California Statewide Travel Demand Model (CSTDM)

Tier 2 Training

Unit 3

Model Overview

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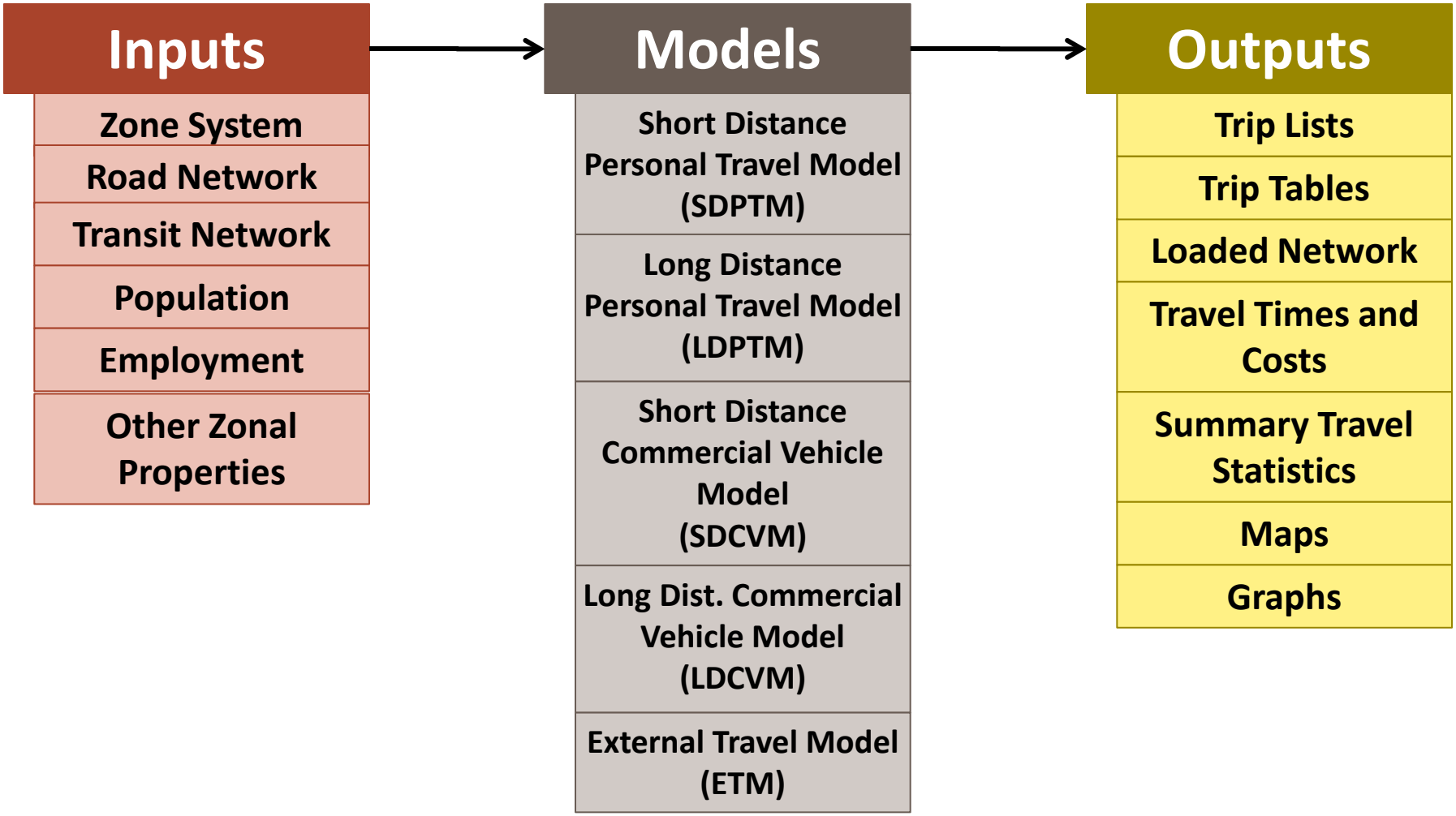
California Statewide Travel Demand Model

- Models travel on a typical weekday in the spring / fall (when schools are in session)
- Models personal travel within California made by every California resident, for all modes and purposes
- Models all commercial vehicle movements within California
- Models vehicle trips entering / leaving California

CSTDM System

CSTDM System

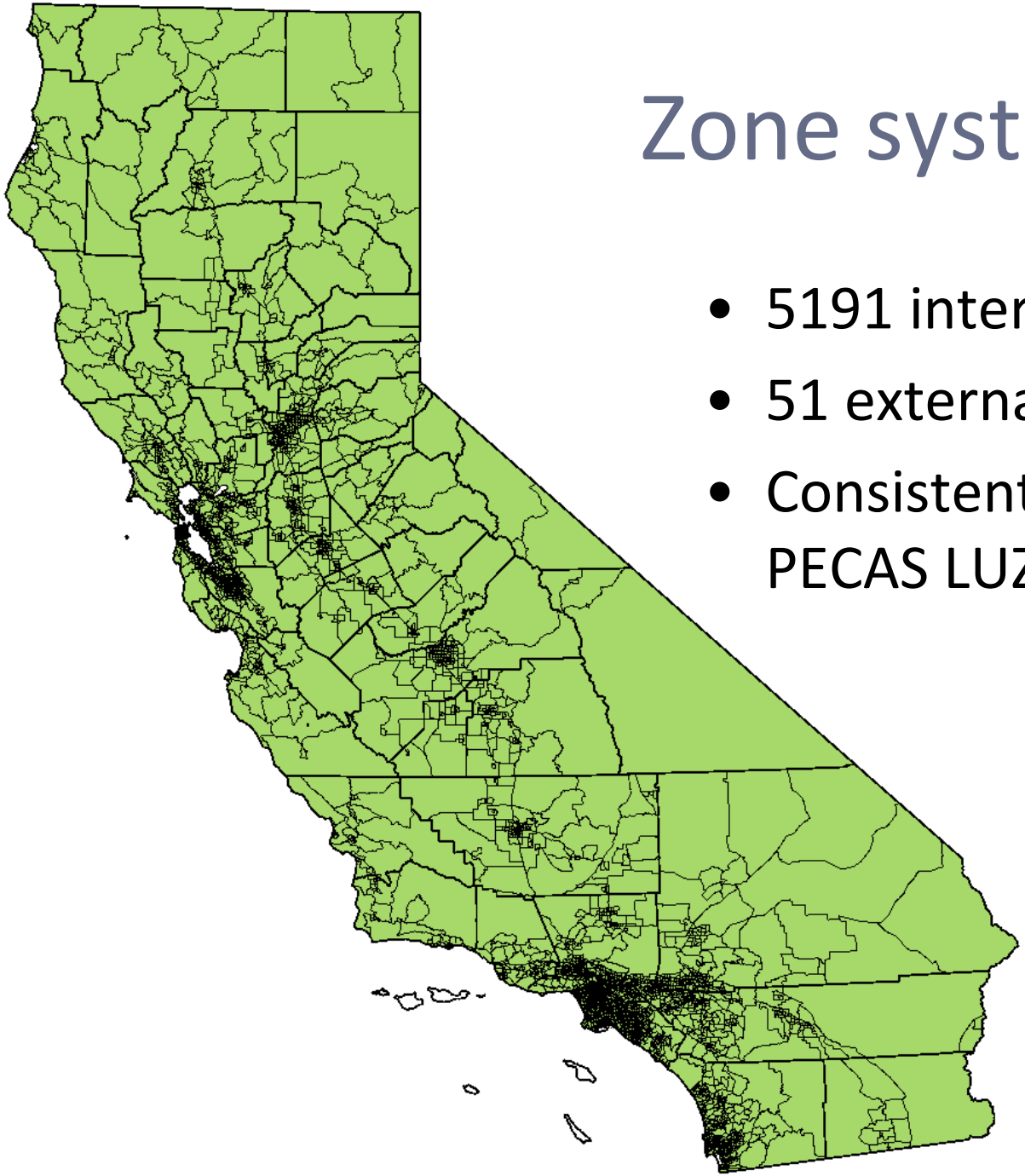


Modes in Model

Mode	Short Distance Personal	Long Distance Personal	Short Distance Commercial	Long Distance Commercial	External Travel
Auto SOV	■	■			■
Auto HOV 2 person	■	■			■
Auto HOV 3+ person	■	■			■
Transit (bus and rail)	■				
Bicycle	■				
Walk	■				
Air		■			
Rail		■			
Light commercial vehicle			■		
Medium (Single unit) truck			■		■
Heavy (Multiple unit) truck			■	■	■

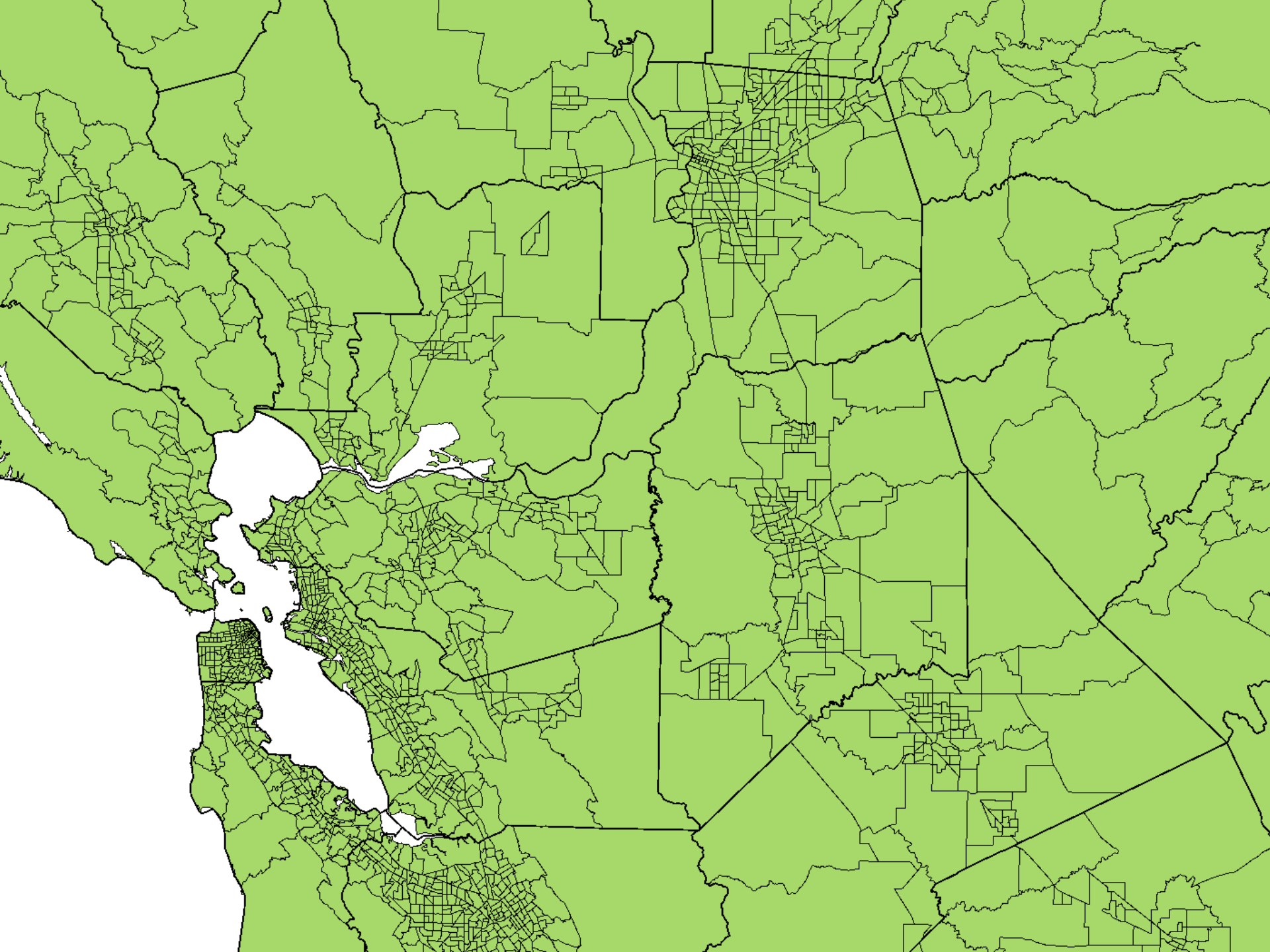
Time Periods

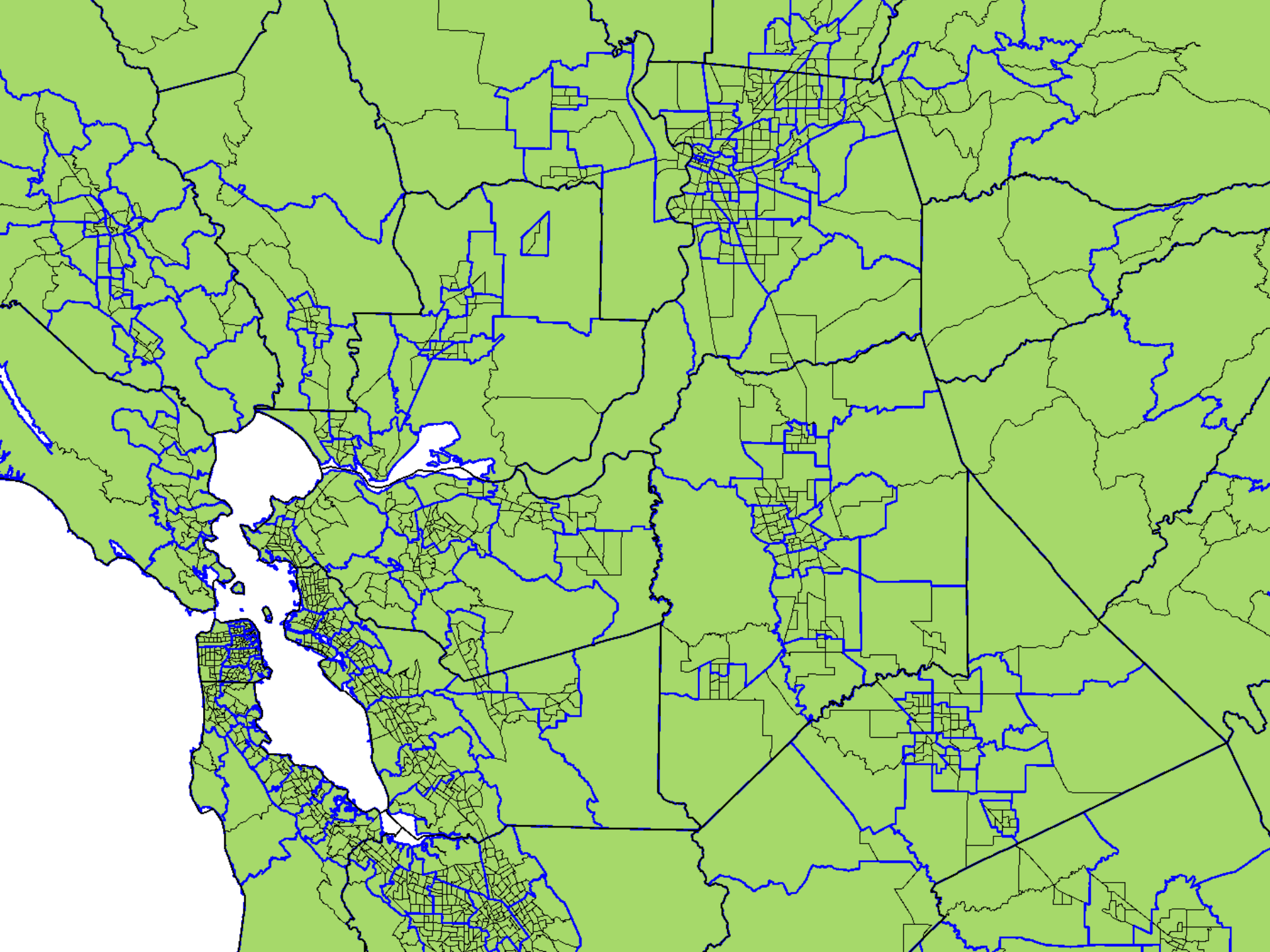
Time period	Definition	Assignment
Offpeak Early	3 AM to 6 AM	Offpeak
AM Peak	6 AM to 10AM	AM Peak
Midday	10 AM to 3 PM	Midday
PM Peak	3 PM to 7 PM	PM Peak
Offpeak Late	7 PM to 3 AM	Offpeak



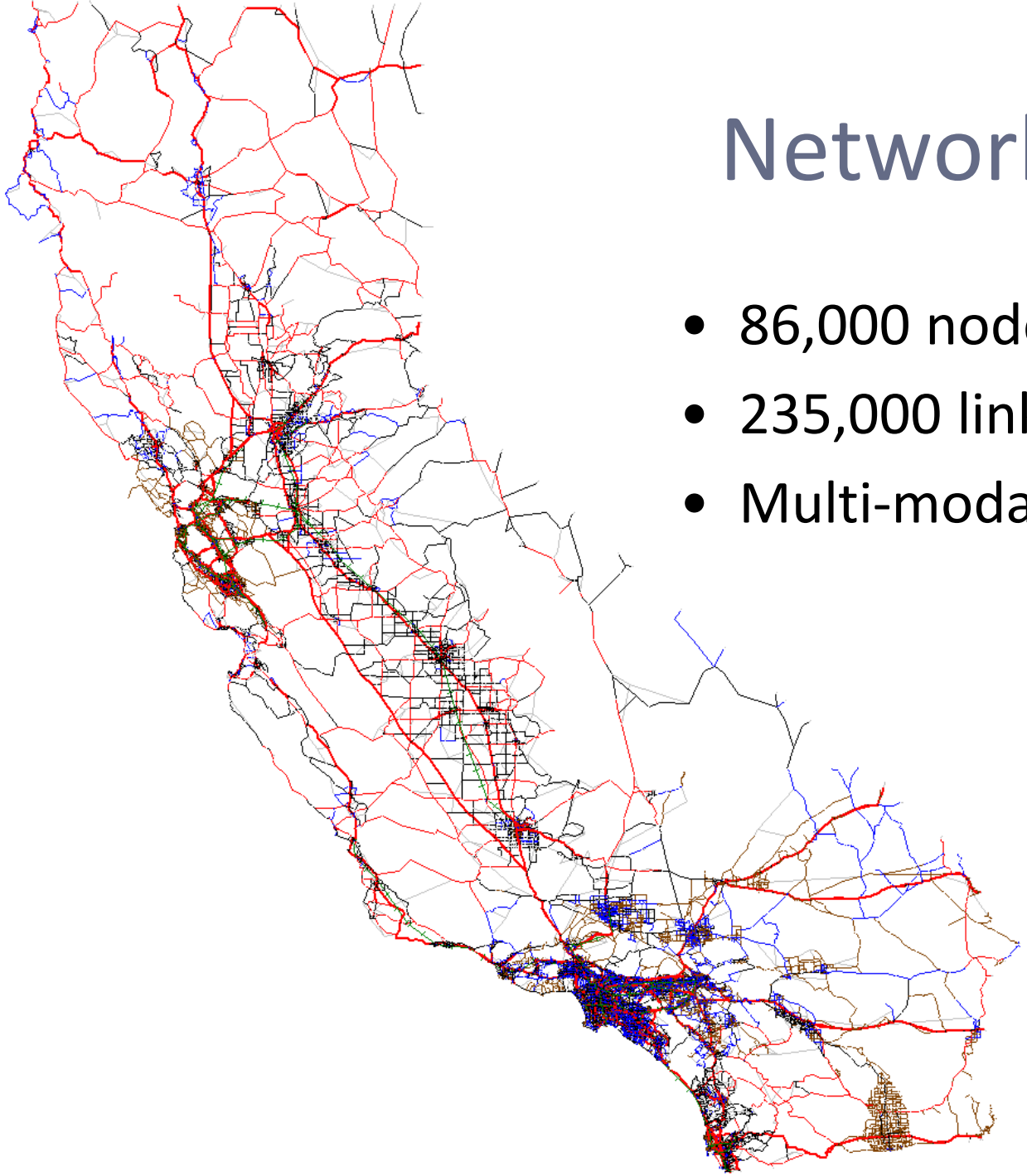
Zone system

- 5191 internal zones
- 51 external zones
- Consistent with 524 PECAS LUZ

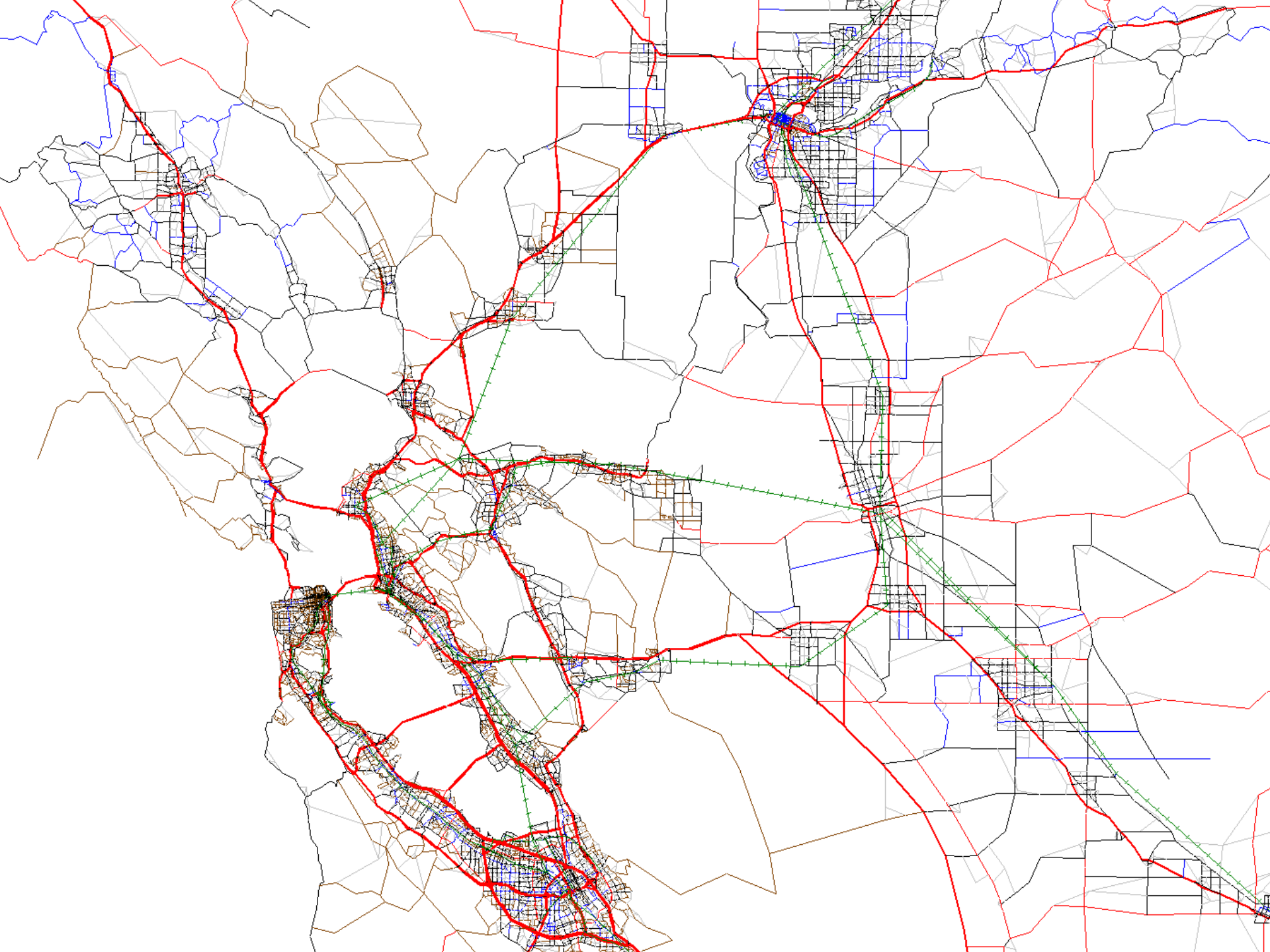




Network



- 86,000 nodes
- 235,000 links
- Multi-modal



Transit Representation

- Code fixed route transit (rail) explicitly by route
- Represent local bus level of service using a mathematical model
  - Based on observed (Google Transit) data
  - Produces in vehicle time and out of vehicle time
  - Uses level of service variable for bus quality
  - Reasonable transit representation for a statewide model with a fraction of the coding

Non-Network Inputs

- TAZ level Data:
  - Employment by Industry Type
  - Employment by Occupation Type
  - School Enrolment by Type

- "Synthetic" Population (Persons / Households)
  - Disaggregate population comprised of PUMS records
  - One record for every person in California
  - Assigned to each TAZ based on marginal total targets
    - e.g. households by income group

CSTDM Models

Models
Short Distance Personal Travel Model (SDPTM)
Long Distance Personal Travel Model (LDPTM)
Short Distance Commercial Vehicle Model (SDCVM)
Long Dist. Commercial Vehicle Model (LDCVM)
External Travel Model (ETM)

- Common features:
  - Disaggregate simulation aspect
  - Produces a consistent trip list output
  - Uses the same set of inputs where common data is needed (e.g. # of retail employees; travel skims)

External Travel Model

Models
Short Distance Personal Travel Model (SDPTM)
Long Distance Personal Travel Model (LDPTM)
Short Distance Commercial Vehicle Model (SDCVM)
Long Dist. Commercial Vehicle Model (LDCVM)
External Travel Model (ETM)

- Travel entering, exiting or through California
- Includes port traffic
- Cars, medium & heavy trucks
- Disaggregate simulation of exogenous crossing counts
- Based on models estimated elsewhere; calibrated using FAF / NHTS data

Long Distance Commercial Vehicle Model

Models
Short Distance Personal Travel Model (SDPTM)
Long Distance Personal Travel Model (LDPTM)
Short Distance Commercial Vehicle Model (SDCVM)
Long Dist. Commercial Vehicle Model (LDCVM)
External Travel Model (ETM)

- Travel by commercial vehicles > 50 miles
- Heavy trucks carrying goods
- Uses CalSIIM commodity flows between TAZs
- Flows factored to represent vehicle trips by time period
- Poisson sampling to establish individual vehicle movements

Short Distance Commercial Vehicle Model

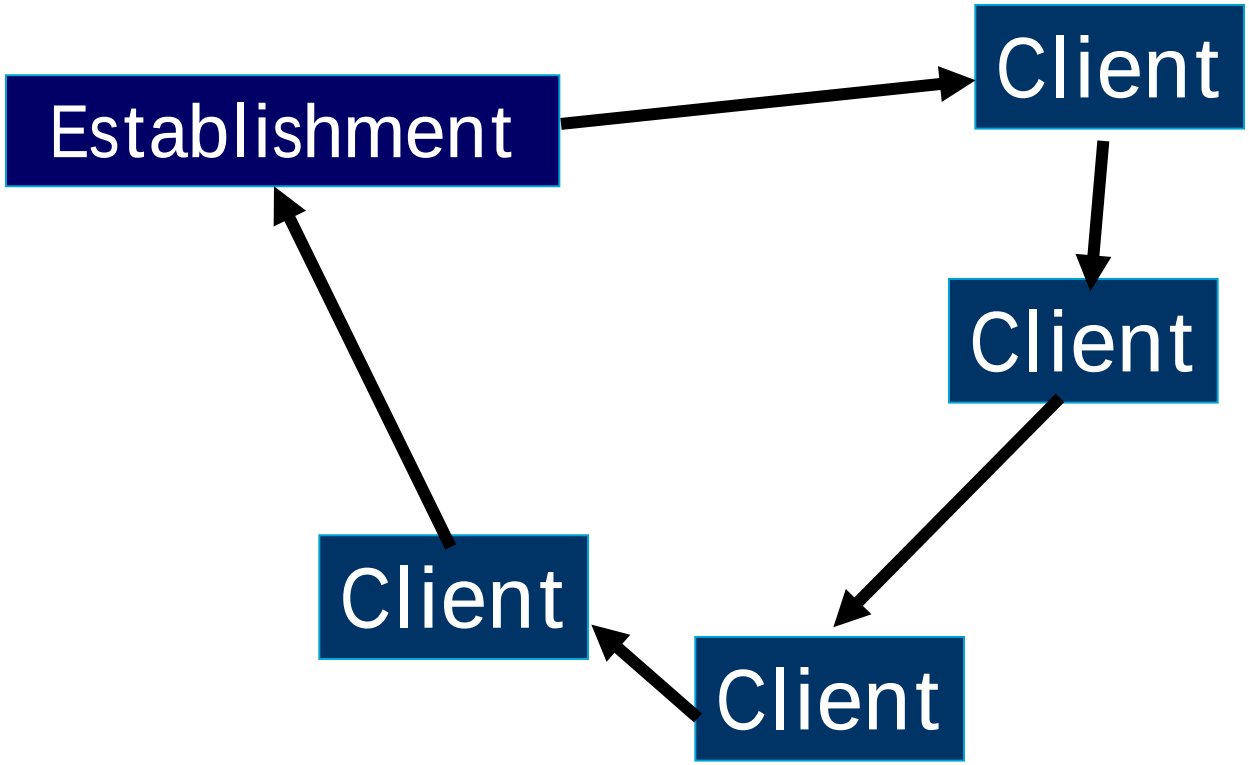
Models
Short Distance Personal Travel Model (SDPTM)
Long Distance Personal Travel Model (LDPTM)
Short Distance Commercial Vehicle Model (SDCVM)
Long Dist. Commercial Vehicle Model (LDCVM)
External Travel Model (ETM)

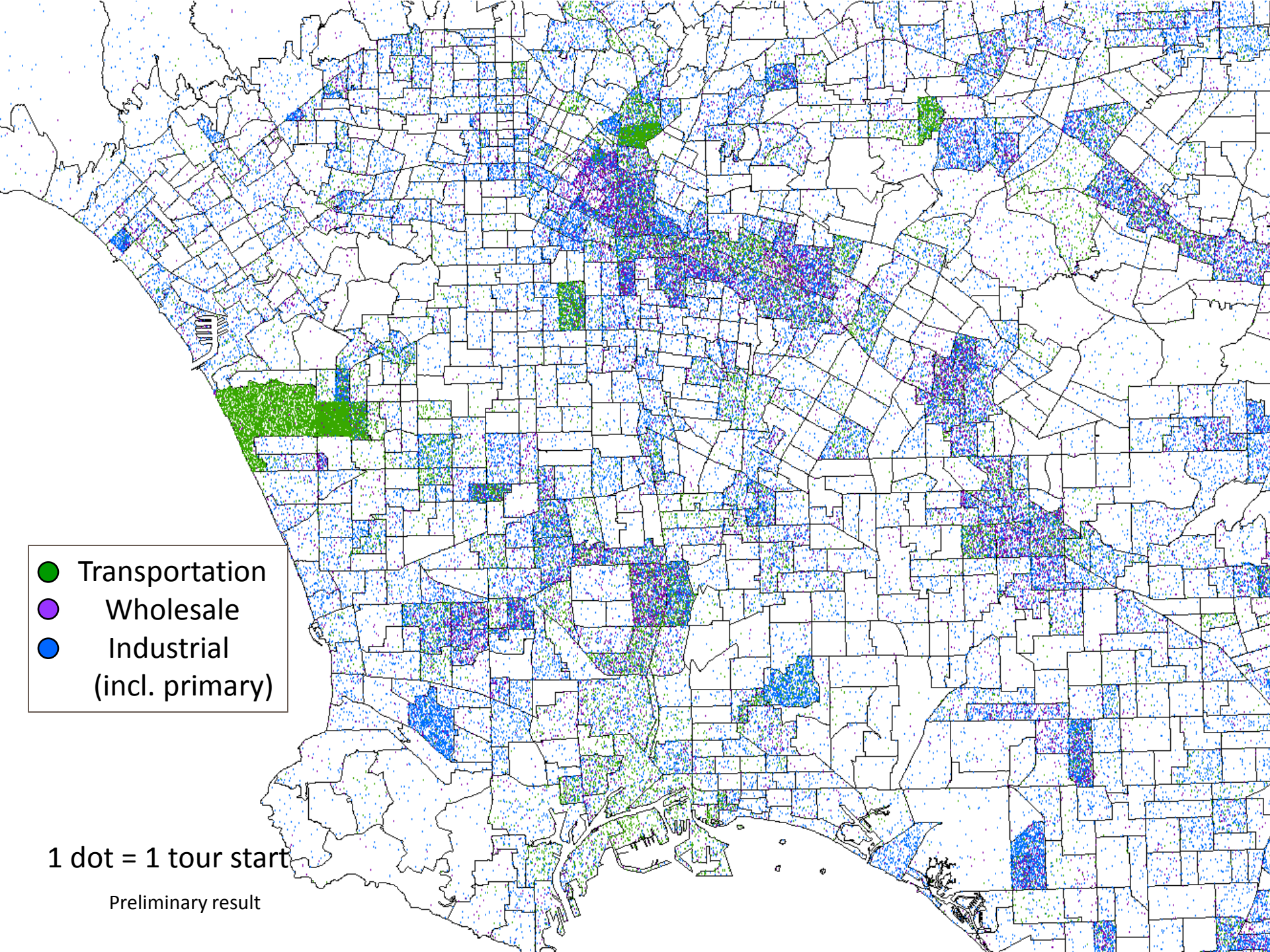
- Commercial vehicles <50 miles
- Includes goods and service
- Light, medium and heavy CV
- Tour-based disaggregate simulation

Commercial Vehicle Model: Tour-based Microsimulation

- Consider tours rather than individual trips
- Generate a list of daily tours made in region
- Microsimulation of each tour
  - Monte Carlo techniques
  - Disaggregate choice-based sampling distributions for decisions
  - Growing' tours according to observed patterns

Commercial Vehicle Model: Tour-Based Microsimulation




Transportation
Wholesale
Industrial
(incl. primary)
1 dot = 1 tour start
Preliminary result

Long Distance Personal Travel Model

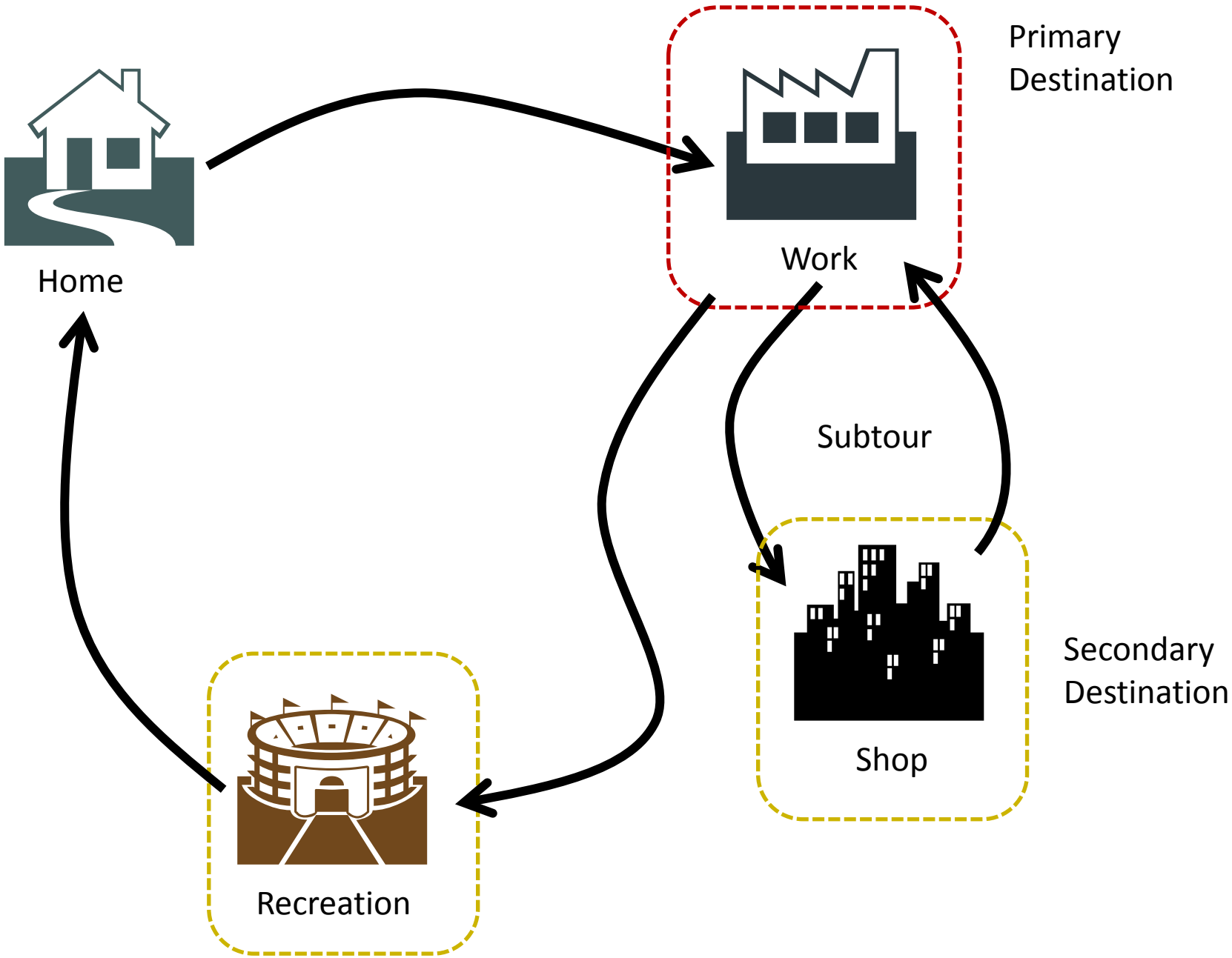
Models
Short Distance Personal Travel Model (SDPTM)
Long Distance Personal Travel Model (LDPTM)
Short Distance Commercial Vehicle Model (SDCVM)
Long Dist. Commercial Vehicle Model (LDCVM)
External Travel Model (ETM)

- Travel by individuals > 100 mi
- Auto, Rail and Air
- Derived from Cambridge Systematics (CSI) model for CHSRA work
- Modified to work off common model inputs (e.g. transit skims) and produce common standard outputs

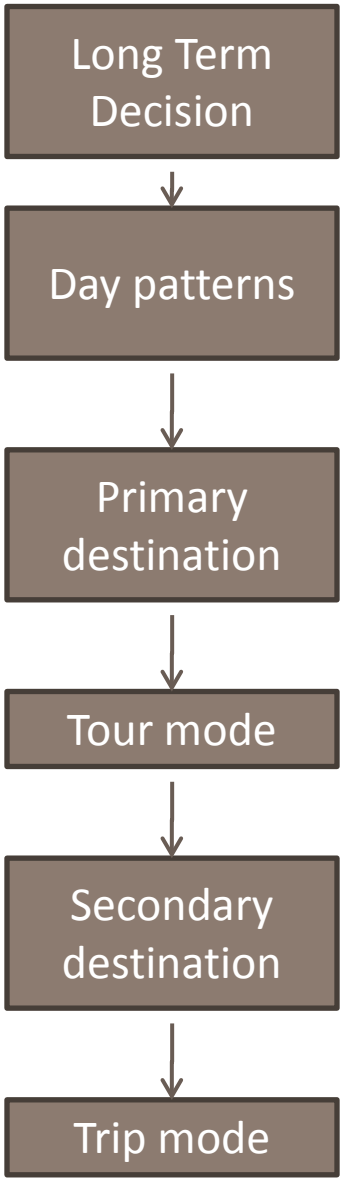
Short Distance Personal Travel Model

Models
Short Distance Personal Travel Model (SDPTM)
Long Distance Personal Travel Model (LDPTM)
Short Distance Commercial Vehicle Model (SDCVM)
Long Dist. Commercial Vehicle Model (LDCVM)
External Travel Model (ETM)

- Travel by individuals < 100 miles
- Includes Walk, Bicycle, Transit
- Disaggregate tour-based approach
- Works off synthetic population
- Developed with ca. 2000 combined (4 survey) California travel data


Primary
Destination
Home
Work
Subtour
Secondary
Destination
Shop
Recreation

Model components



Driving license for each person; household auto ownership; Work and school locations for each HH member;

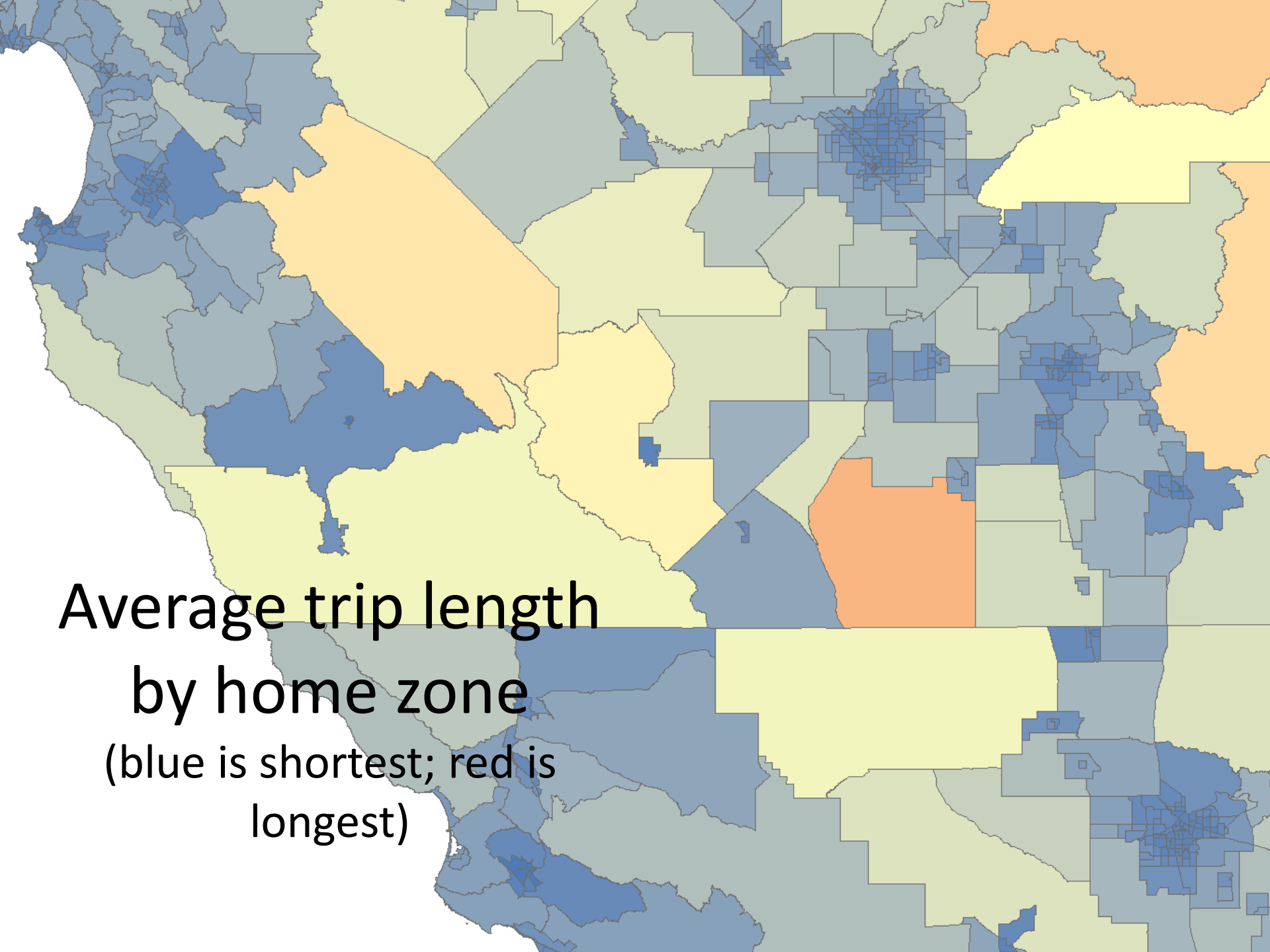
Number and purpose of tours for each HH member; time periods for tour legs; presence and purpose of secondary stops

Destination of primary stop on tour for each tour

Overall tour mode choice for each tour

Destination of each secondary stop on tour

Mode choice for each trip on tour


Average trip length
by home zone
(blue is shortest; red is
longest)

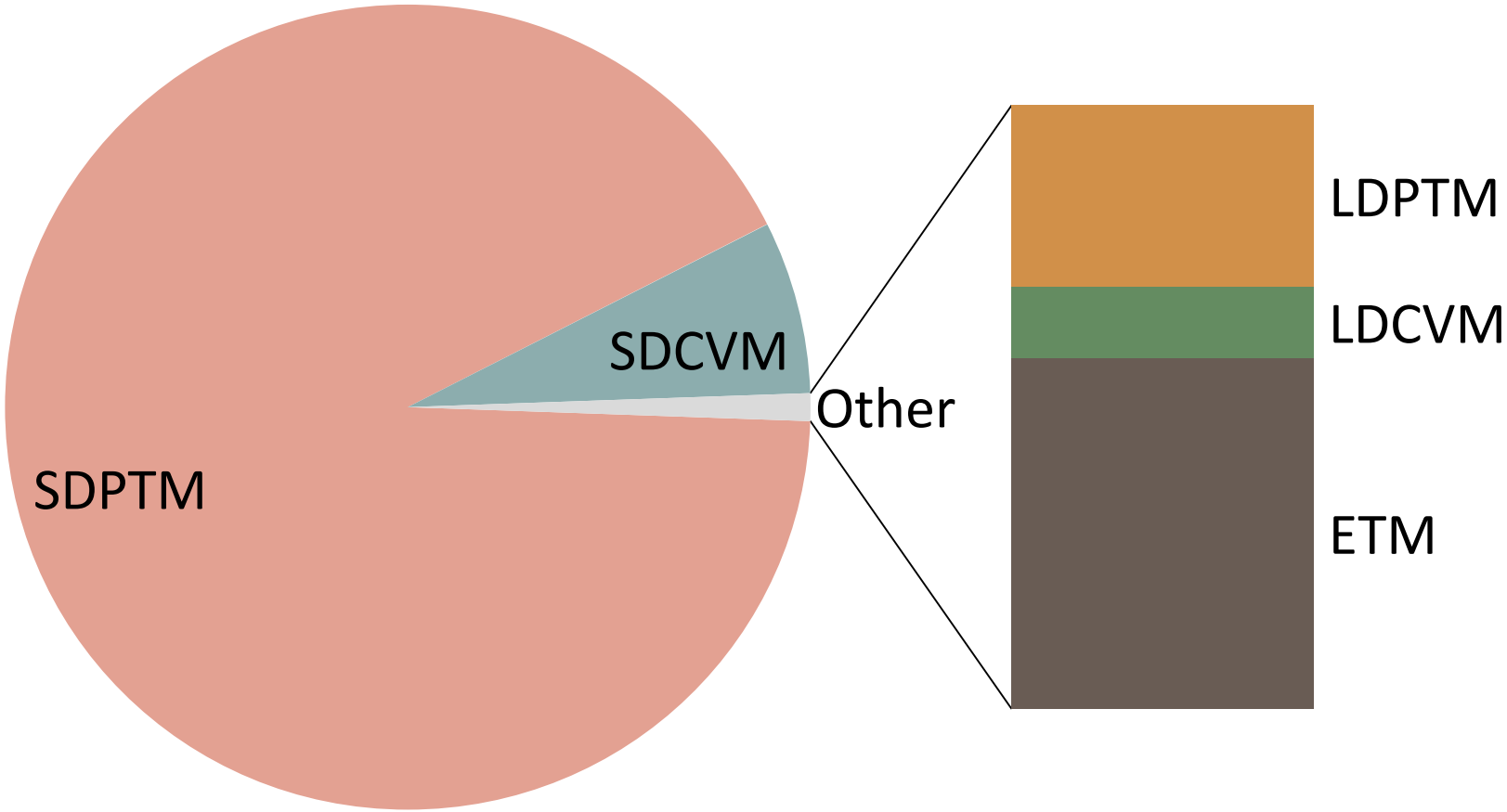
CSTDM Outputs

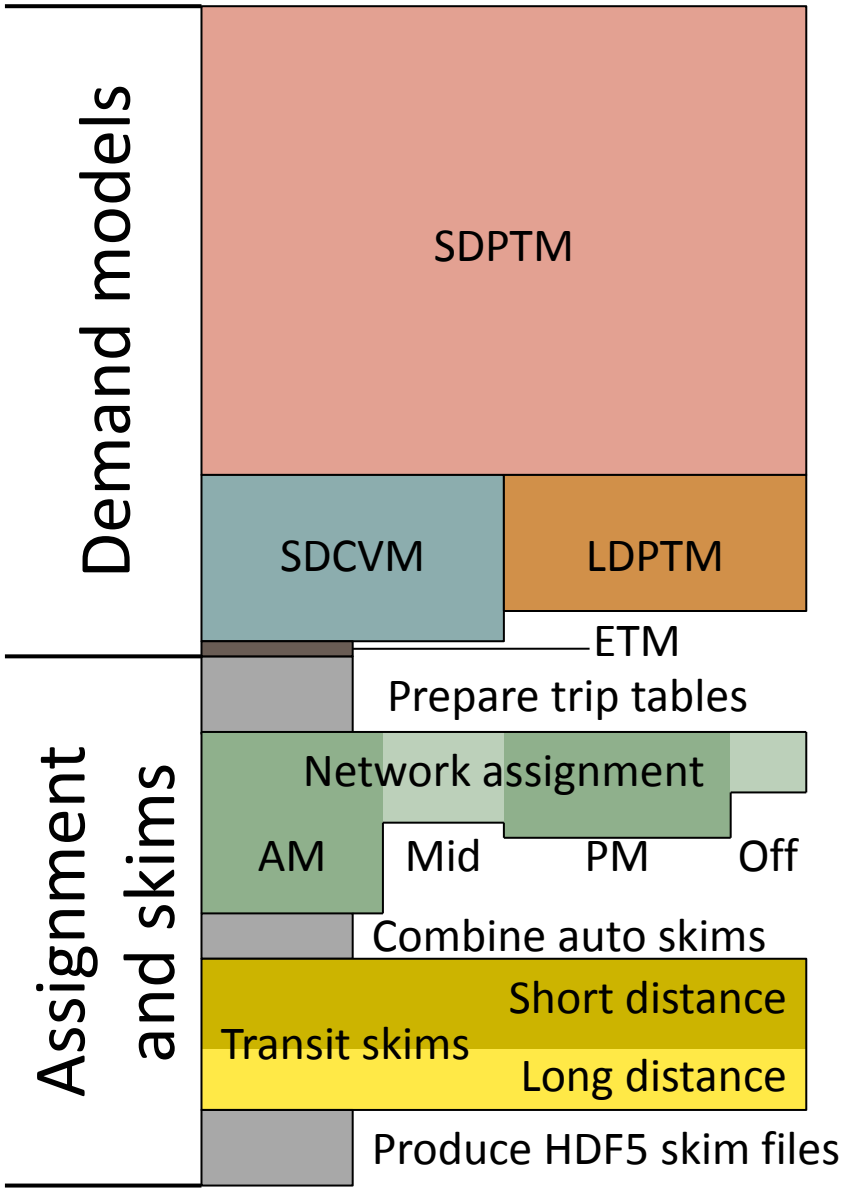
Outputs
Trip Lists
Trip Tables
Loaded Network
Travel Times and Costs
Summary Travel Statistics
Maps
Graphs

- Trip lists output from all 5 models in standardized form
- Loaded networks for each time period in Cube
- Standard output processes developed (e.g. interregional trip matrix)
- Highly flexible

125 million trips

(2008 typical fall weekday)





Model run

- Running on 8 core computer
- About 27 hours for one run through

Implementation

- Model runs within Cube
- Demand models are external programs (Python / Java) called from run process
- Standardized directory structure for inputs and outputs
- User guide and 18 technical memos describing components