangements in MAG ABM

- Usual workplace choice model including work from home, telecommuting, and comparisons between Phoenix and Tucson:
  - TRB Publication [*Vovsha, Gupta, Freedman, Livshits, Sun (2012) Workplace Choice Model: Comparison for Different Regions*]
- Unique sub-models for business chains and midday circulation:
  - TRB Publication [*Paul, Vovsha, Hicks, Vyas, Livshits, Jeon (2014) Generation of Mandatory Activities and Formation of Mandatory Tours: Application to the Activity-Based Model for Phoenix, AZ*]

Modeling Business Chains



Modeling Special Events

- Crucial importance for the MAG region:
  - Very different TLD and mode choice compared to other activities – standard models do not work
- Unique innovative approach where participation in Special Events is fully integrated with the core microsimulation model:
  - TRB publication [*Paul, Vovsha, Hicks, Livshits, Pendyala (2013) Extension of the Activity-Based Modeling Approach to Incorporate Supply Side of Activities: Examples for Major Universities and Special Events*]
- Accounts for possible linkage of Special Events to work tours and frequent carpooling (intra-household and inter-household)
- Special Event participant change their activity patterns:
  - Avoid double counting pertinent to standard special generator models

Model Structure for Participation in Special Events

- Participation Model:
  - Expansion of the Special Event survey to synthetic population of participants
  - Initial formation of travel parties
  - Combinatorial optimization algorithm to match travel party composition targets
- Allocation Model:
  - Each individual participant or travel party is allocated to a residential MAZ
  - Each intra-household travel party is allocated to HH within that MAZ with the best person-to-person match
  - Each individual participant or member of inter-household party is allocated to HH within that MAZ with the best person-to-person match

Special Events Model Validation

Participation Generation Output
Mill Avenue Block Party

Target

Party Size	Adult	Mixed	Child
1	0.98	0	0.02
2	0.93	0.05	0.02
3	0.86	0.1	0.04
4	0.83	0.13	0.04
5	0.79	0.18	0.03
6	0.74	0.24	0.02

Initial

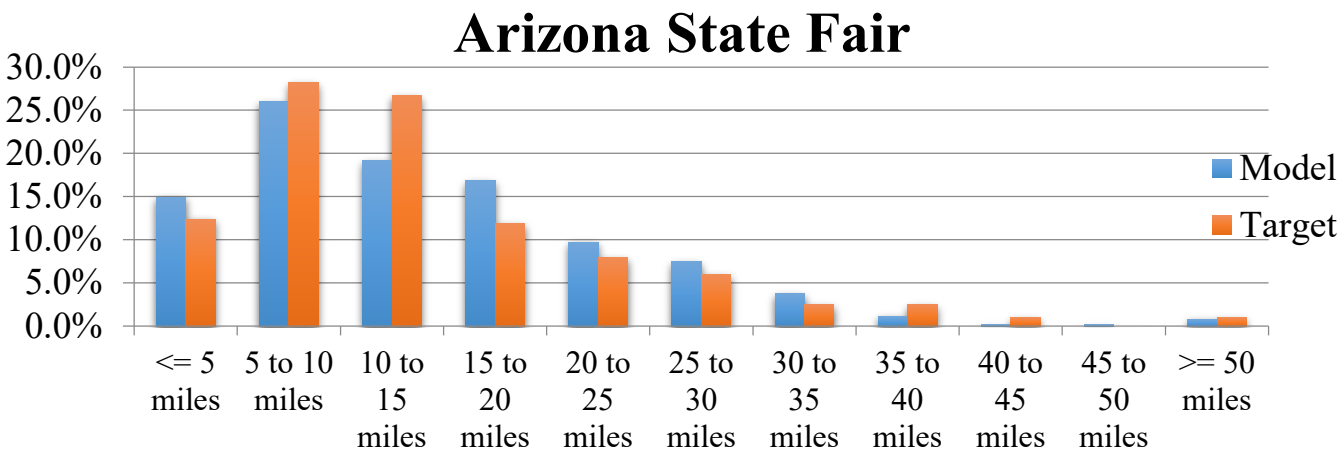
Party Size	Adult	Mixed	Child
1	0.897	0.000	0.103
2	0.925	0.062	0.014
3	0.647	0.325	0.029
4	0.774	0.226	0.000
5	0.660	0.340	0.000
6	0.544	0.456	0.000

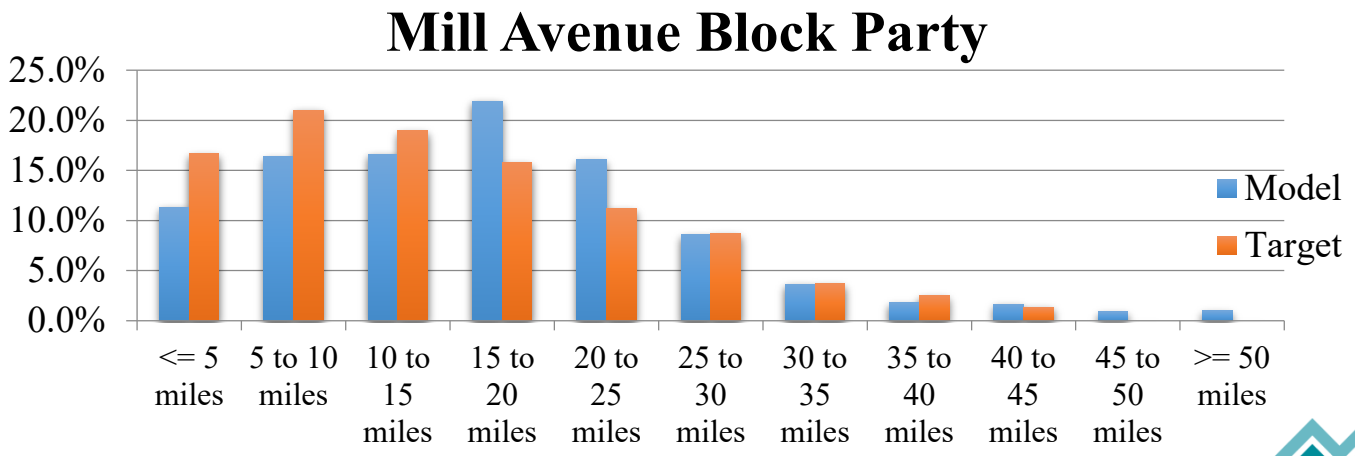
Final

Party Size	Adult	Mixed	Child
1	0.938	0.000	0.062
2	0.928	0.051	0.021
3	0.819	0.117	0.064
4	0.829	0.152	0.019
5	0.791	0.193	0.017
6	0.736	0.244	0.020

Special Events Model

Trip Length Distribution (TLD) Comparison to SE Surveys

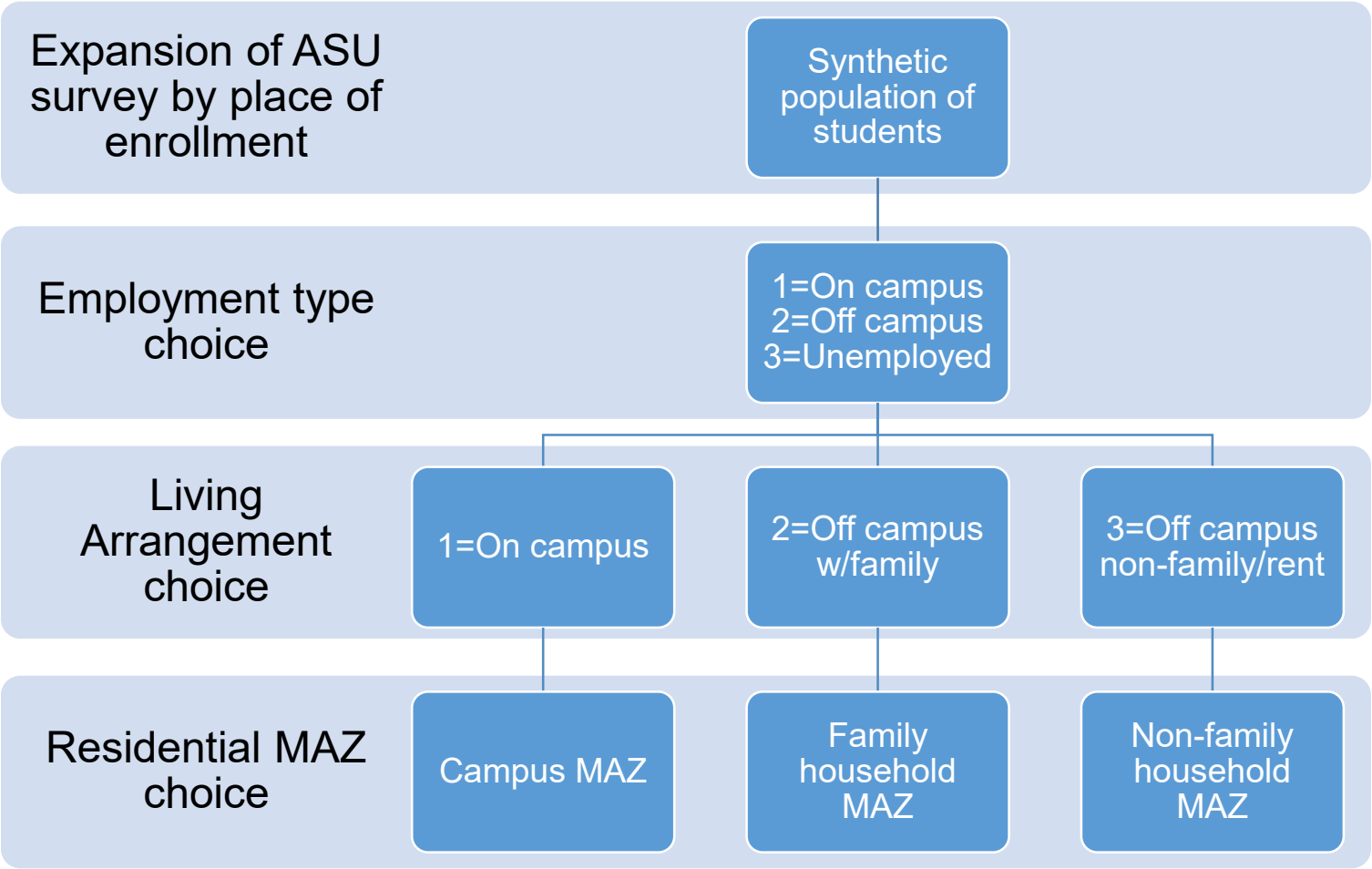




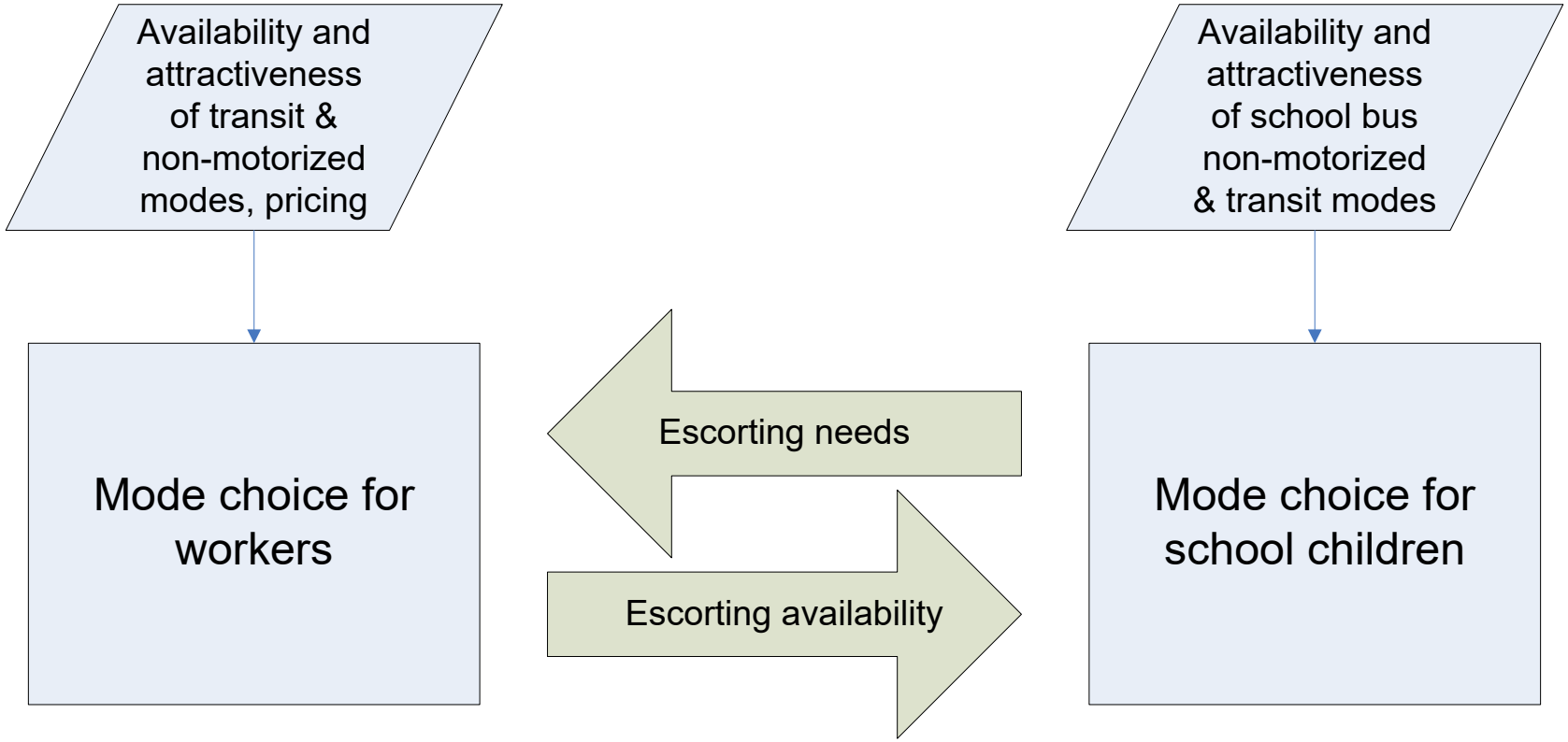
Modeling ASU

- Crucial importance for transit forecasting
- Unique innovative approach where university sub-model is fully integrated with the core microsimulation model:
  - see TRB publication [*Paul, Vovsha, Hicks, Livshits, Pendyala (2013) Extension of the Activity-Based Modeling Approach to Incorporate Supply Side of Activities: Examples for Major Universities and Special Events*]
- Accounts for residential arrangements of ASU student (dorms, rent apartments, family households)
- The main purpose is to model all trips of university students properly, not only school trips to and from university

Modeling ASU



Escorting children to school



- see TRB publication [*Gupta, Vovsha, Livshits, Maneva, Jeon (2013) Incorporation of Escorting Children to School in Daily Activity Patterns of the Household Members*]

Tour generation vs. tour formation

Tour-generation paradigm pertinent to 2nd generation of ABMs

1=Predict number of tours by type for each individual

Tours predicted

2=Identify primary destination, time-of-day choice, and main mode for each tour

3=Add details on stop frequency and stop location for each tour

Activities predicted

4=Identify trip mode for each trip

5=Predict trip departure time for each trip

Tour-formation paradigm pertinent to 3rd generation of ABMs

1=Predict number of prioritized activities, their preliminary schedules and tour skeletons by type for each individual

2=Predict number of other activities by type for each individual

Activities predicted

3=Form tours as sequence of activity stops and locations for each individual

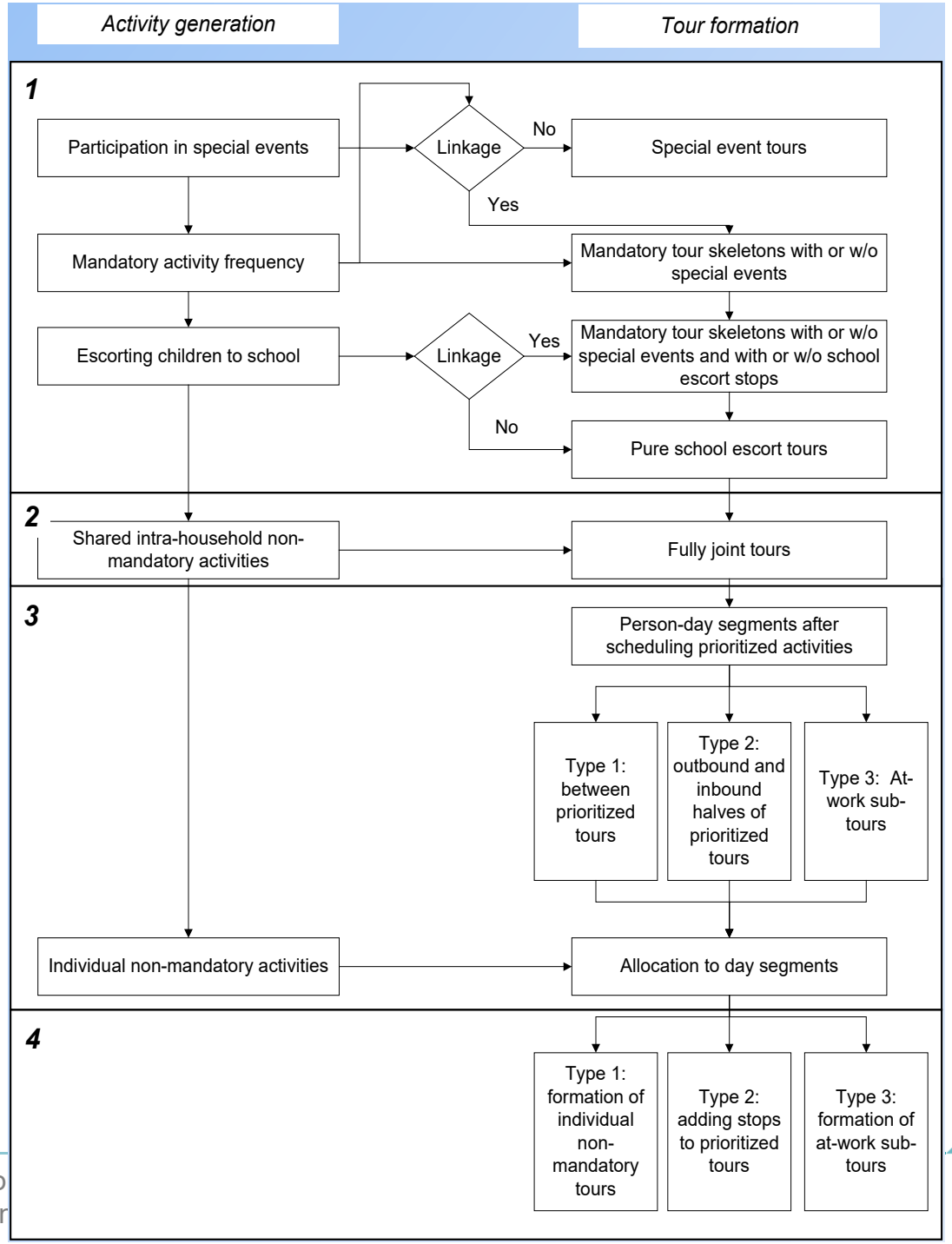
Tours predicted

4=Final tour time-of-day choice and combinatorial tour-trip mode choice

5=Time allocation within the tour and trip departure time

Tour Formation Steps

1. Fixed prioritized activities: special events, school, work, business, escorting children
2. Joint activities
3. Other activities allocated into residual time windows between prioritized activities
4. Formation of tours within each window

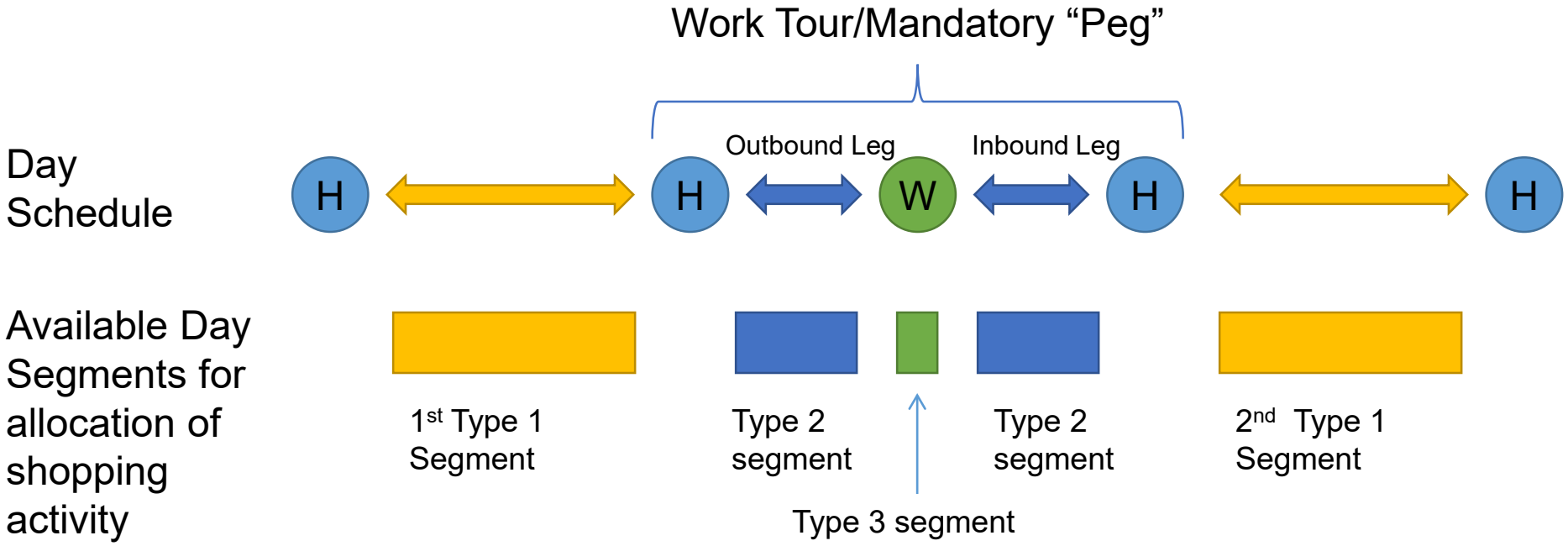


Tour formation documented

- TRB publication [*Paul, B.M., P. Vovsha, J. Hicks, G. Vyas, V. Livshits, D, Givon, Y. Birotker (2015). Generation of Mandatory Activities and Formation of Mandatory Tours: Application to the Activity-Based Models for Phoenix, AZ and Jerusalem, Israel*]
- TRB publication [*Vyas, G., P. Vovsha, B. Paul, D. Givon, V. Livshits (2015) Allocation of Individual Non-Mandatory Activities to Day Segments in the Tour Formation Procedure: Application to the Activity-Based Models for Jerusalem, Israel and Phoenix, AZ*]
- Journal of Transportation [*Paleti, R., P. Vovsha, G. Vyas. R. Anderson, G. Giaimo (2015) Activity Sequencing, Location, and Formation of Individual Non-Mandatory Tours: Application to the Activity-Based Models for Columbus, Cincinnati, and Cleveland, OH*]

Tour Formation Illustration: Activity Allocation

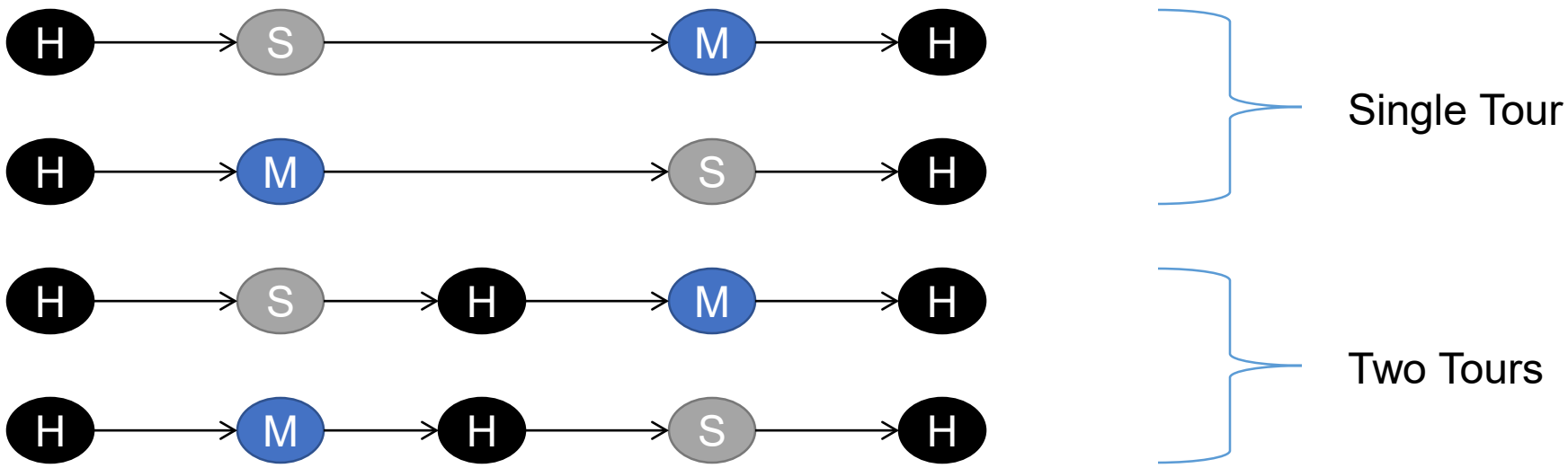
- Person with 1 workplace activity & 1 individual shopping activity:
  - Workplace activity creates a commuting tour skeleton
  - Were would the shopping activity go (5 options)?



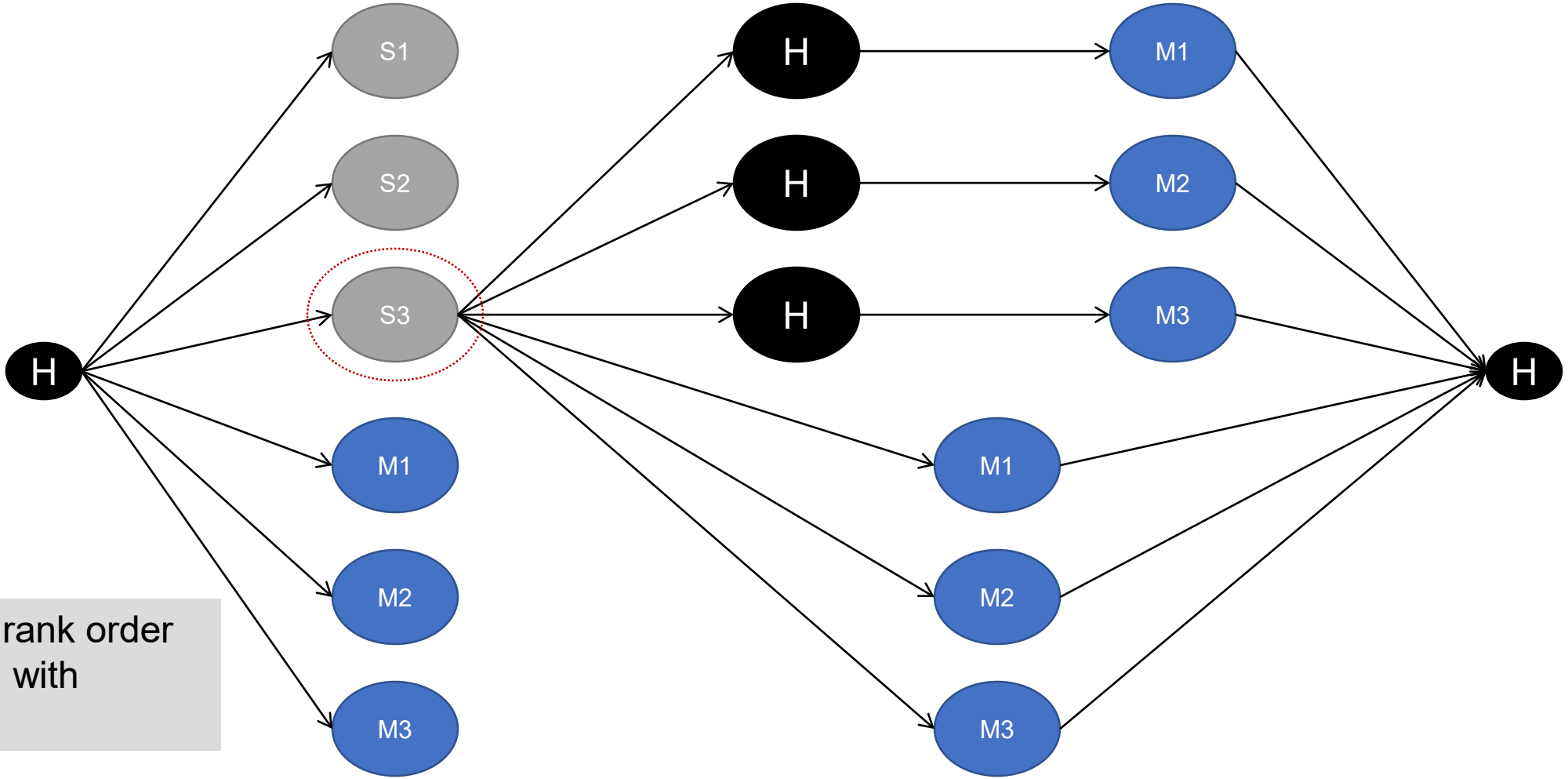
Tour formation illustration: activity sequence and tour breaks

1 shopping (S) and 1 maintenance (M) activity allocated to a Type 1 segment

Possible tour formation scenarios:

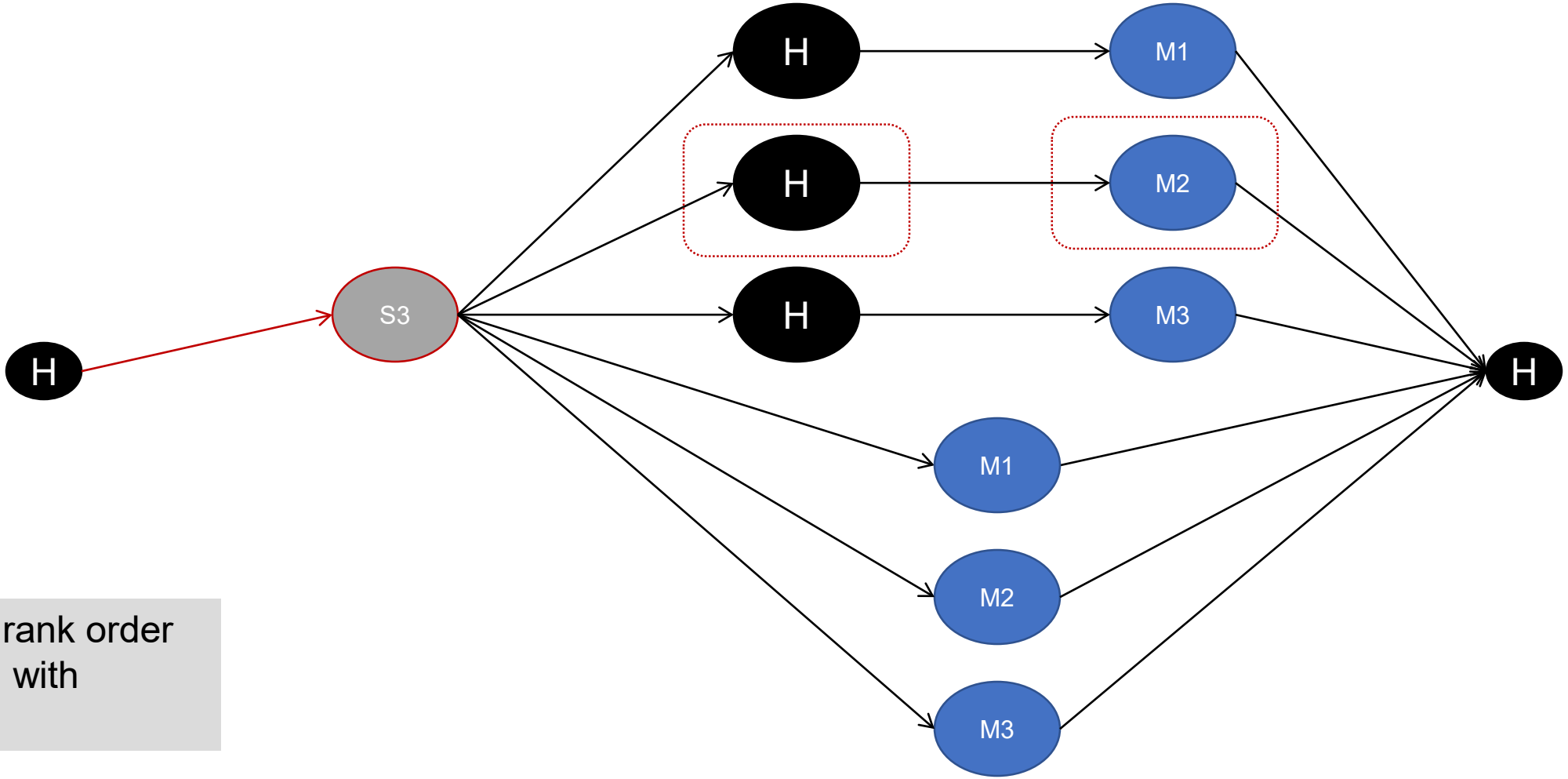


Tour formation illustration: activity location



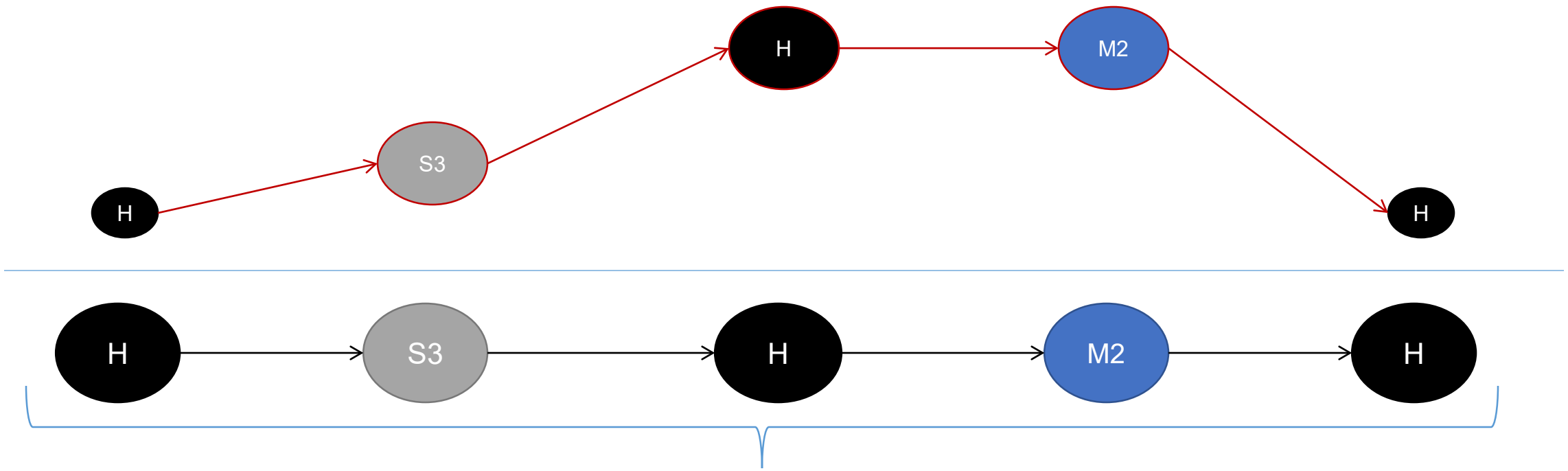
Innovative rank order logit model with sampling

Tour formation illustration: activity location



Innovative rank order logit model with sampling

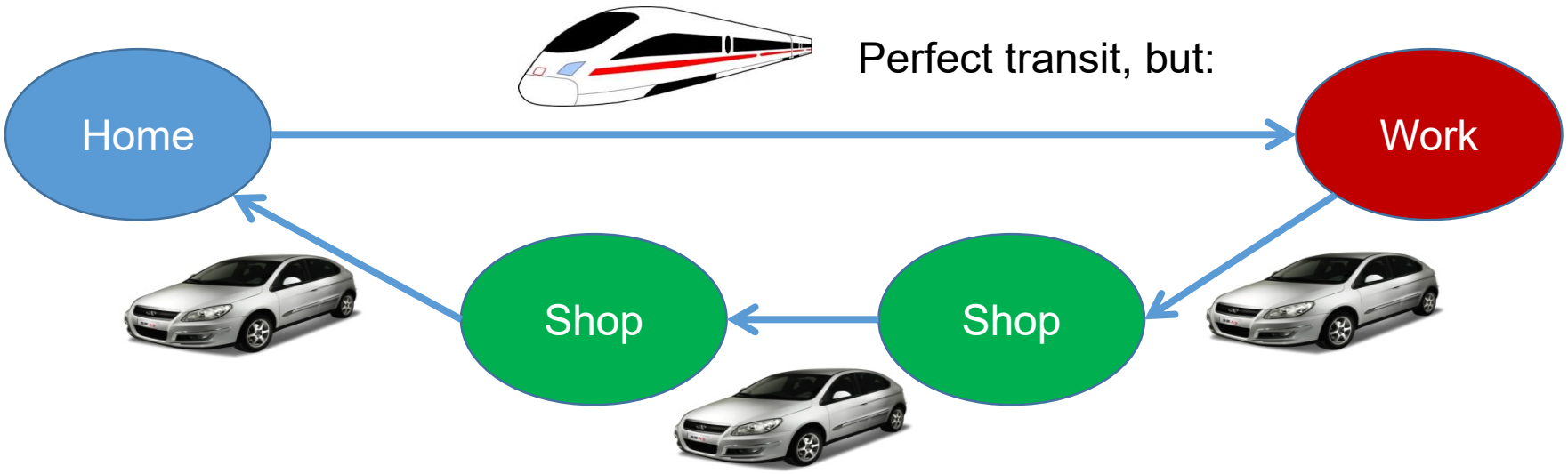
Tour formation: activity location



Shopping (3rd location) before maintenance (2nd location) & Two Tours

Combinatorial mode choice

- Mode choice in 2 steps in most ABMs:
  - Tour mode based on primary destination ignoring stop location
  - Trip mode choice conditional upon tour mode choice
- Suggested mode choice structure:
  - Tour-level and trip-level choices fully integrated
  - All feasible trip mode combinations are considered
  - Stop location may have a strong impact on tour mode choice
  - TRB publication [*Vovsha, Hicks, Vyas, Livshits, Jeon (2017) Combinatorial Tour Mode Choice*]

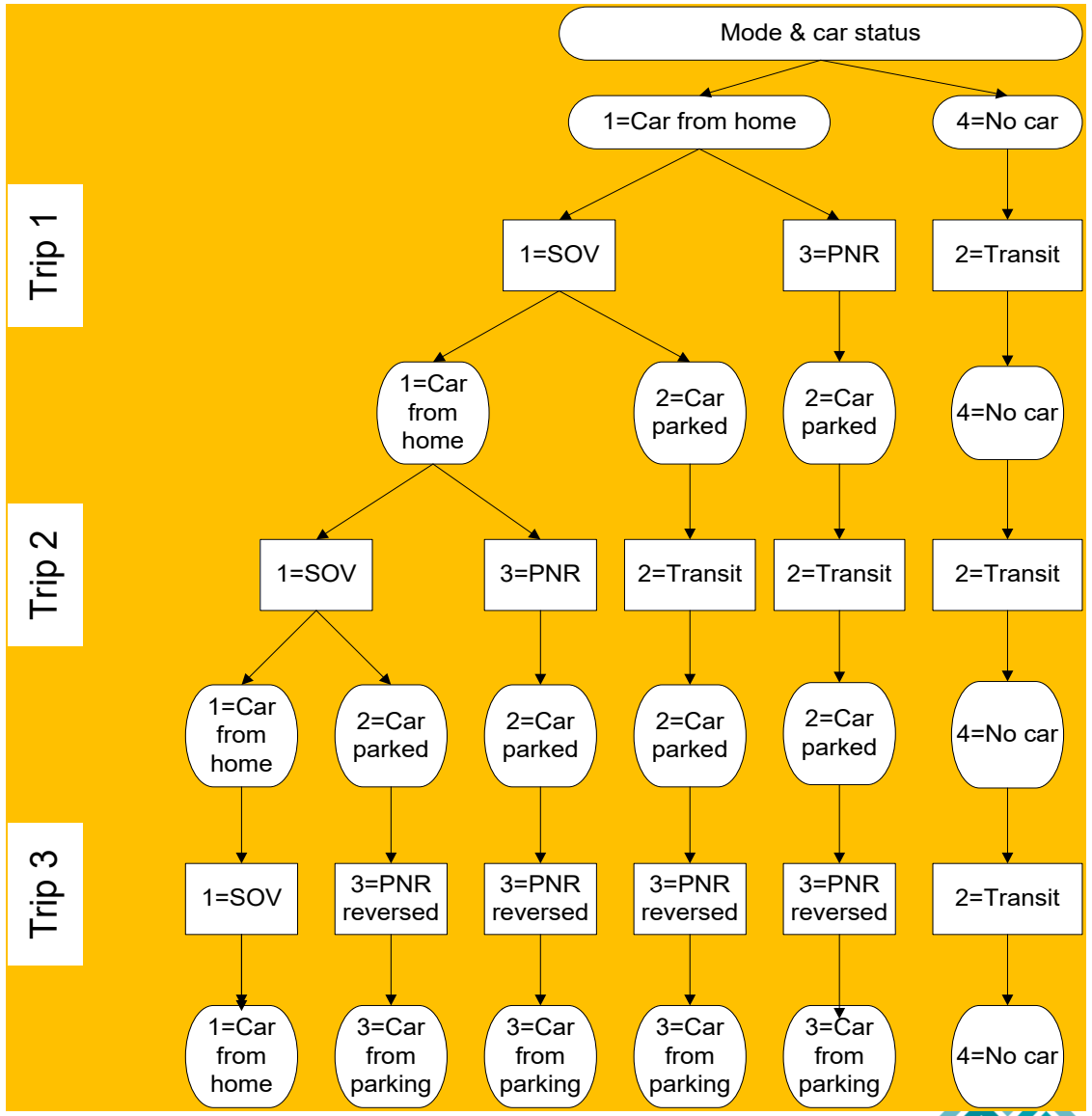


Car Status

1. "Car from home"
   - Until this point the car was used on all preceding trips and has never been parked outside home, hence car is available for the subsequent trip
2. "Car parked"
   - Car was used originally (at least for the first trip from home) but is was subsequently parked outside home on one of the preceding trips, hence car it is not available for the subsequent trip until it has been taken from the parking lot
3. "Car from parking"
   - Car was parked earlier on this tour but then it was taken from the parking lot and is available for the subsequent trip
4. "No car on tour"
   - Car was not used for the very first trip on the tour and hence it is not available for any subsequent trip

Combinatorial Mode Choice Tree Illustration

- Considers all feasible trip mode combinations
- Tracks car status that truncates the tree:
  - In the example of 3 modes (1=SOV, 2=Transit, 3=PNR) and 3 trips there are 27 possible combinations but only 6 are feasible



Combined Trip-Mode & Destination-Car-Status Alts in MAG ABM

Car status at trip origin				Mode in outbound direction	Car status at trip destination			
1=Car from home	3=Car from parking	2=Car parked (N/A for 1st trip)	4=No car on tour		1=	3=	2=	4=
X				1=SOV/driver	X		X	
X				2=HOV2/driver	X		X	
X				3=HOV3+/driver	X		X	
			X	4=HOV/passenger				X
		X	X	5=Conventional transit/walk			X	X
			X	6=Conventional transit/KNR				X
X				7=Conventional transit/PNR			X	
		X	X	8=Premium transit/walk				X
			X	9=Premium transit/KNR				X
X				10=Premium transit/PNR			X	
		X	X	11=Walk			X	X
		X	X	12=Bike			X	X
			X	13=Taxi				X
			X	14=School bus				X

Thinking forward in the dynamic world

Openness of the ABM software & addressing new emerging planning needs

New View on Travel Model as Data Integration Tool

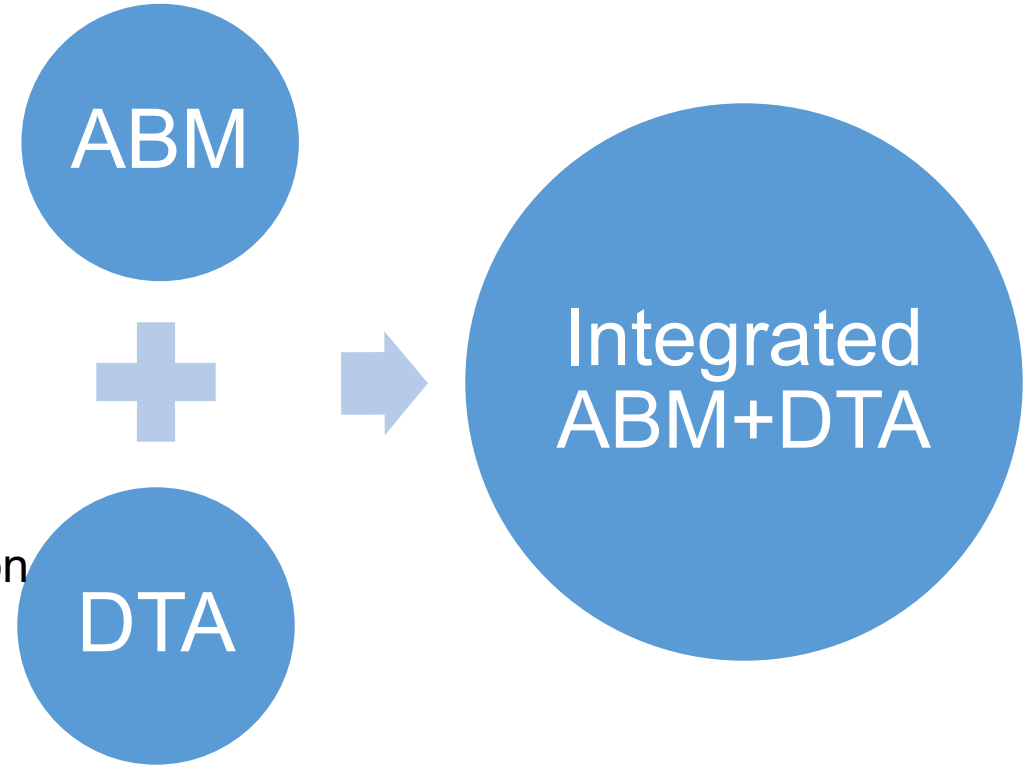
- MAG collects many different sources of data
- ABM is the lowest possible denominator
- Big data can eventually replace each of them (to a certain extent)
- ABM incorporates all surveys and consolidates them in one consistent output – ***complete synthetic HTS for the entire population***

Examples of new planning needs that require ABM extensions

- Integration with advanced network simulation tools like DTA/DPTA
  - forthcoming TRB publication [*Vovsha, Hicks, Stratton, Tung, Anderson, Giaimo, Rousseau (2018) Integrated Model of Travel Demand and Network Simulation*]
- Addressing mobility changes with Autonomous / Connected Vehicles
  - TRB publication [*Vovsha, Hicks, Kulshreshta, Livshits, Jeon (2017) Modeling impacts of autonomous vehicles on travel demand with an Activity-Based Model*]
- Incorporation of travel time reliability
  - forthcoming TRB publication [*Gupta, Vovsha, Dutta, Livshits, Zhang, Zhu (2018) Incorporation of Travel Time Reliability in Regional Travel Model*]
- Time-use (activity-participation) analysis and visualizations

Major Direction in Travel Modeling Profession

- Detailed population & travel markets
- Dynamics of individual travel preferences
- Willingness to pay & User Benefits



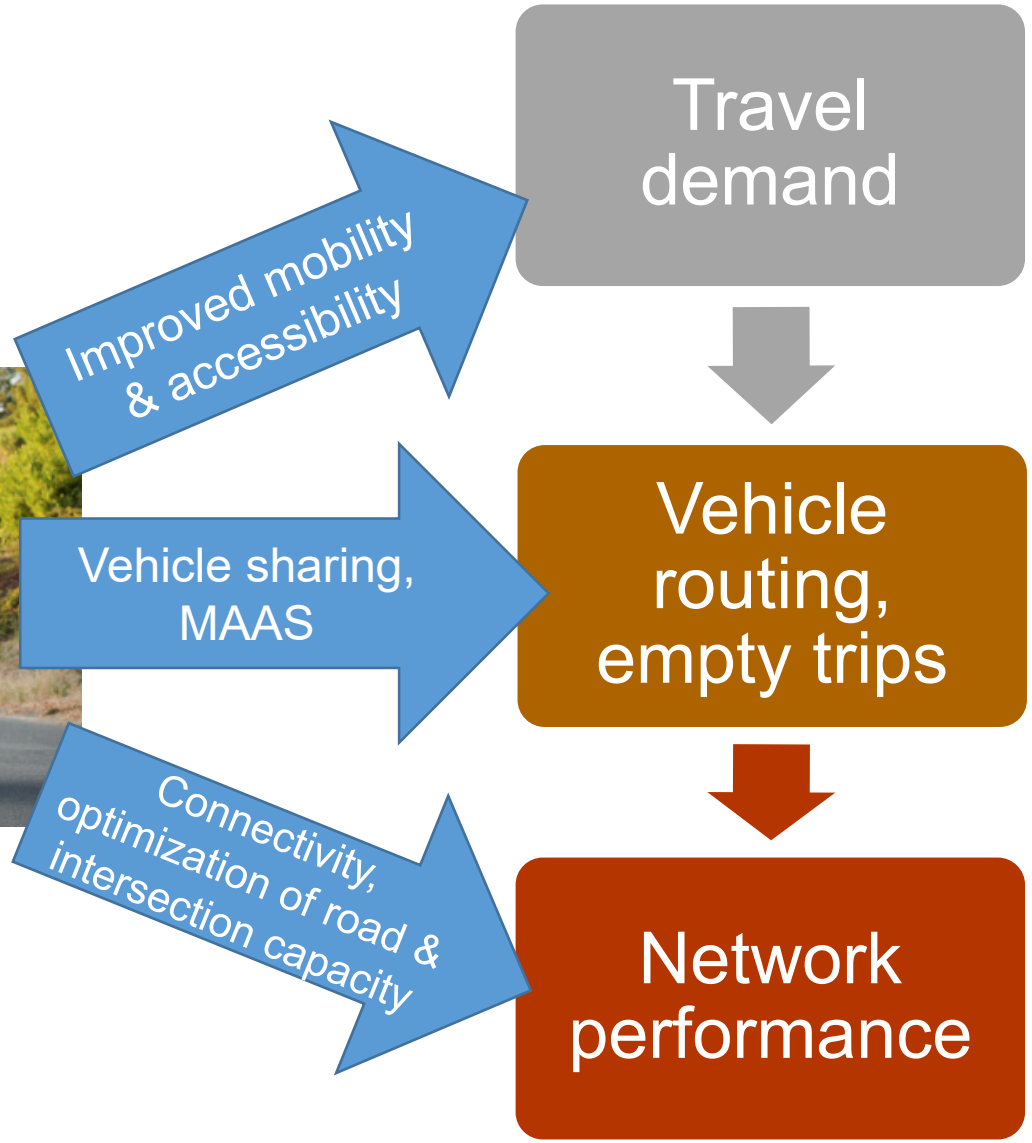
- Realistic portraying of traffic congestion
- Regional network simulation and impacts
- Detailed highway operation analysis

Integrated ABM-DTA model combines main advantages of ABM and DTA
It opens a way for unique project analysis and evaluation

“Integratable” ABM and DTA

Component	ABM extension	DTA extension	Integration Layer
Individual route choice consistent with mode choice	Minor adjustment of the output files	Efficient individual route choice with unique VOT for each vehicle	
Enhanced spatial resolution	Location choices at MAZ level	Individual trip loading from MAZ to MAZ	
Continuous trip departure time	Built-in in CT-RAMP2		
Individual schedule adjustment	Adjustment of the output files (and ABM objects)		Implemented exactly this way as a separable software piece
Trajectory mining and dissecting	Replace LOS skim references with references to LOS manager	Changes in trajectory output format	Database of individual trajectories with mining engine
Selective TDSP calls	Replace LOS skim references with references to getTDSP()	Provide a separable router	
Dynamically updated destination choice sets	Replace independent random sampling with a different individual-memory-based procedure		
ABM-DTA integrated system (3 levels)	Separation between “stressed” and “unstressed” HHs and retaining choices of “unstressed” HHs		Equilibration manager

AV/CVs are coming!



- TRB publication [*Vovsha, P., J. Hicks, A. Kulshreshta, V. Livshits, K. Jeon (2017) Modeling impacts of autonomous vehicles on travel demand with an Activity-Based Model*]

Software & Implementation

Jim Hicks wsp & Kyunghwi Jeon

ABM Software Overview

- **Java** software for ABM implementation
  - Supporting libraries
- **MySQL** database software
- **TransCAD**
  - Network Assignment Models and LOS Skim I/O
- **MS Excel**
  - Viewing choice model specifications
- **Ultraedit**
  - Viewing and editing large text format files
- **Python/ArcGIS**
  - Area Type calculation, ABM Input Preparation, and statistics reporting
- **Google Optimization Tools** (OR-Tools)
  - PopSyn

Java-based ABM Components

- MAG Regional Population Synthesis
- ASU/Other College Student Synthesis
- ASU Student Residential Location Choice
- Accessibility Calculation
- Activity Based Model
- Individual Schedule Adjustment
  - Xu, X., A. Zockaie, H. Mahmassani, H Halat, O.Verbas, M Hyland, P Vovsha, J. Hicks, *Schedule Consistency for Daily Activity Chains in Integrated Activity-Based Dynamic Multi-Modal Network Assignment*, accepted for publication in *Transportation Research Record*, Washington, DC, Jan 2018.

Utility Calculation Definitions

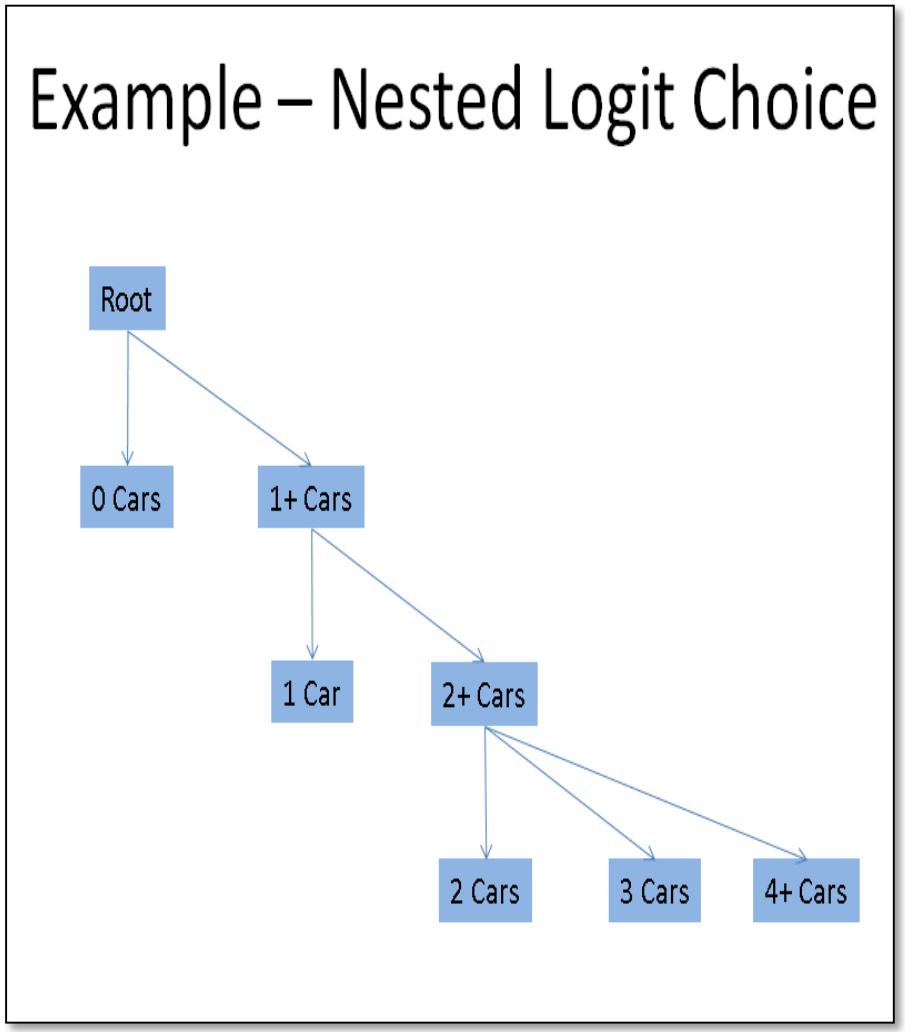
	A	B	C	D	E	F	G	H
1	Mode	2	SE_Worker_Linkage_Model		Decision_making_unit	t	Alt	2
2								
3	No	Token	Description	Filter	Formula_for_variable	Index	Alt1	Alt2
4							linked	not_linked
5								
6	1	homeWorkDistan	distance between home and work location (miles)		@homeWorkDistance			
7	2	workEventDistanc	distance between work and event location (miles)		@workEventDistance			
8	3	eventHomeDistan	distance between event and home location (miles)		@eventHomeDistance			
9	4	distanceSaving	distance saved by linking the special event on inbound work tour leg		homeWorkDistance + eventHomeDistance - workEventDistance			
10	5		if worker works at home, they cannot be a linked worker		@worksAtHome		-999.000	0
11	6		Distance saving (in miles)		distanceSaving		0.9711	0
12	7		calibration constant for linking		1		-9.0000	0
13	8		single person party indicator		@partySize == 1		2.4306	0
14	9		same HH party (partysize>=2) indicator		@partySize > 1		-0.0540	0
15	10		Flexible timing for the event dummy - events 3, 8, and 18 have flexible t		(@eventNum == 3) + (@eventNum == 8) + (@eventNum == 1		-0.7434	0
16	11		Event starts after 5PM dummy - only event 3 starts after 5		@eventNum == 3		1.9083	0

Plain Text Properties Files

```
#logsum.manager.host.address = 192.168.1.108
logsum.manager.host.port = 1059
logsum.manager.read.data = false

#matrix.server.host.address = 192.168.1.92
matrix.server.host.port = 1188
matrix.server.transcad5 = false

# highway skim tables
pk.sov.time.key = IVT_SOV
pk.sov.time.file = amHovSkm.mtx
pk.sov.time.table = Time
pk.sov.dist.key = HWY_DIST
pk.sov.dist.file = amHovSkm.mtx
pk.sov.dist.table = Distance (Skim)
op.sov.dist.file = mdHovSkm.mtx
op.sov.dist.table = Distance (Skim)


# enable specific model components (true or false)

usual.workplace.location.enabled = false
usual.schoolplace.location.enabled = false
auto.ownership.transit.pass.enabled = false
special.event.matching.enabled = false
coordinated.daily.activity.pattern.enabled = false
linked.worker.enabled = false
mandatory.tour.frequency.enabled = false
mandatory.tour.business.location.enabled = false
mandatory.tour.preliminary.tod.enabled = false
school.escorting.arrangement.enabled = false
fully.joint.tour.frequency.enabled = false
fully.joint.tour.participation.enabled = false
fully.joint.tour.formation.tod.enabled = false
maintenance.task.frequency.enabled = false
maintenance.task.allocation.enabled = false
discretionary.task.frequency.enabled = false
tour.formation.enabled = false
activity.sequence.location.break.enabled = false
individual.tour.tod.and.extension.enabled = false
tour.mode.choice.enabled = true
```

Nested Logit Definitions – external file

```
# aotpNestedLogit.properties


# alogit nesting structure
#$NEST ROOT() 1001 1002
#
#$NEST 1001(theta1) 2001
#$NEST 1002(theta1) 2002 2003
#
#$Nest 2001 (theta2)  1 2 11 12 13 14 31 32 33 34 35 36 37 38 71
#+  72 73 74 75 76 77 78 79 80 81 82 83 84 85 86
#
#$Nest 2002 (theta2)  3 4 15 16 17 18 39 40 41 42 43 44 45 46 87
#+  88 89 90 91 92 93 94 95 96 97 98 99 100 101 102
#
#$Nest 2003 (theta2)  5 6 7 8 9 10 19 20 21 22 23 24 25 26 27 28
#+  29 30 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64
#+  65 66 67 68 69 70 103 104 105 106 107 108 109 110 111 112 113
#+  114 115 116 117 118 119 120 121 122 123 124 125 126 127 128
#+  129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
#+  144 145 146 147 148 149 150



levels = 4

level1.names = Root
level2.names = 0 cars, 1+ cars
level3.names = 0 cars, 1 car, 2+ cars
level4.names = 0_0, 0_1, 1_0, 1_1, 2_0, 2_1, 3_0, 3_1, 4_0, 4_1, 0_0_0,


level1.nestCoeffs = 1.0
level2.nestCoeffs = 0.432372342755, 0.432372342755
level3.nestCoeffs = 0.761126047431, 0.761126047431, 0.761126047431
level4.nestCoeffs = 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,


level1.alloc1 = 1.0

level2.alloc1 = 1.0
level2.alloc2 = 1.0

level3.alloc1 = 1.0, 0.0
level3.alloc2 = 0.0, 1.0
level3.alloc3 = 0.0, 1.0

level4.alloc1   = 1.0, 0.0, 0.0
level4.alloc2   = 1.0, 0.0, 0.0
level4.alloc3   = 0.0, 1.0, 0.0
level4.alloc4   = 0.0, 1.0, 0.0
```



ABM Component Runtime (6 nodes)

Component	Duration (mins)
start	
usual workplace location	2.6
usual school location	3.1
auto ownership / transit pass	0.9
coordinated daily activity pattern	1.5
linked worker	0.6
mandatory tour frequency	9.0
work tour business chains	29.1
mandatory preliminary time of day	5.6
school escorting	1.7
fully joint tour frequency	3.3
fully joint tour participation	6.5
fully joint tour formation	19.1
maintenance task frequency	0.4
maintenance task allocation	7.9
discretionary task frequency	2.0
non-manadatory activity allocation	10.0
non-mandatory activity sequence, location, tour break	16.7
individual tour time of day and tour time extension	6.8
mode choice/output file processing	86.1

Total time: 3 h 32 mins

ABM Output – Travel Diary Like Details

Person TripId	Trip Mode	Person Nums	Orig Activity	Sched Depart	Dest Activity	Sched Arrive
					0_home	3:00
1	1_sov	1	0_home	6:07	1_work	6:51
2	1_sov	1	1_work	16:07	0_home	16:50
			0_home	30:00		
					0_home	3:00
1	1_sov	2	0_home	6:22	1_work	6:47
2	3_hov3+/dr	2	1_work	14:46	412_ride sharing	15:09
3	3_hov3+/dr	2,4	412_ride sharing	15:16	9_discretionary	15:38
4	3_hov3+/dr	2,4	9_discretionary	15:26	9_discretionary	15:26
5	3_hov3+/dr	2,4	9_discretionary	15:36	8_visiting	15:37
6	3_hov3+/dr	2,4	8_visiting	15:46	0_home	16:11
7	1_sov	2	0_home	19:51	73_eat dinner	20:14
8	1_sov	2	73_eat dinner	19:54	0_home	20:17
			0_home	30:00		
					0_home	3:00
1	4_hov/pass	4	0_home	7:52	9_discretionary	8:00
2	4_hov/pass	4	9_discretionary	8:05	8_visiting	8:14
3	4_hov/pass	4	8_visiting	8:19	3_school	8:50
4	4_hov/pass	2,4	3_school	15:16	9_discretionary	15:38
5	4_hov/pass	2,4	9_discretionary	15:26	9_discretionary	15:26
6	4_hov/pass	2,4	9_discretionary	15:36	8_visiting	15:37
7	4_hov/pass	2,4	8_visiting	15:46	0_home	16:11
			0_home	30:00		

Distributed Computing Lessons Learned

- Distributing ABM solution over cluster
  - Faster, but at a cost of complexity/network resilience issues
  - Issues with integration with running model from TransCAD
- Desire to support multiple scenarios running simultaneously
- Desire to run scenarios on desktop class computers vs expensive cluster
- Exploring other parallel programming approaches in new CT-RAMP version

Model Implementations

Highlights on the hardware specs, model setup, debugging, and challenges

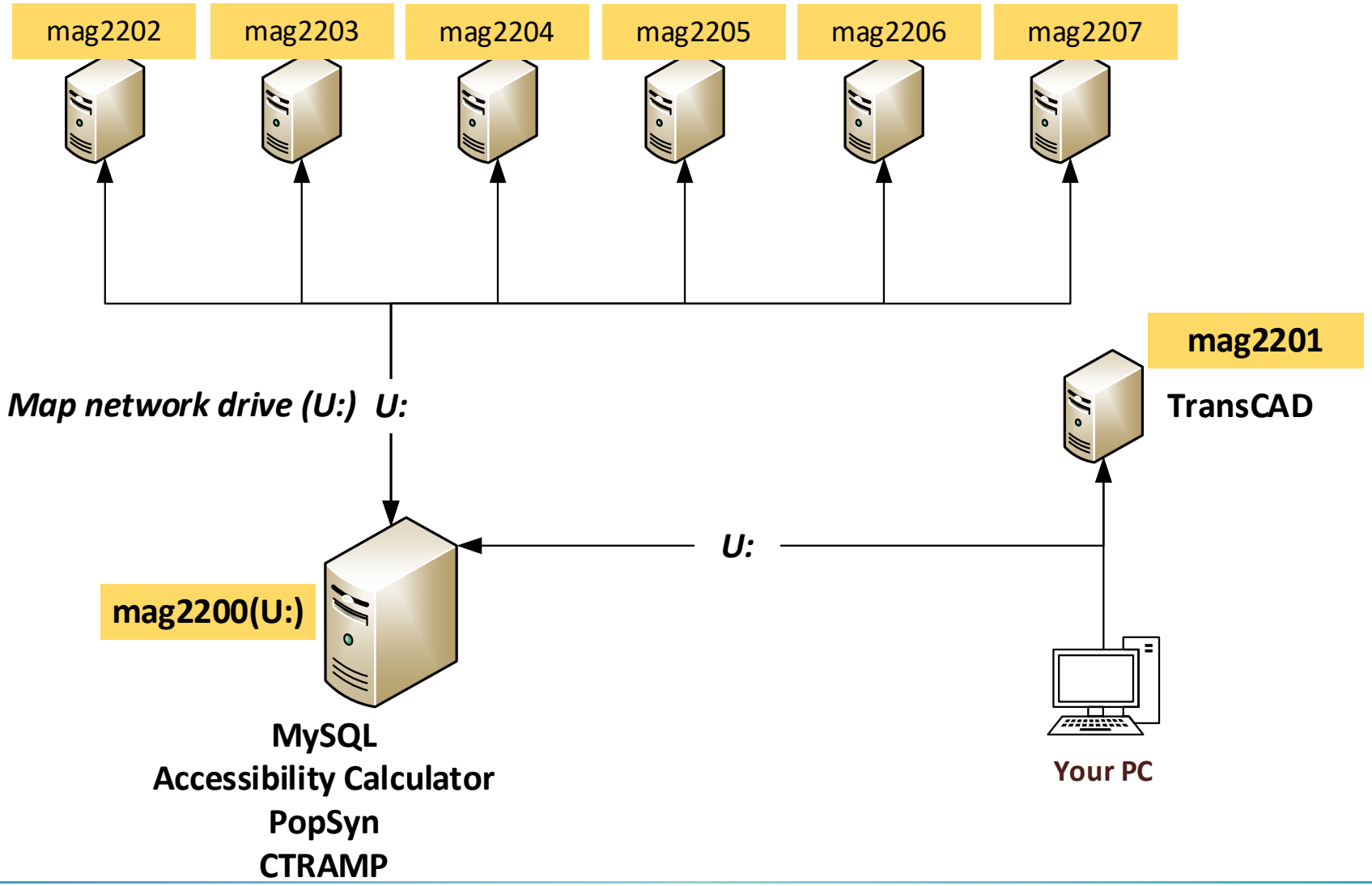
Hardware Specs

8 x Dell PowerEdge M620 Blade Server

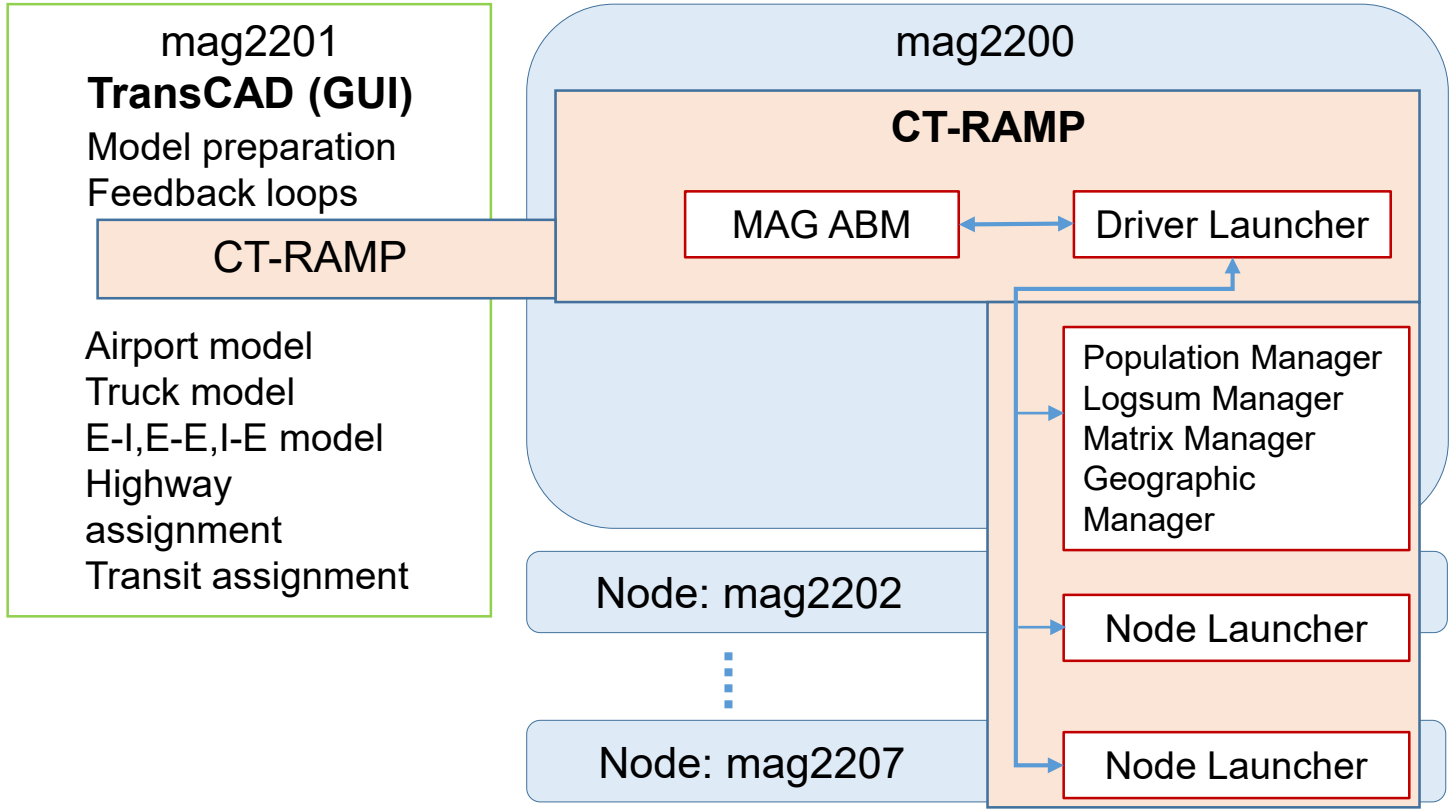
- CPU: Dual Xeon E5-2670 2.6GHz processors 16 cores (32 logical threads)
- RAM: 128GB (8x16GB) RDIMM 1.6GHz
- Hard Disk: 300GB 10K RPM SAS 6Gbps 2.5in Hot-plug Hard Drive
- OS: Windows Server 2012 Standard

Connected via
10 Gb Ethernet network

MAG ABM Cluster Structure

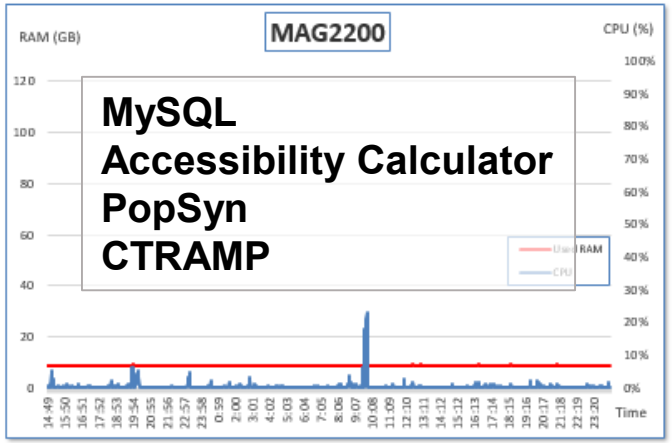


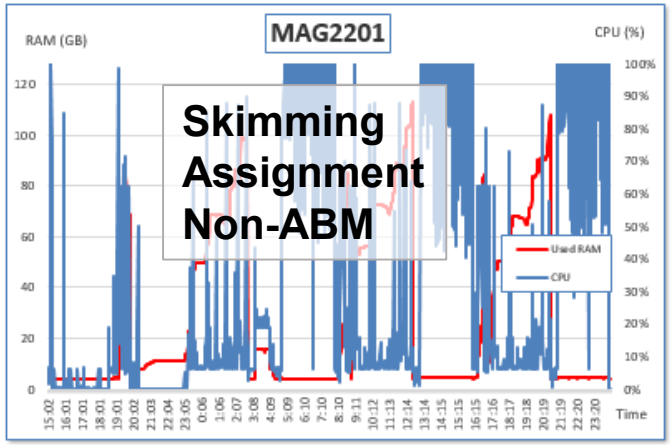
ABM Run Setup on Multiple Nodes

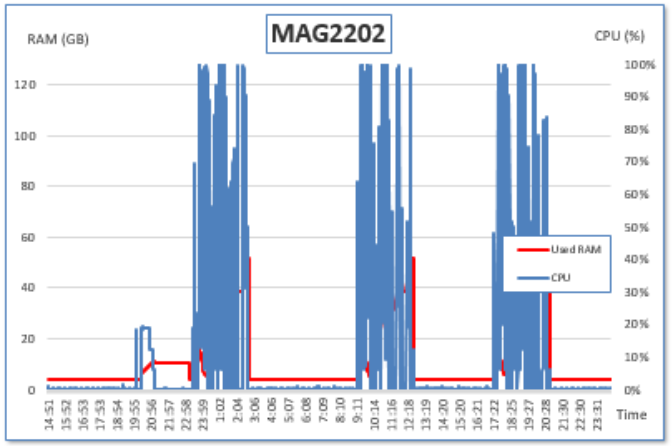


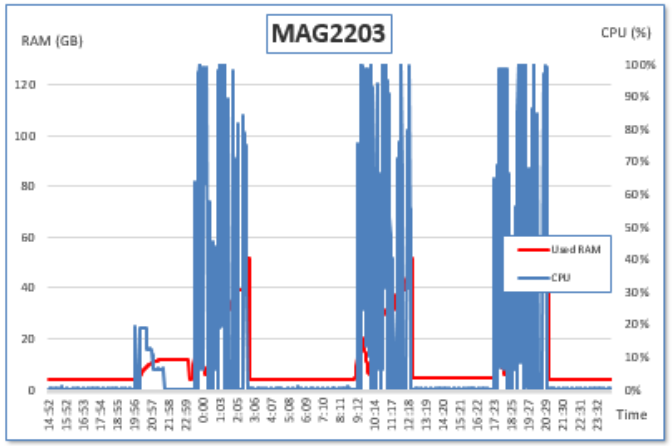
- **Driver Launcher** manages communicating with the nodes
- **Node Launcher** listens for tasks from the JPPF driver

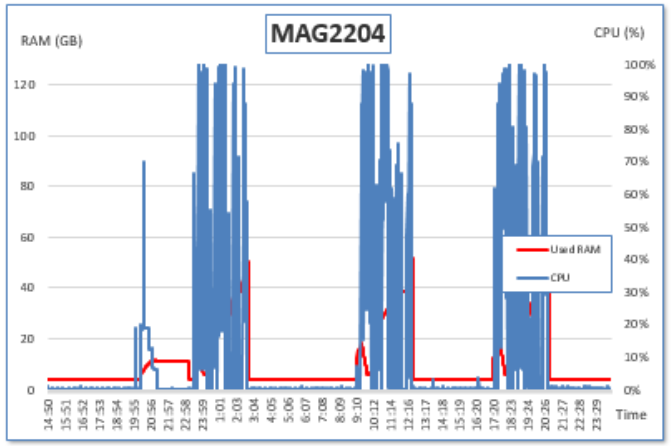
CPU/RAM usage on multiple nodes

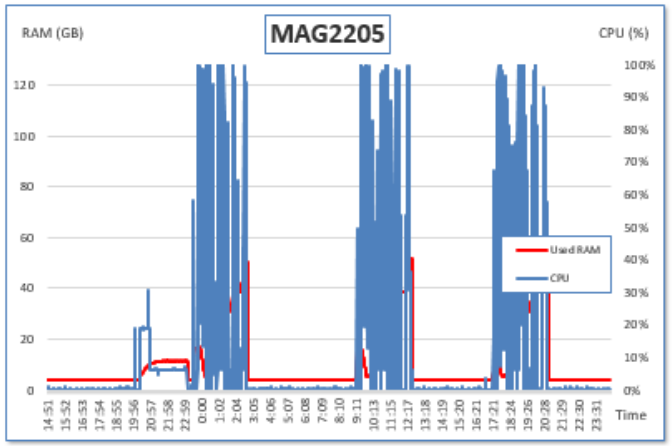


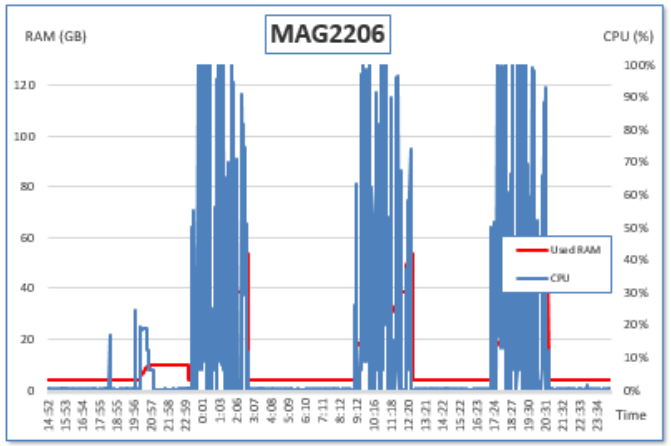


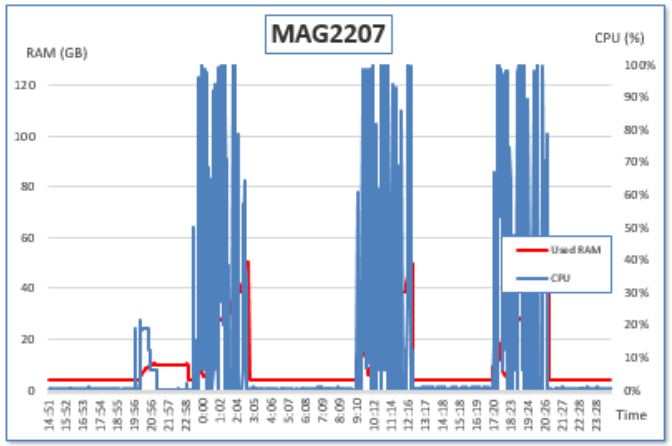






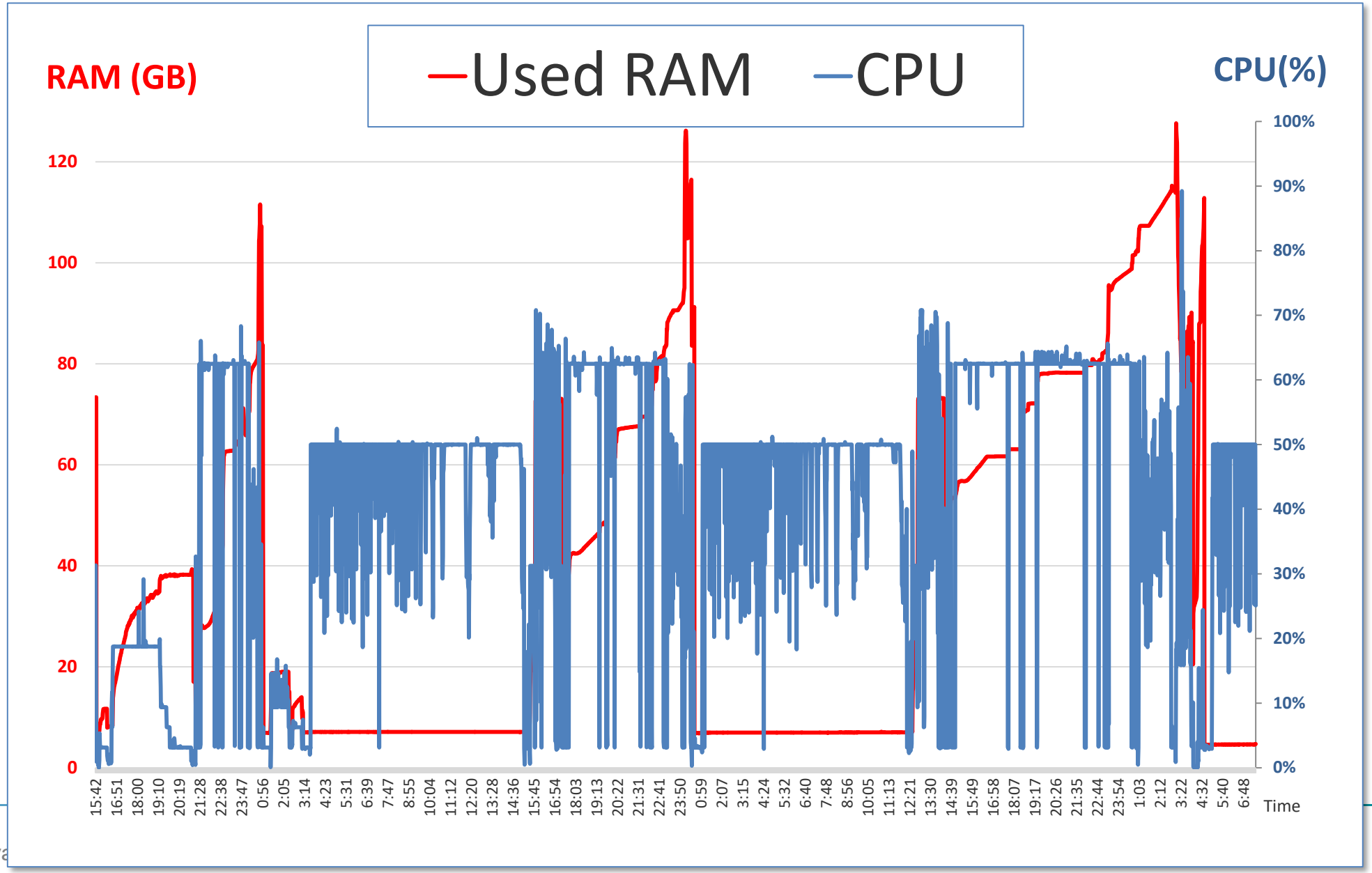






TMIP

CPU/RAM usage on single node



TMIP

Incremental population sample size by loop

Loop	Population proportion
1	25%
2	50%
3	100%

Model runtime

Scenario	Population	Households	Multiple nodes	Single node
2015	4.4 M	1.6 M	34 Hours (↓32%)	50 Hours
2035	6.3 M	2.3 M	43 Hours (↓32%)	63 Hours

Single Node Runtime Statistics (2015)

Step	Runtime (hh:mm:ss)	Runtime split
Initialization	3:51:20	8%
Network Skimming	0:36:27	1%
Accessibility Manager	5:14:18	10%
Population Synthesis	4:06:43	8%
Activity Generator	17:31:14	35%
Non ABM Models	3:08:52	6%
Assignment	15:36:17	31%
Total Runtime	**50:05:11**	**100%**

Debugging Settings in Eclipse Mars

Version: Mars Release (4.5.0)

Java EE - mag-release/src/main/java/models/MainAbmApplication.java - Eclipse

File Edit Source Refactor Navigate Search Project Run Window Help

Quick Access | Java EE

Project Explorer

- gradle-wrapper.jar
- cajo.jar
- common-base-0.1.jar
- JRE System Library [jre1.8.0_92]
- jppf-client-5.1.1.jar - D:\Projects\mag\MagA
- jppf-common-5.1.1.jar - D:\Projects\mag\Ma
- jppf-node-5.1.1.jar - D:\Projects\mag\MagAB
- log4j-1.2.16.jar - D:\Projects\mag\MagABM_
- build
- gradle
- lib
- src
- build.gradle
- gradlew
- gradlew.bat
- README.md
- settings.gradle
- mag_popsyn
- mag-release
  - src/main/java
    - accessibility
    - activities
    - core
    - jppfAdmin
    - jppfSLA
    - logit
    - mdcev
    - methods
    - models
      - AbstractChoiceHandler.java
      - AbstractLogitHandler.java
      - DecisionMakerIf.java
      - DistributableIf.java
      - MainAbmApplication.java
      - ModelComponents.java
      - MyJobListener.java
      - MyRandom.java
      - ParallelHelper.java
      - SizeTermDmu.java
      - SolveDistributedIf.java
    - models.aotp
    - models.cdap
    - models.discrTask
    - models.jtf
    - models.locSoa
    - models.maintTask
    - models.mc
    - models.mc.avail
    - models.mtf
    - models.oldUnused
    - models.results
    - models.schoolEscorting
    - models.specialEvent
    - models.tod
    - models.tourFormation
    - models.university
    - models.usl
    - models.uwl

MainAbmApplication.java

1 MainAbmApplication
Run As
Run Configurations...
Organize Favorites...

```
1   package models;
2
3⊕  import java.util.Arr
93
94
95  public class MainAbmApplication {
96
97
98      public static final int DEFAULT_PACKET_SIZE = 200;
99
100     public static final String FIRST_HH_INDEX_KEY = "first.hh.index";
101     public static final String LAST_HH_INDEX_KEY = "last.hh.index";
102
103     public static final int AO_PACKET_SIZE = DEFAULT_PACKET_SIZE;
104     public static final int CDAP_PACKET_SIZE = DEFAULT_PACKET_SIZE;
105     public static final int BUSINESS_LOC_PACKET_SIZE = DEFAULT_PACKET_SIZE;
106     public static final int MAND_TOD_PACKET_SIZE = DEFAULT_PACKET_SIZE;
107     public static final int SCHOOL_ESCORT_PACKET_SIZE = DEFAULT_PACKET_SIZE;
108     public static final int JOINT_FREQ_PACKET_SIZE = DEFAULT_PACKET_SIZE;
109     public static final int JOINT_LOC_TOD_PACKET_SIZE = DEFAULT_PACKET_SIZE;
110     public static final int MAINT_FREQ_PACKET_SIZE = DEFAULT_PACKET_SIZE;
111     public static final int MAINT_ALLOC_PACKET_SIZE = DEFAULT_PACKET_SIZE;
112     public static final int DISCR_FREQ_PACKET_SIZE = DEFAULT_PACKET_SIZE;
113     public static final int TOUR
114     public static final int ACT_
115     public static final int TOUR
116     public static final int TOUR
117
118     public static final String M
119     public static final String M
120     public static final String M
```

Markers | Properties | Servers | Data Source

No consoles to display at this time.

Outline | Task List

- models
- MainAbmApplication
  - DEFAULT_PACKET_SIZE : int
  - FIRST_HH_INDEX_KEY : String
  - LAST_HH_INDEX_KEY : String
  - AO_PACKET_SIZE : int
  - CDAP_PACKET_SIZE : int
  - BUSINESS_LOC_PACKET_SIZE : int
  - MAND_TOD_PACKET_SIZE : int
  - SCHOOL_ESCORT_PACKET_SIZE : int
  - JOINT_FREQ_PACKET_SIZE : int
  - JOINT_LOC_TOD_PACKET_SIZE : int
  - MAINT_FREQ_PACKET_SIZE : int
  - MAINT_ALLOC_PACKET_SIZE : int
  - DISCR_FREQ_PACKET_SIZE : int
  - TOUR_FORMATION_PACKET_SIZE : int
  - ACT_SEQ_LOC_PACKET_SIZE : int
  - TOUR_TOD_PACKET_SIZE : int
  - TOUR_MODE_CHOICE_PACKET_SIZE :
  - MATRIX_SERVER_HOST_ADDRESS_KEY
  - MATRIX_SERVER_HOST_PORT_KEY : St

models.MainAbmApplication.java - mag-release/src/main/java

Create, manage, and run configurations

Run a Java application

type filter text

- Apache Tomcat
- Eclipse Application
- Eclipse Data Tools
- Generic Server
- Generic Server(External
- HTTP Preview
- J2EE Preview
- Java Applet
- Java Application
  - MainAbmApplicatic
- JUnit
- JUnit Plug-in Test
- Maven Build
- OSGi Framework
- Task Context Test
- XSL

Filter matched 16 of 17 items

Name: MainAbmApplication

Main | Arguments | JRE | Classpath | Source | Environment | Common

Project: mag-release | Browse...

Main class: models.MainAbmApplication | Search...

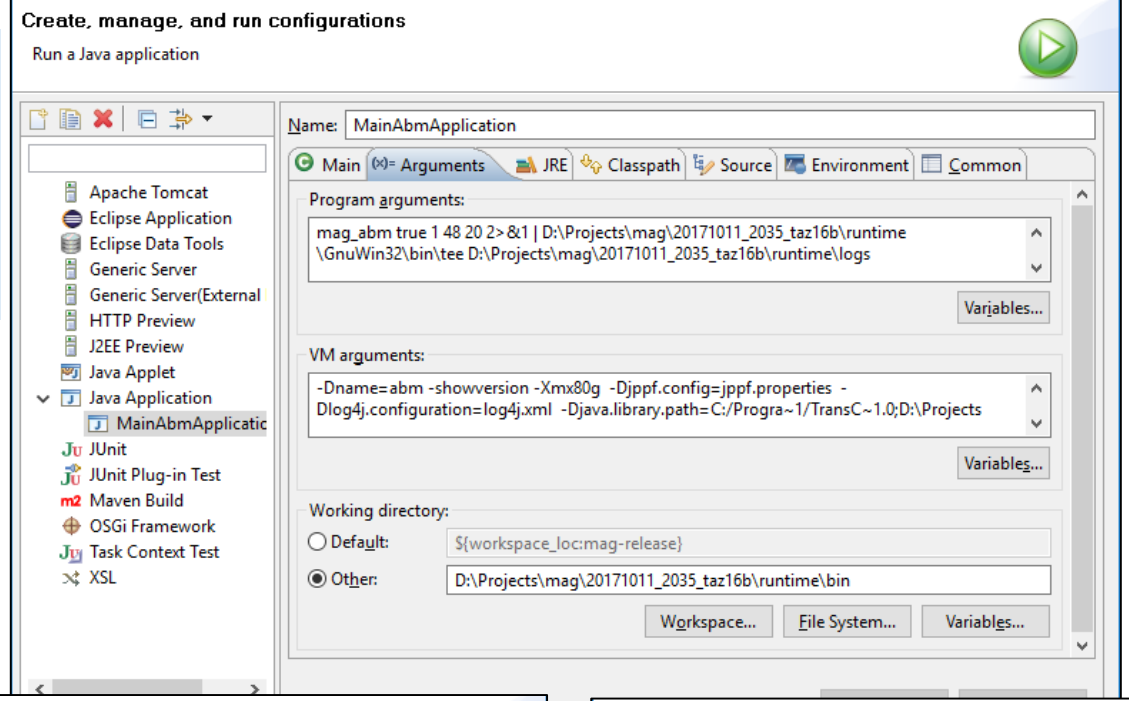
- [x] Include system libraries when searching for a main class
- [x] Include inherited mains when searching for a main class
- [ ] Stop in main

Revert | Apply

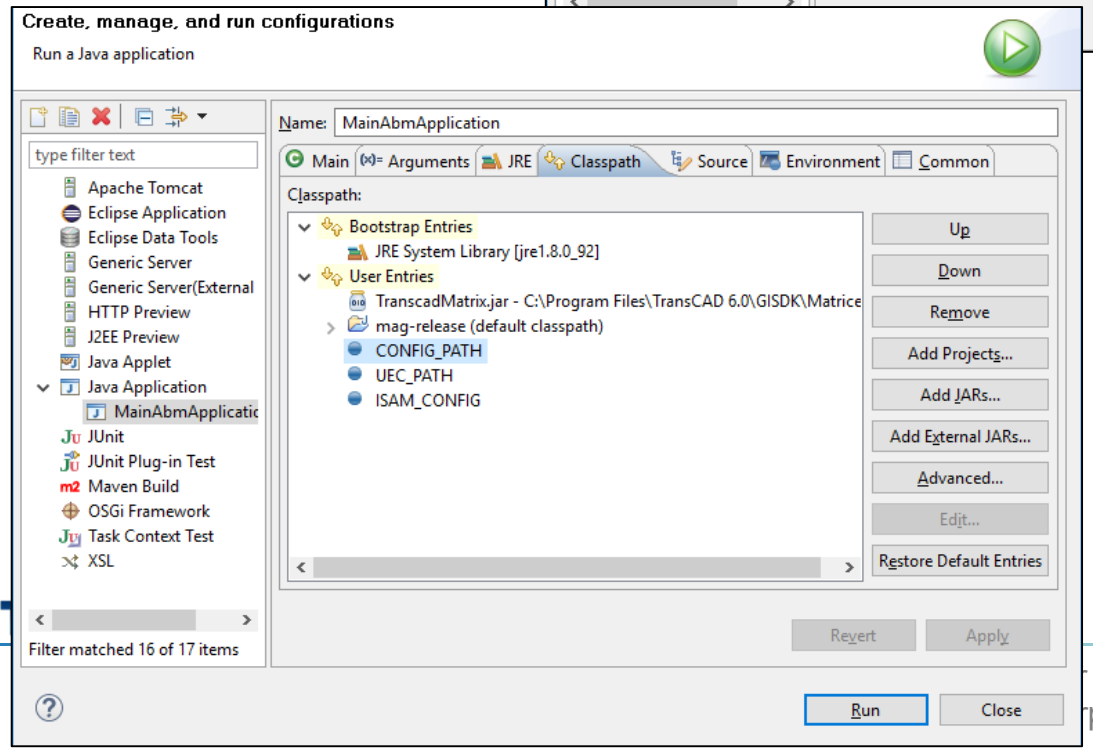
TMIP

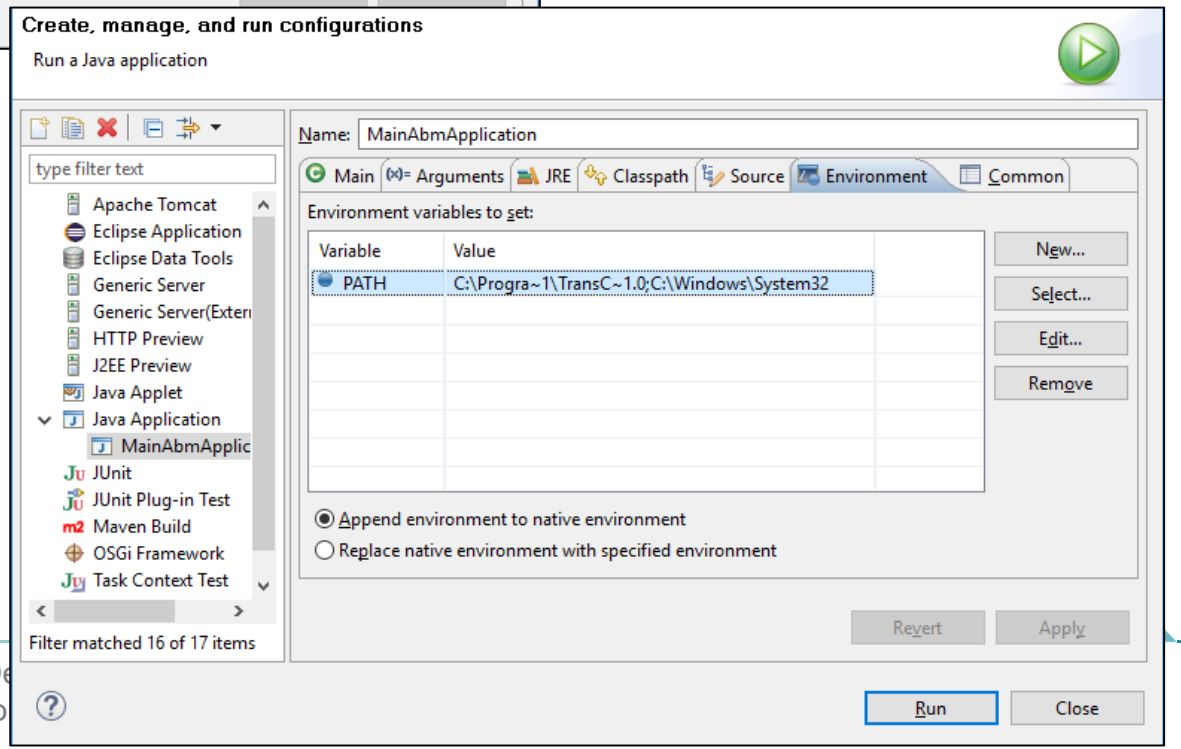
In

Debugging Settings in Eclipse Mars



Small sample (1%) for debugging





Scenario File Size

- Default input: 2.5 GB
- Complete run: 60 - 80 GB
- 100 GB space for one ABM scenario run

Main Output Files

Aggregate trip tables for static assignment

tripTables.csv	tripTables_late.mtx	tripTables_pm.mtx	tripTables_midday.mtx	tripTables_am.mtx
tripTables_early.mtx	adjusted_disaggTripList.csv	output_disaggTripList.csv	output_disaggAtWorkSubTourList...	output_disaggFullyJointTourList.csv
output_disaggPartiallyJointTourLi...	output_disaggPersonList.csv	output_disaggTourList.csv	output_disaggHouseholdList.csv	activitySequenceCalib.csv
individualActivitySequenceResults...	individualNonMandTourResults.csv	discrTaskFreq.csv	discrTaskFreqCalib.csv	maintTaskAlloc.csv
maintTaskFreq.csv	maintTaskFreqCalib.csv	jointActivitySequenceLocation.csv	jointTourParticipants.csv	jointFreqComp.csv
schoolEscortBundles.csv	schoolEscortByChauffeur.csv	schoolEscortByChild.csv	mandatoryTourTodResults.csv	mandatoryTourResults.csv
schoolActivityChainResults.csv	workActivityChainResults.csv	mandActFreqOrderResults.csv	linkedWorkerResults.csv	cdapResults.csv
aoResults.csv	tpResults.csv	schoolLocationResults.csv	workLocationResults.csv	

Disaggregate household and person level info

Challenges

- Distributed computing using JPPF saves runtime but could be unstable due to **network disruptions**
- Access to MySQL database could be denied: **Refresh Access Privileges**
- “java.rmi.ConnectException: Connection refused to host…” frequently: **Reboot Servers**
- “[org.jppf.server.node.JPPFNode.run(142)]: Socket closed”: **Restart Nodes**
- Terminate any previous Java runs before submitting ABM run when it crashed
- Change too many location of settings such as memory, discovery group, input file names

Contact Information

- Vladimir Livshits, MAG, VLivshits@azmag.gov
- Shuyao Hong, MAG, SHong@azmag.gov
- Petya Maneva, MAG, PManeva@azmag.gov
- Arup Dutta, MAG, ADutta@azmag.gov
- Peter Vovsha, WSP, Peter.Vovsha@wsp.com
- Jim Hicks, WSP, James.Hicks@wsp.com
- Kyunghwi Jeon, MAG, KJeon@azmag.gov