Space And Accessibility in the SANDAG Activity-Based Travel Model

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Introduction

- Treatment of space in the San Diego Activity-Based travel demand model system
- Supporting data structures and sources
- Use of data to construct accessibility measures
- Activity-based model structure and estimation results
- Status of model development and next steps

Treatment of Space: TAZs and MGRAs

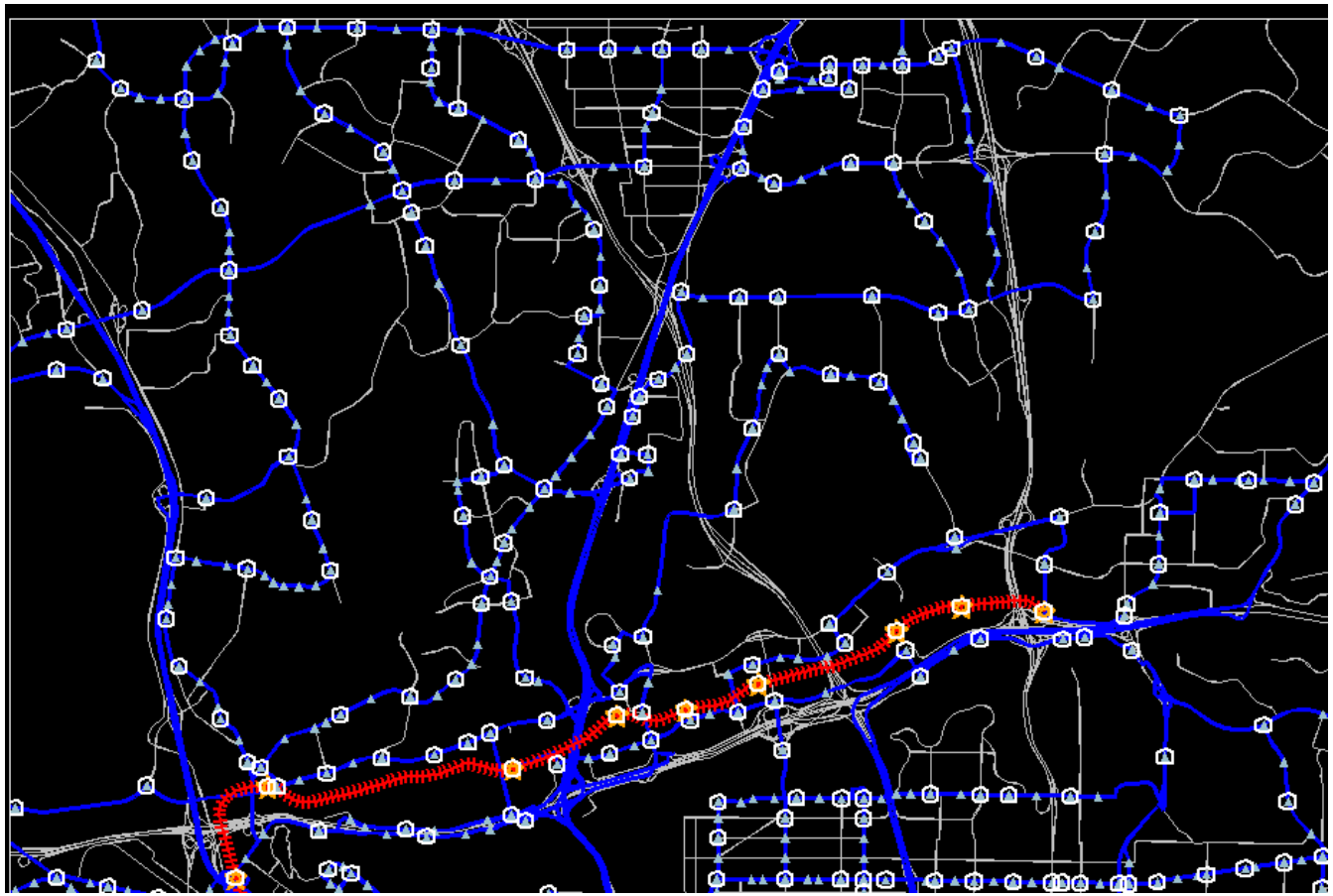
- MGRA (white lines) follow streets
- 32,000 MGRAs
- 4,600 TAZs (red lines)
- About 10 MGRAs to 1 TAZ

MGRA: Master Geographic Reference Area

MGRA Data

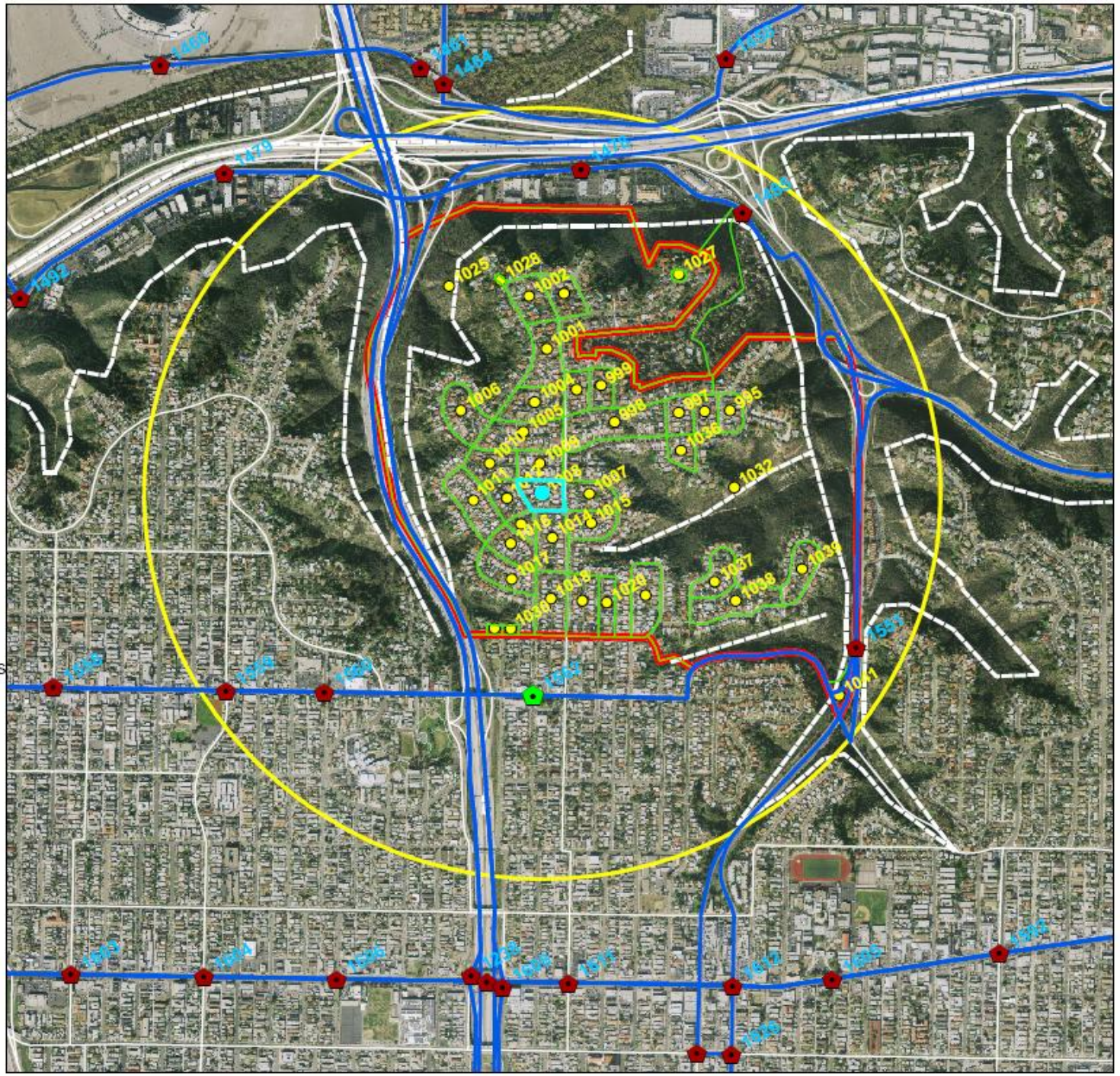
- Employment by ~25 sectors
  - With production versus office broken out
- Enrollment
  - K-8, 9-12, University, College, Other Adult Education
- Households/Population
  - By dwelling unit type, military versus non-military, non-institutional group quarters
- Data based on parcel-level space inventory with employment allocation procedures
- PECAS model currently under development (super-TAZ level)

Transit Network, Stops and Access Points



- About 2,500 transit access points (stops)
- Stop-to-stop skims (TransCAD)
- All transit boardings/alights located at TAPs

Walking Constraints



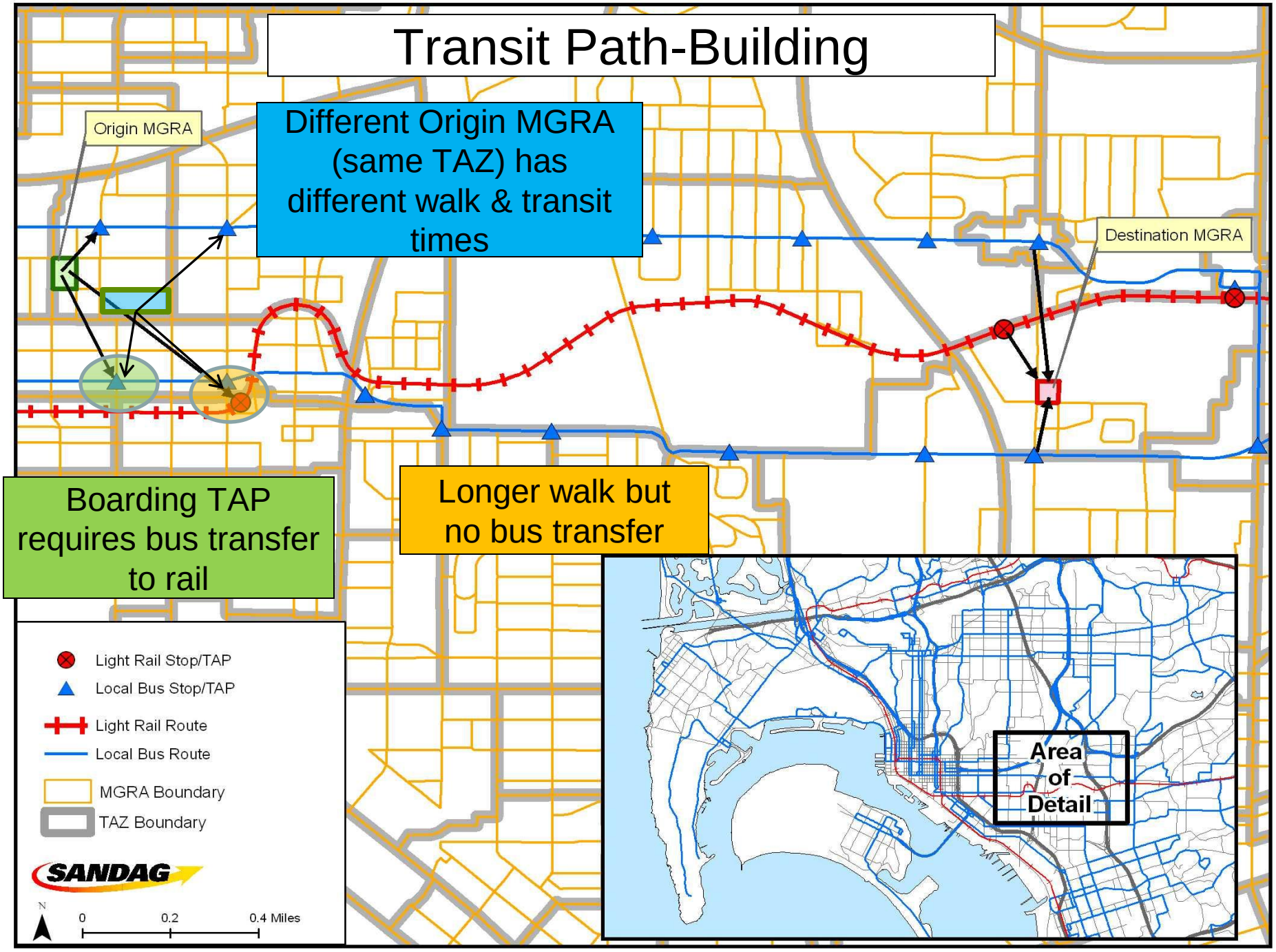
Level-of-Service Components

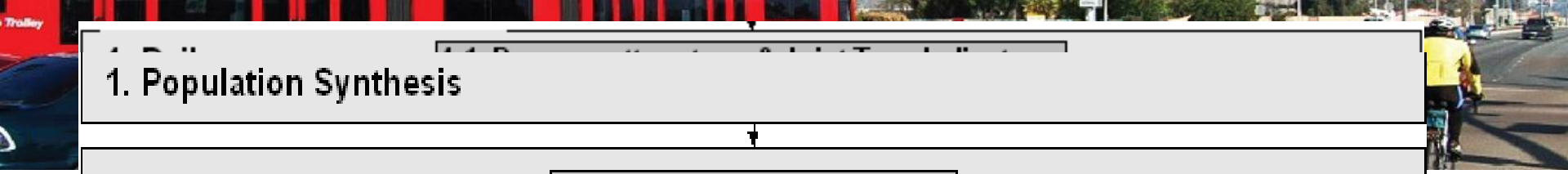
Component	Geography	Source
Transit Walk Access and Egress	MGRA to TAP	GIS
Transit Drive Access and Egress	TAZ (MGRA) to TAZ (TAP)	TransCAD
Transit In-vehicle Times, Wait Times, Fares	TAP to TAP	TransCAD
Auto Times, Distances, Costs	TAZ (MGRA) to TAZ (MGRA)	TransCAD
Walk/Bike Time • Close MGRA pair • Far MGRA pair	 • MGRA to MGRA • TAZ (MGRA) to TAZ (MGRA)	 • GIS • TransCAD

“On-the-Fly” Transit Path-Building

- Utility calculated for each available transit path
  - Origin MGRA – Initial Boarding TAP – Final Alighting TAP To Destination MGRA
- For each of 5 line-haul modes
  - Local, Express, BRT, LRT, Commuter Rail
- And 3 access modes
  - Walk, Park-and-Ride, Kiss-and-Ride
- Best (highest utility) TAP-pair retained for each line-haul mode

Transit Path-Building





1. Population Synthesis

2. Long-term

2.1. Usual workplace / school

3. Mobility

3.1. Free Parking Eligibility → 3.2. Car ownership → 3.3. Transponder Ownership

Individual Mandatory Tours

Joint Non-Mandatory Tours

Allocated Tours

Individual Discretionary Tours

5. Tour level

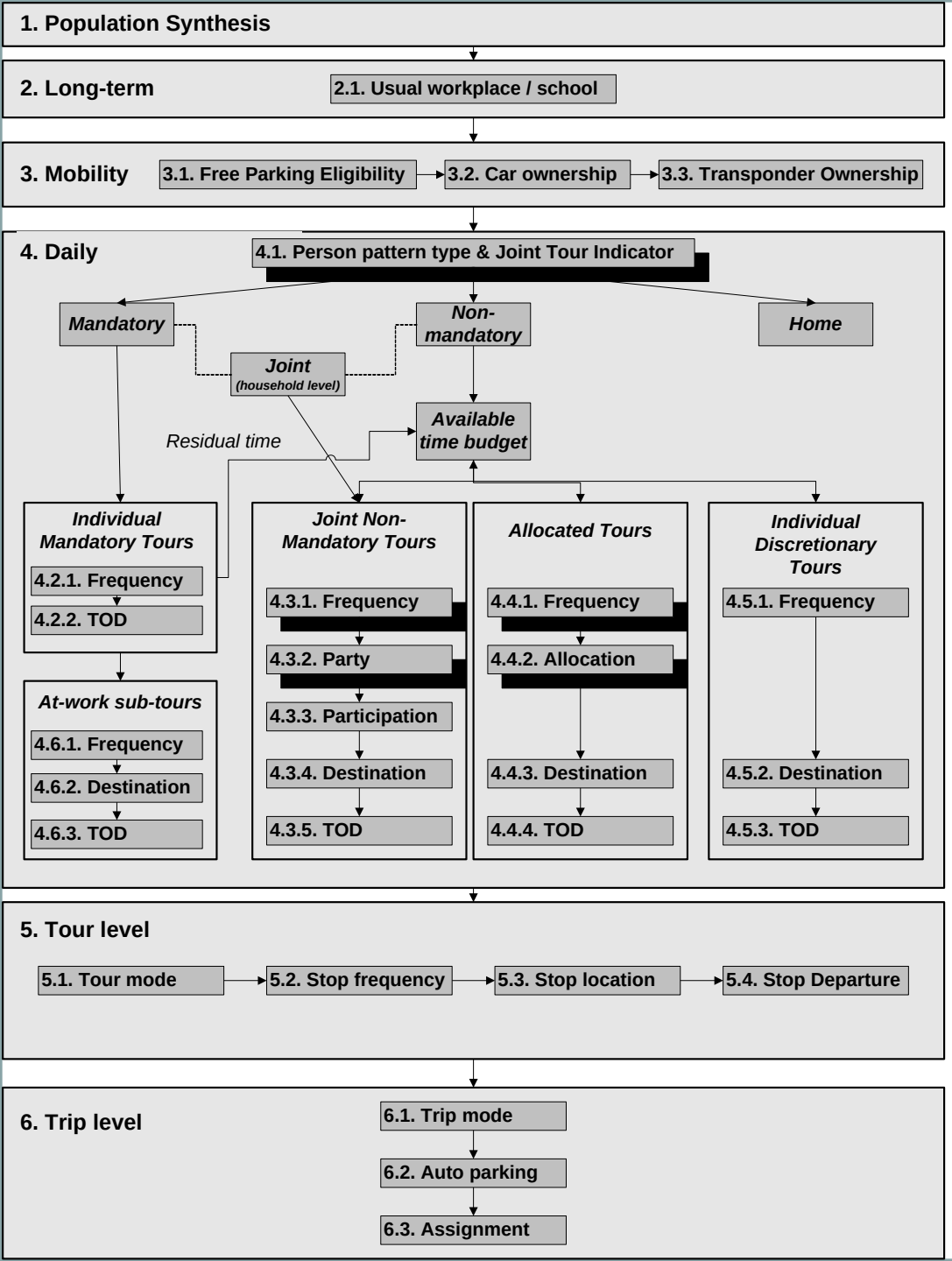
5.1. Tour mode → 5.2. Stop frequency → 5.3. Stop location → 5.4. Stop Departure

6. Trip level

6.1. Trip mode

6.2. Auto parking

6.3. Assignment



Accessibilities provide important linkages between lower-level model components and upper-level choices

For example: The influence of transit accessibility tour generation?

Types of Accessibility Measures

$$P_{a^*,i} = \frac{e^{V_{a^*,i}}}{\ln[\sum_{a \in A} e^{V_{a,i}}]}$$

Mode Choice Logsum (composite utility of travel across all modes)

One per MGRA-pair

$$A_i = \ln\left[\sum_{j=1}^{I} S_j \times \exp(-\gamma c_{ij})\right]$$

Destination Choice Logsum (composite utility of travel across all modes to all destinations)

One per Origin MGRA

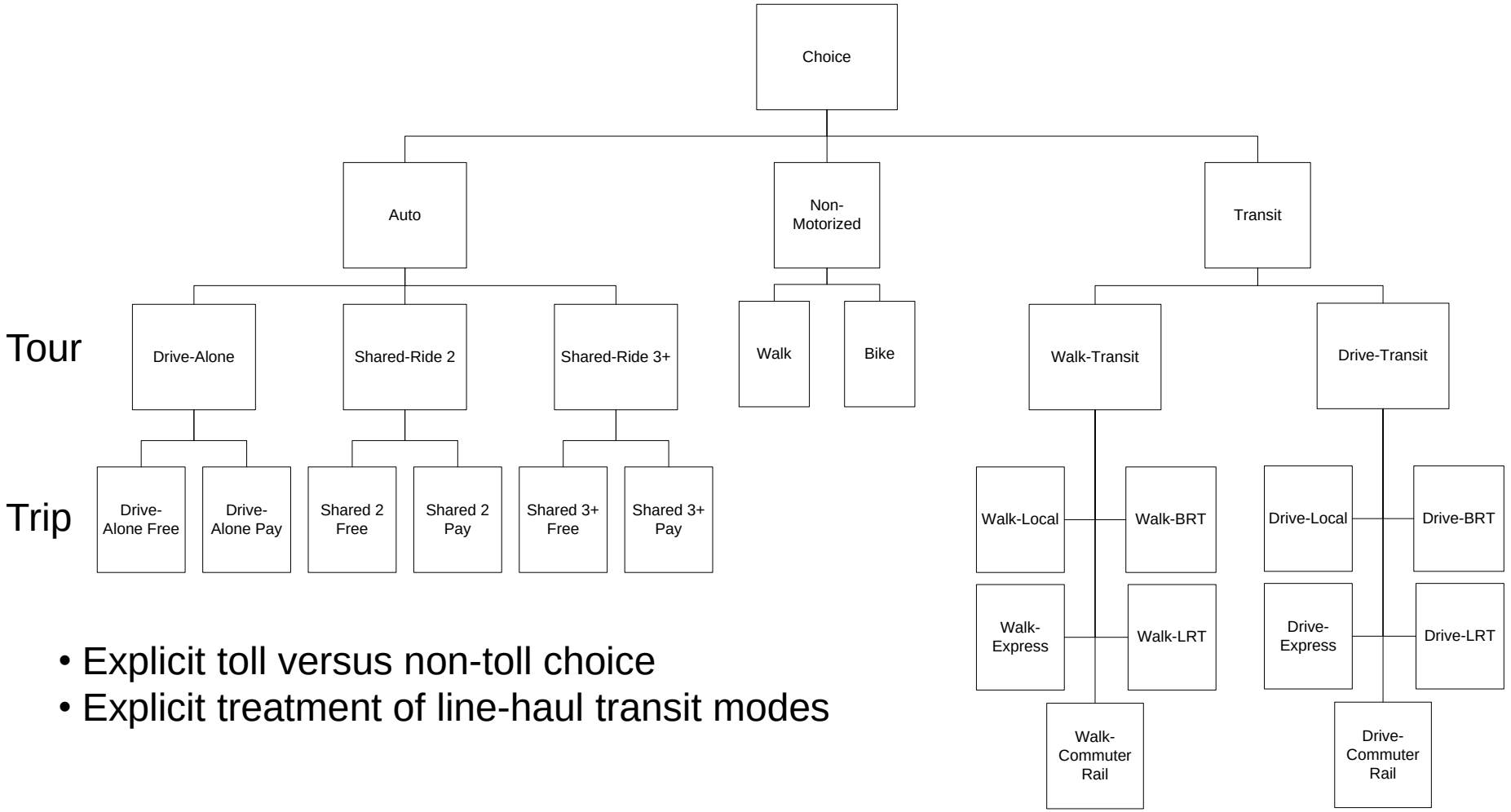
Types of Accessibility Measures

- Mode choice accessibilities used for:
  - Auto ownership, mandatory tour frequency models, destination choice models, and time-of-day choice models
- Destination choice accessibilities used for:
  - Auto ownership, Coordinated Daily Activity Pattern Model, Non-Mandatory Tour Frequency Models, Intermediate Stop Frequency Models
  - A total of 46 different accessibilities calculated based on activity type, mode combinations available, auto sufficiency

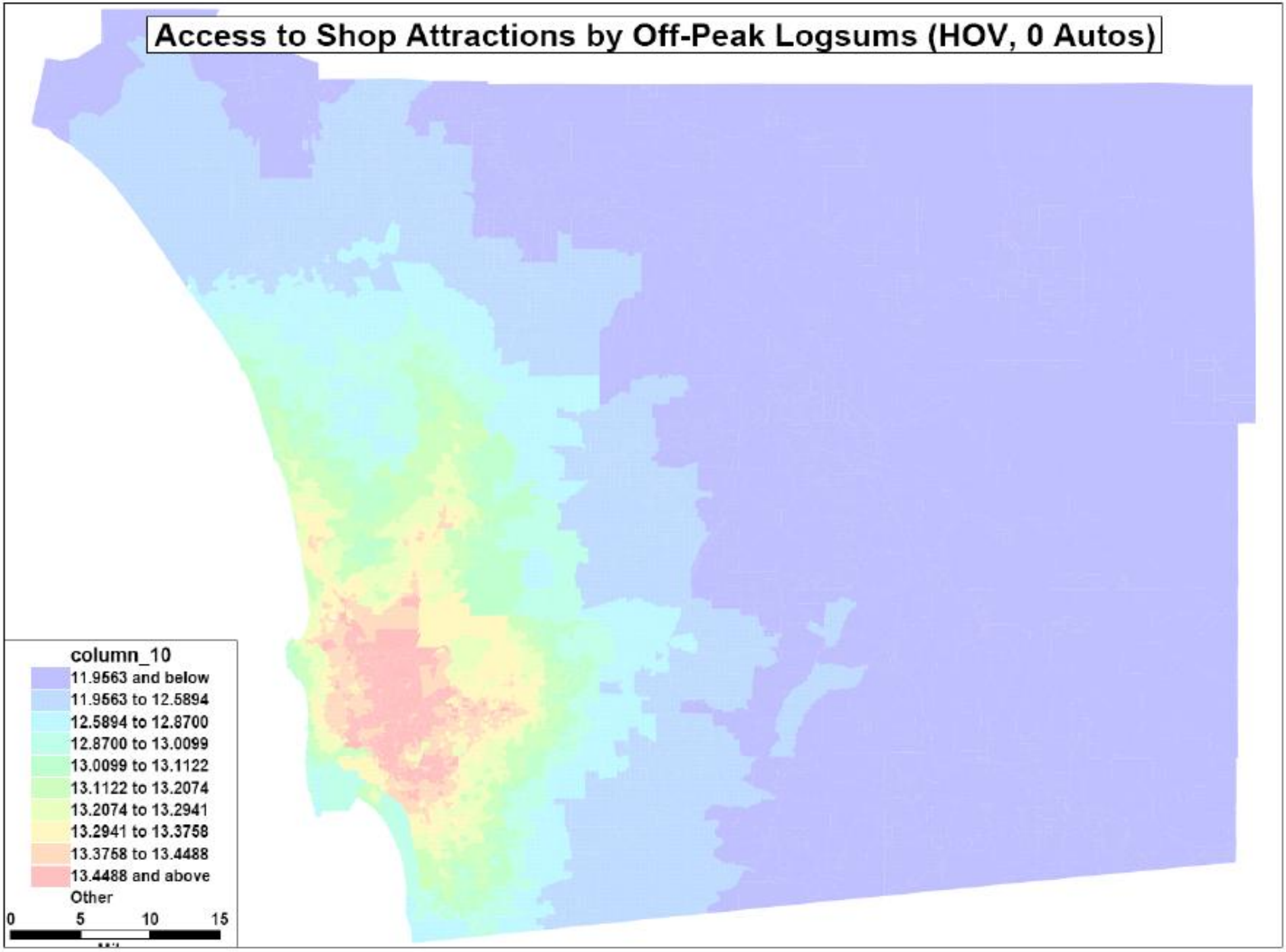
Activity Types

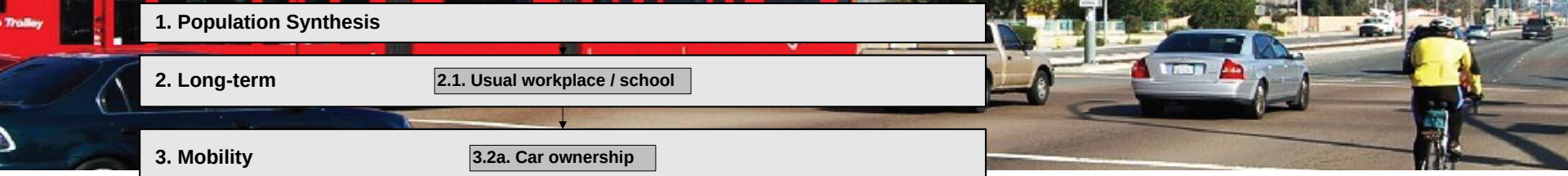
TYPE	PURPOSE	DESCRIPTION	CLASSIFICATION	ELIGIBILITY
1	Work[1]	Working at regular workplace or work-related activities outside the home.	Mandatory	Workers and students
2	University	College +	Mandatory	Age 18+
3	High School	Grades 9-12	Mandatory	Age 14-17
4	Grade School	Grades K-8	Mandatory	Age 5-13
5	Escorting	Pick-up/drop-off passengers (auto trips only).	Maintenance	Age 16+
6	Shopping	Shopping away from home.	Maintenance	5+ (if joint travel, all persons)
7	Other Maintenance	Personal business/services, and medical appointments.	Maintenance	5+ (if joint travel, all persons)
8	Social/Recreational	Recreation, visiting friends/family.	Discretionary	5+ (if joint travel, all persons)
9	Eat Out	Eating outside of home.	Discretionary	5+ (if joint travel, all persons)
10	Other Discretionary	Volunteer work, religious activities.	Discretionary	5+ (if joint travel, all persons)

Modes



- Explicit toll versus non-toll choice
- Explicit treatment of line-haul transit modes


Access to Shop Attractions by Off-Peak Logsums (HOV, 0 Autos)
column_10
11.9563 and below
11.9563 to 12.5894
12.5894 to 12.8700
12.8700 to 13.0099
13.0099 to 13.1122
13.1122 to 13.2074
13.2074 to 13.2941
13.2941 to 13.3758
13.3758 to 13.4488
13.4488 and above
Other
0
5
10
15



Year 1 (2009):

Simplified activity-based travel generation models estimated, implemented, and calibrated

Selected Estimation Results: Auto Ownership

- Non-motorized DC accessibility (+ for 0 autos)
- Auto minus transit DC accessibility to non-mandatory activities (- for 0 autos)
- Auto minus transit MC accessibility across workers and students (- for 0 autos)
- Percent of mandatory travel by rail for workers (+ for 0 autos)
- Intersection, population density also significant and reasonable

Coordinated DAP

- Accessibilities to non-mandatory destinations (+ for non-mandatory travel patterns)
- Accessibilities to work & school locations (+ for mandatory and ***joint*** travel) – less time commuting, more time with family!

Individual DAP

- Accessibilities to shopping, eating out, maintenance, discretionary destinations (+ for tours generated by appropriate purposes)
- Accessibilities to work & school locations (+ for non-mandatory travel)

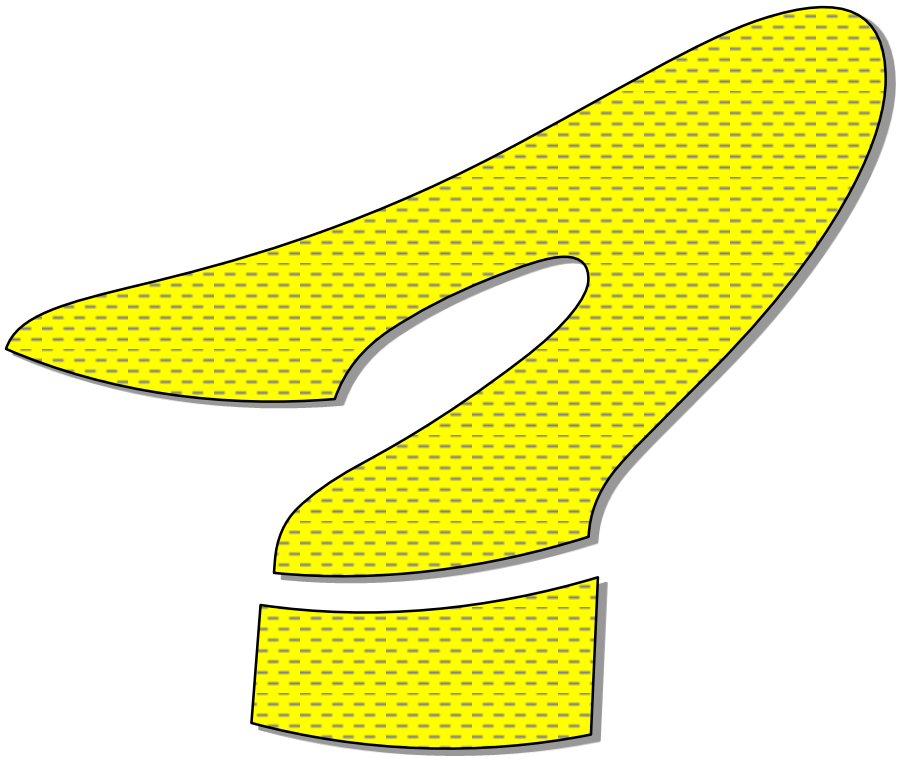
Conclusions

- Use of MGRA system
  - Provides rich data on activity locations for destination choice
- Detailed transit path-building
  - No percent walk assumptions
  - Consistency between activity locations and level-of-service matrices
- Accessibilities
  - Multiple measures related to activity purpose, combinations of modes, auto sufficiency
  - Provide upward integrity in model system
  - Estimation results support influence of accessibility on auto ownership, tour generation

Model Development Schedule

- Year 2 (2010)
  - On-board survey data available
  - Tour mode choice, time-of-day choice, destination choice
- Year 3 (2011)
  - Trip-level models estimated, implemented
  - Toll transponder ownership
  - Employer-provided parking and parking lot choice
- Year 4 (2012)
  - Special market models (visitors, air passengers, special events)
  - PECAS (land-use model) integration
  - Model validation

Questions and Discussion



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