

# California Statewide Travel Demand Model



*presented to*  
**SCAG Model Task Force**

*presented by*  
**Ron West, Cambridge Systematics**

January 22, 2014



Transportation leadership you can trust.

# Presentation Overview

CSTDM Overview

Year 2010 Model Update Activities

Preparation for Validation and Future Year Model Runs

Long and Short Distance Freight Models

Long and Short Distance Passenger Models

External Travel Model

Other Tasks



# Updated 2010 Base Year Data

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Long and Short Distance Freight Models

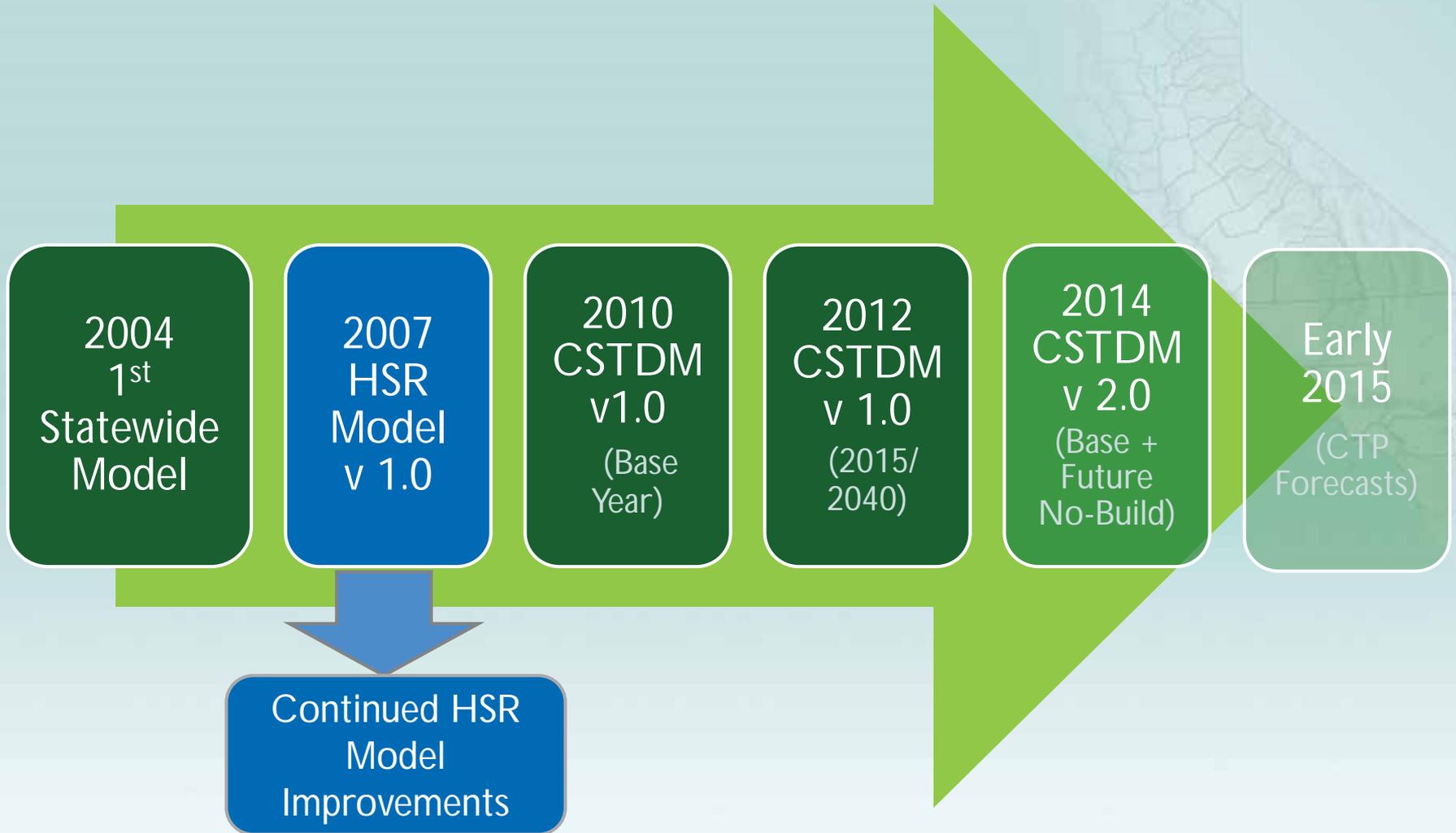
Long and Short Distance Passenger Models

External Travel Model

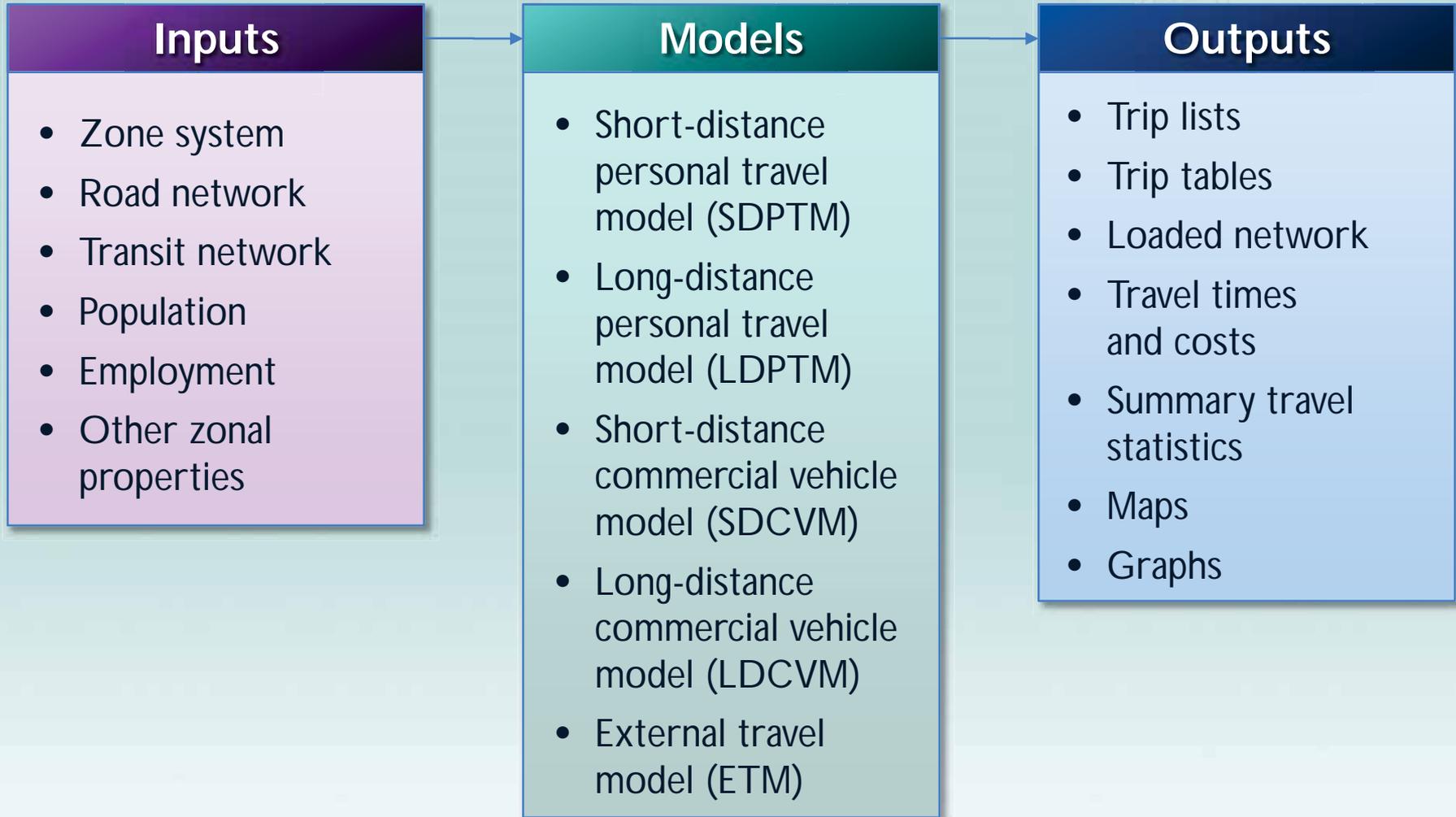
Other Tasks



# Statewide Modeling History



# CSTDM System

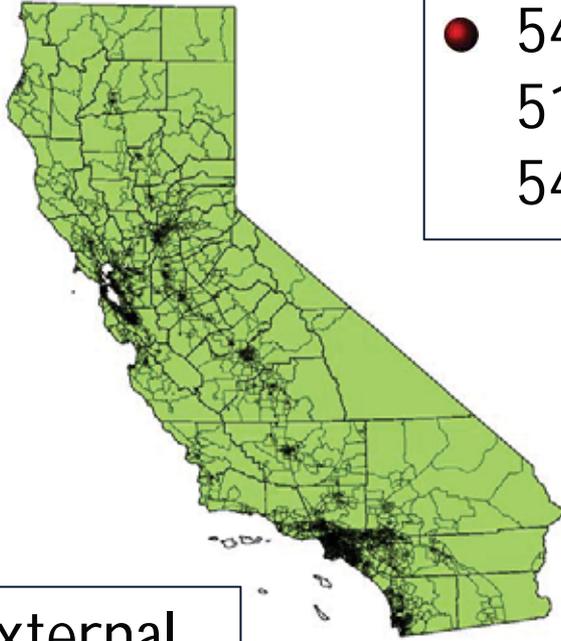


# CSTDM Modes

Mode	Short Distance Personal	Long Distance Personal	Short Distance Comm.	Long Distance Comm.	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			✓	✓	✓

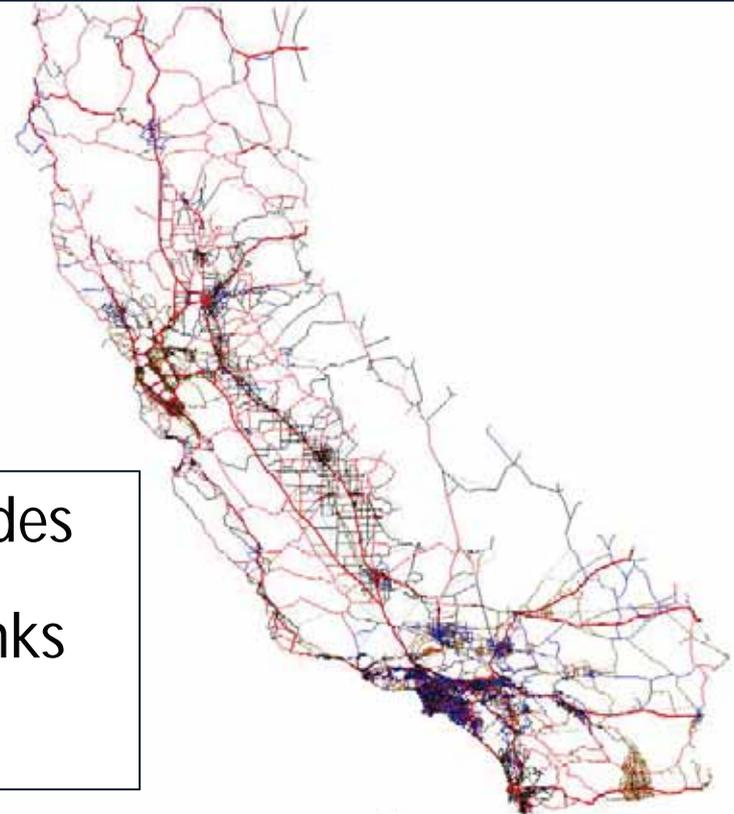


# CSTDM Zones and Network (Current Model)



- 5454 internal zones (TAZ) currently  
5191 (from 2008 base year system)  
5422 (from future year forecasts)

- 53 external zones



- 92,000+ nodes
- 250,000+ links
- Multi-modal



# CHTS Data Clean-up and Expansion

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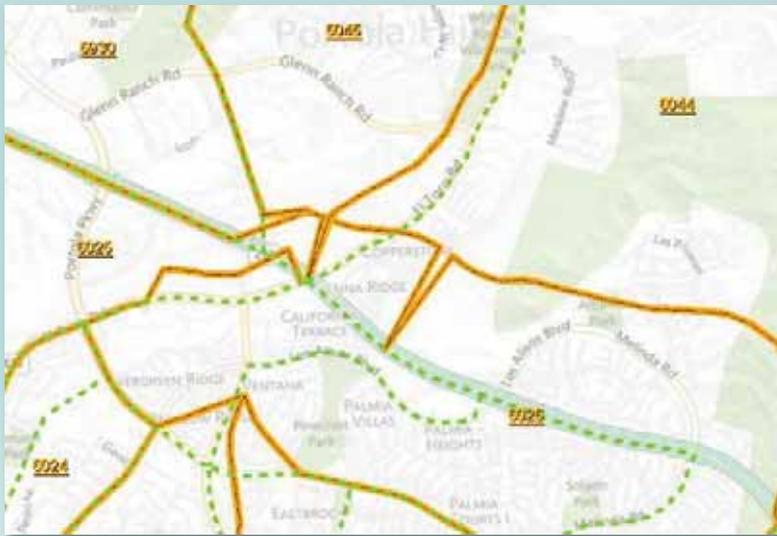
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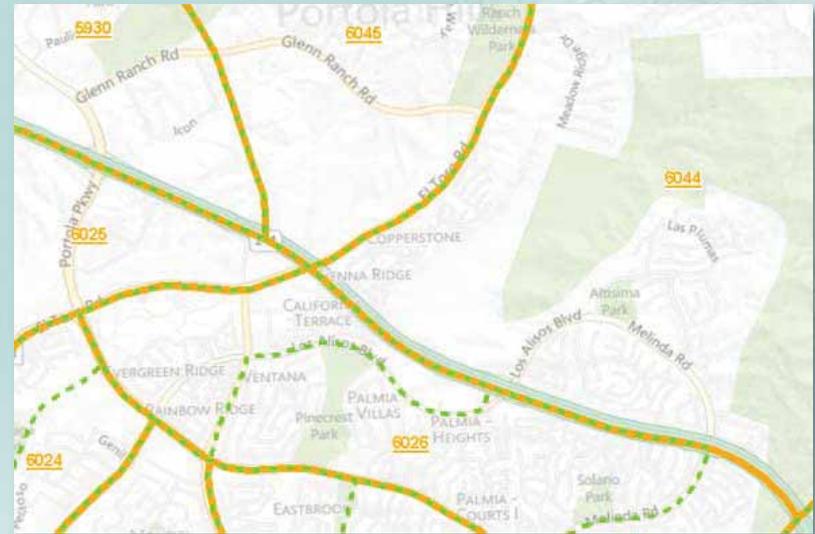
# Base Year Model Development: Update Zones

- Improved Zone boundaries to better align with Census

BEFORE:



AFTER:



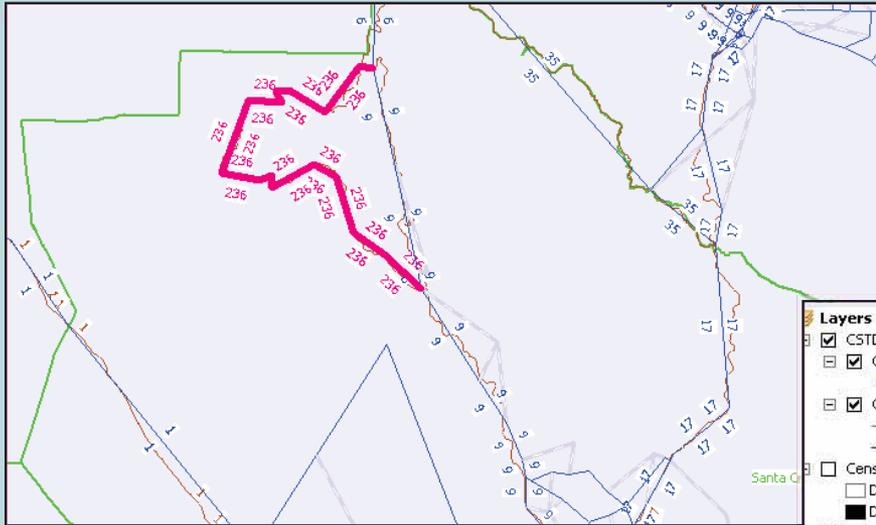
**Green line = Census Tract Boundary**  
**Orange Line = Zone Boundary**

TAZ boundaries also aligned to be better match with Air Basin boundaries



# Base Year Model Development: Update Networks

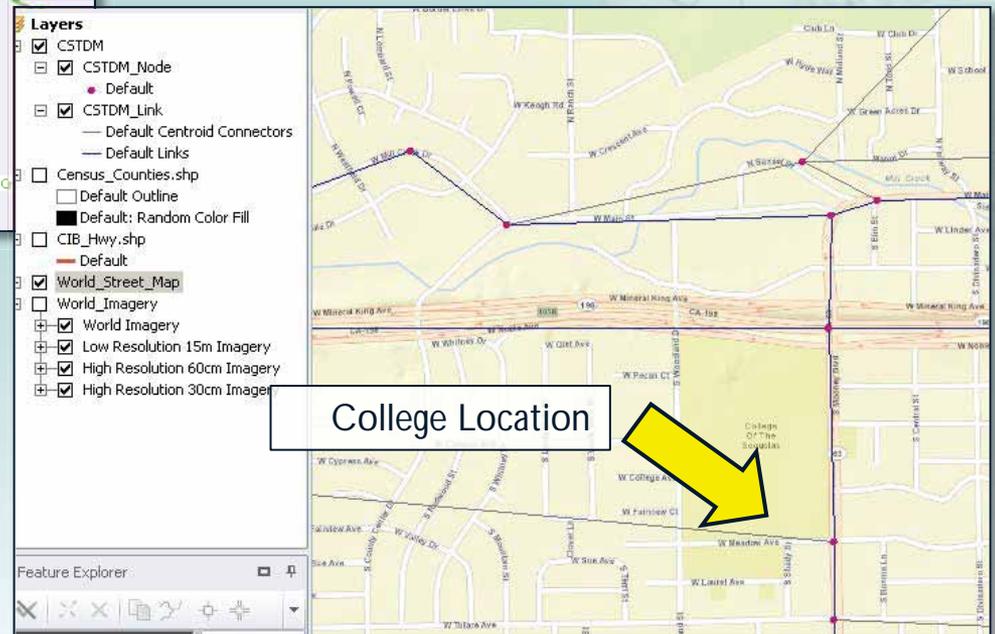
Include all State highways



Utilizing ESRI base map layers to improve geometry and see features

Example: Hwy 236 added to network

- Existing network = blue
- CIB Hwy Network = brown
- County Boundary = green
- New network addition = pink



# Synthetic Population for 2010



## TAZs

- Aggregate Census Block Data
- Census Population and Household Totals
- Added More Data on Group Quarters

## Census Zones

- Aggregate Census Tracts
- ACS Household Characteristics

Run  
Population  
Synthesizer

Contains Information on  
Every Synthetic Household  
in California, including:

- Household Size
- Persons by Age
- Employment
- Income
- Housing Type

United States  
Census  
2010

IT'S IN OUR HANDS



# Development of Year 2010 Employment Data

State of California  
Employment Development Department

 BUREAU OF LABOR STATISTICS

OnTheMap

## Equal Employment Opportunity (EEO)

### Industry

- Agriculture/Mining
- Construction
- Manufacturing
- Wholesale
- Transportation/Utilities
- Retail
- Information
- Finance/Insurance/Real Estate
- Professional/Management/Administration
- Education/Health
- Arts/Entertainment/Recreation/  
Accommodation/Food Service
- Other Service
- Government

### Occupation

- Management/Business
- Professional/Technical
- Education
- Health
- Service
- Sales, Food, and Entertainment
- Clerical
- Blue Collar



# CHTS Data Expansion – Process Overview

- Weekday expansion
  - » Uses only households with “valid” travel days
    - Monday to Friday, September to May ex. holidays
    - Typical weekday travel behavior (SDPTM calibration)
- Full expansion
  - » Uses all households
  - » Socioeconomic and long term decisions (e.g. auto ownership)
  - » Long distance travel (retrospective survey)



# CHTS Data Expansion – Sampling Rates

County	Households	Weekday		Full		Percent Weekday
		Samples	Rate	Samples	Rate	
Alpine	497	9	1 in 55	21	1 in 24	43%
Del Norte	9,907	90	1 in 110	187	1 in 53	48%
Monterey	125,946	318	1 in 396	1,012	1 in 124	31%
Tulare	130,352	281	1 in 464	793	1 in 164	35%
San Mateo	257,837	581	1 in 444	1,129	1 in 228	51%
Stanislaus	165,180	192	1 in 860	541	1 in 305	35%
Los Angeles	3,239,571	3,301	1 in 981	8,102	1 in 400	41%
Sacramento	513,945	350	1 in 1,468	818	1 in 628	43%
San Diego	1,086,865	698	1 in 1,557	1,668	1 in 652	42%
Statewide	12,575,860	17,445	1 in 721	41,958	1 in 300	42%



# Preparation for Validation and Future Year Model Runs

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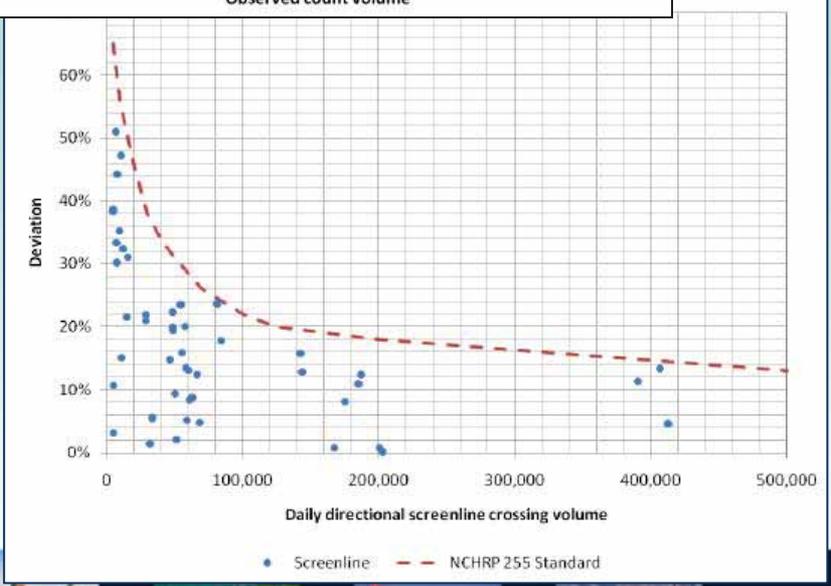
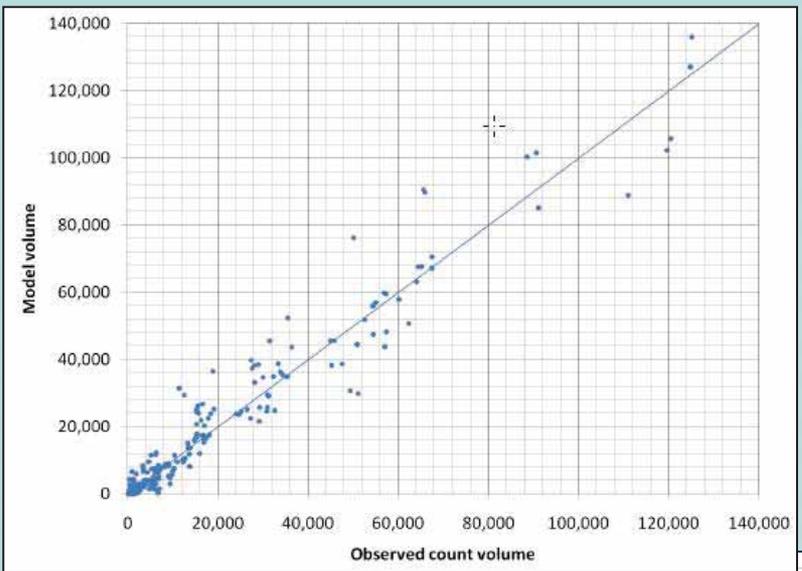
# Collection of Validation Data

- Auto and truck counts
  - » Caltrans TSN database for auto counts (147 locations)
  - » Truck counts still being evaluated (only 18% of count locations have vehicle class data)
- Transit ridership data collected from operators
  - » Capitol Corridor
  - » San Joaquin
  - » Pacific Surfliner
  - » ACE
  - » Caltrain
  - » BART
  - » Metrolink
  - » Coaster
- Year 2000 backcast





# Validation Plan (sample outputs for auto volumes)



Facility Type	Number of Obs.	Observed Links Counts	Estimated Link Volumes	Relative Error (E-O)/O	% RMSE
Freeway					
Expressway					
Major Arterial					
Minor Arterial and Collectors					
Total					



# Sensitivity Tests

- Year 2000 Backcast
- Change in Costs
  - » Increase auto operating costs
- Network Change
  - » Decrease transit service



# Overview of Future Year Networks

● Assume California State Rail Plan service assumptions for the following rail services:

- » Amtrak San Joaquin
- » Amtrak Capitol Corridor
- » Amtrak Pacific Surfliner
- » ACE
- » Caltrain\*
- » Metrolink

\* Slight modification to include opening of Transbay Terminal



# Overview of Future Year Networks - Transit

- Refer to latest MPO RTPs/SCSs for other rail assumptions

**TABLE 2.5 Major Transit Projects**

County	Project	Completion Year*
Los Angeles	Crenshaw/LAX Transit Corridor	2018
Los Angeles	Gold Line Eastside Transit Corridor–Phase 2	2035
Los Angeles	Exposition Line–Phase 2 to Santa Monica	2018
Los Angeles	Gold Line Extension to Glendora	2018
Los Angeles	Gold Line Extension to Montclair	2035
Los Angeles	Green Line LAX Extension	2030
Los Angeles	South Bay Green Line Extension	2035
Los Angeles	Regional Connector	2020
Los Angeles	San Fernando Valley North/South Transitways	2018
Los Angeles	San Fernando Valley Orange Line Canoga Extension	2014
Los Angeles	West Santa Ana Branch Corridor	2030
Los Angeles	Westside Subway Extension to La Cienega	2023
Los Angeles	Westside Subway Extension to Century City	2030
Los Angeles	Westside Subway Extension to Westwood	2035
Orange	Anaheim Rapid Connection	2020
Orange	Bristol/State College, Harbor, and Westminster BRT	2030
Orange	Santa Ana/Garden Grove Fixed Guideway	2020
Riverside	Metrolink Perris Valley Line Extensions to San Jacinto and Temecula	2035
San Bernardino	E Street BRT (sbX)	2014
San Bernardino	Redlands Rail–Phase 1	2018
San Bernardino	Redlands Rail–Phase 2	2020

\* Represents the Plan network year for which the project was analyzed for the RTP/SCS modeling and regional emissions analysis



# Future Year Forecasts

- Socio-Economic Forecasts
  - » MPO data used directly
  - » RTPAs – Combination of:
    - UC Davis forecasts
    - Dept of Finance
    - Moody's (Employment)

**Future transportation improvement and service assumptions from SCSs and RTPs throughout the state, and from Caltrans modal plans.**



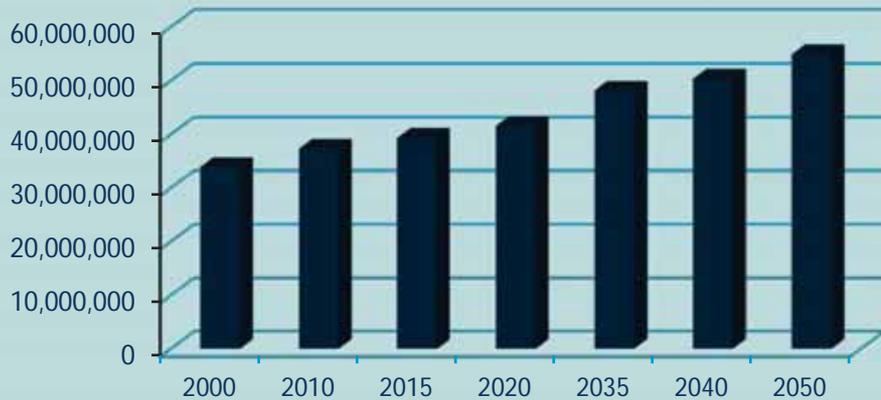
# Update Socioeconomic Data

MPO	Population/ Household Data	Employment Data
MTC	Update	Update
SCAG	Update (Number of Workers)	Update
SACOG	Update	Update
SANDAG	Ok to Use As Is	Ok to Use As Is
AMBAG	Ok to Use As Is	Ok to Use As Is
BCAG	Ok to Use As Is	Update
SBCAG	Update	Update
SLOCOG	Update	Update
Tahoe RTPA	Update	Update
Other Counties	Ok to Use As Is	Update some based on Moody's Growth Rates

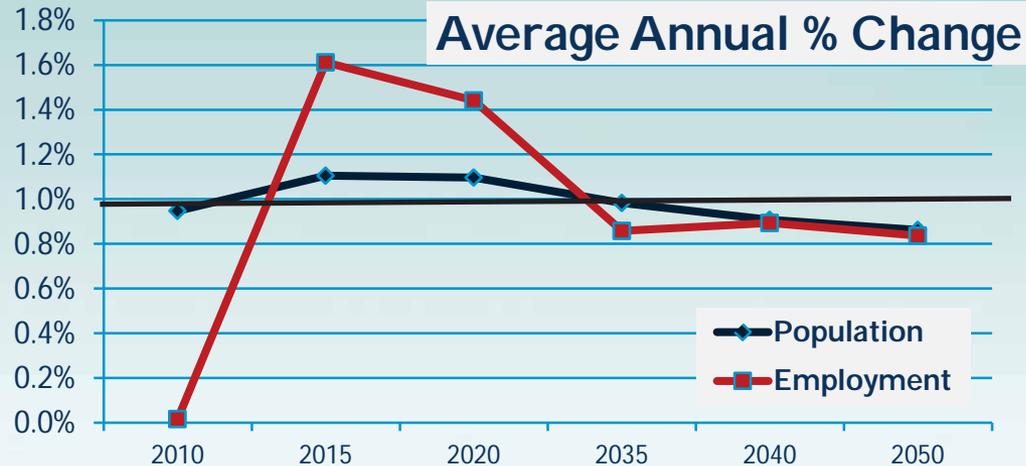
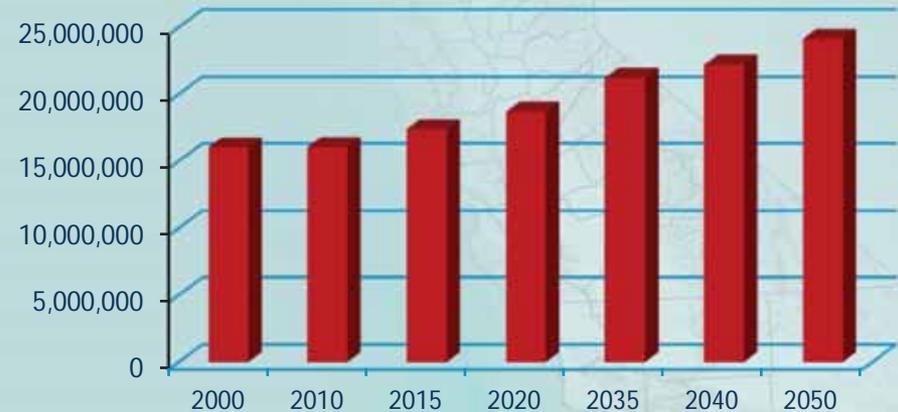


# Changes in Population and Employment

## Total Population



## Total Employment



# Long and Short Distance Freight Models

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# California State Freight Forecasting Model

- Under development by UC Irvine
- Commodity-based model
  - Forecasts the long haul flow of commodities and commercial vehicles on freight infrastructure as a function of socioeconomic conditions and infrastructure parameters

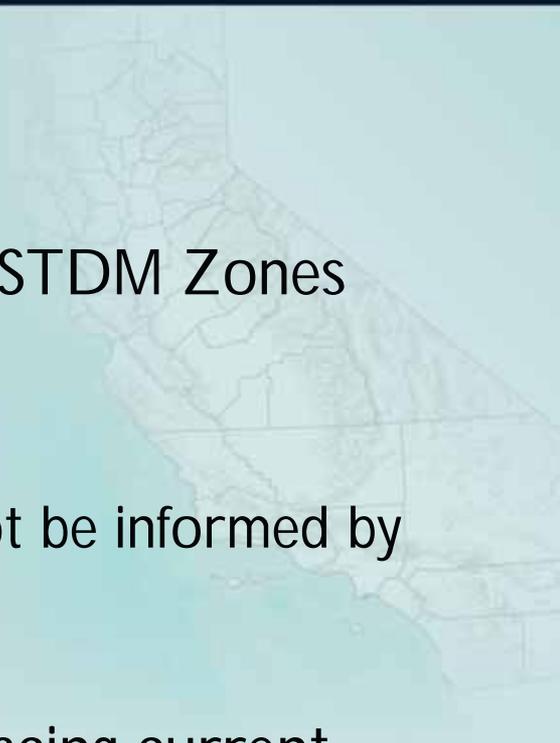
Primary Modules	Mode	Vehicle Class
<ul style="list-style-type: none"><li>● Commodity Module : Predicts commodity flows</li><li>● Transshipment Module : Assigns commodities to specific modes</li><li>● Network Module : Assigns truck/rail modes to routes</li></ul>	<ul style="list-style-type: none"><li>● Truck</li><li>● Rail</li><li>● Water</li><li>● Air (+Truck-Air)</li><li>● Multiple Modes</li></ul>	<ul style="list-style-type: none"><li>● FHWA Class : Class 5 to 13</li></ul>

Source: UC Irvine



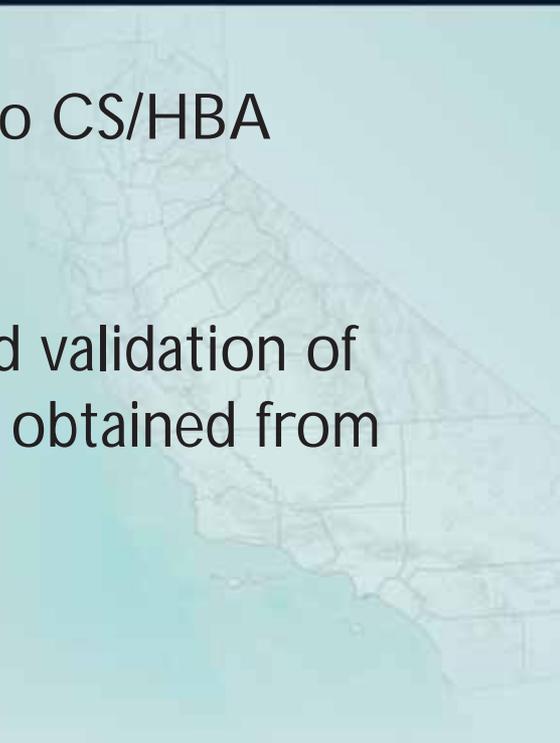
# Combining CSFFM with CSTDM

- Common highway network
- Freight Model truck trips disaggregated to CSTDM Zones
- Long distance commercial truck trips only
  - » Short distance commercial truck trips will not be informed by CSFFM – modeled in SDCVM component
- CSFFM includes external freight flows – replacing current external travel model for trucks



# Status of CSFFM

- Disaggregation model completed. Delivery to CS/HBA expected within a month.
- Currently in process of model calibration and validation of truck assignment, payload, and empty factors obtained from VIUS.



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# Short Distance Personal Travel Model Improvements

- Addition of Day Pattern choice model system
  - » Provides policy and demographic responses in terms of activities and trips chosen
  - » Final aspect in bringing SDPTM to full activity-based travel model status
- Addition of Work-At-Home choice model
- Recalibration of model components using 2012 CHTS data
- Calibration of travel behaviors in rural areas to degree supported by model data

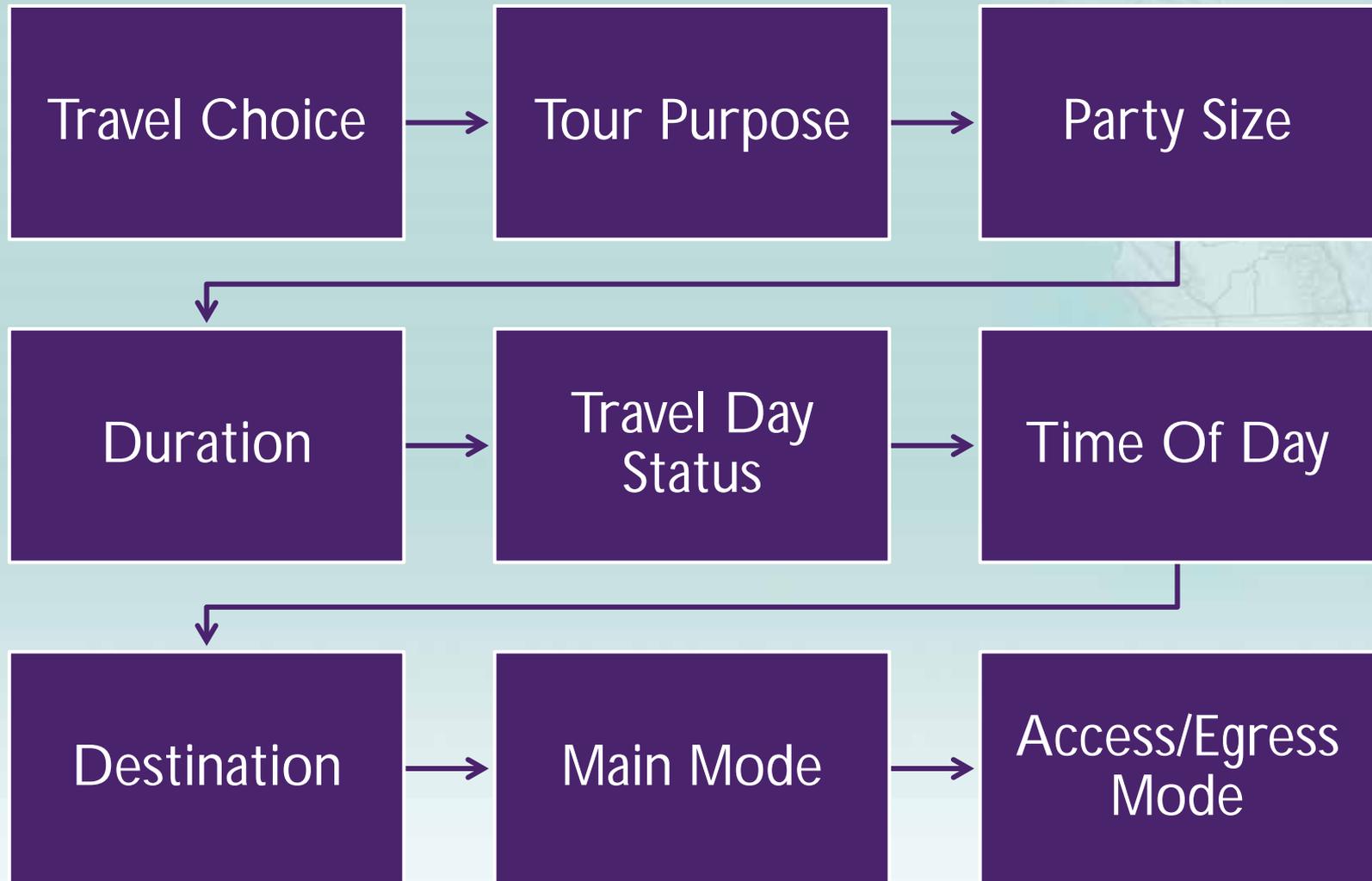


# Long Distance Personal Travel Model

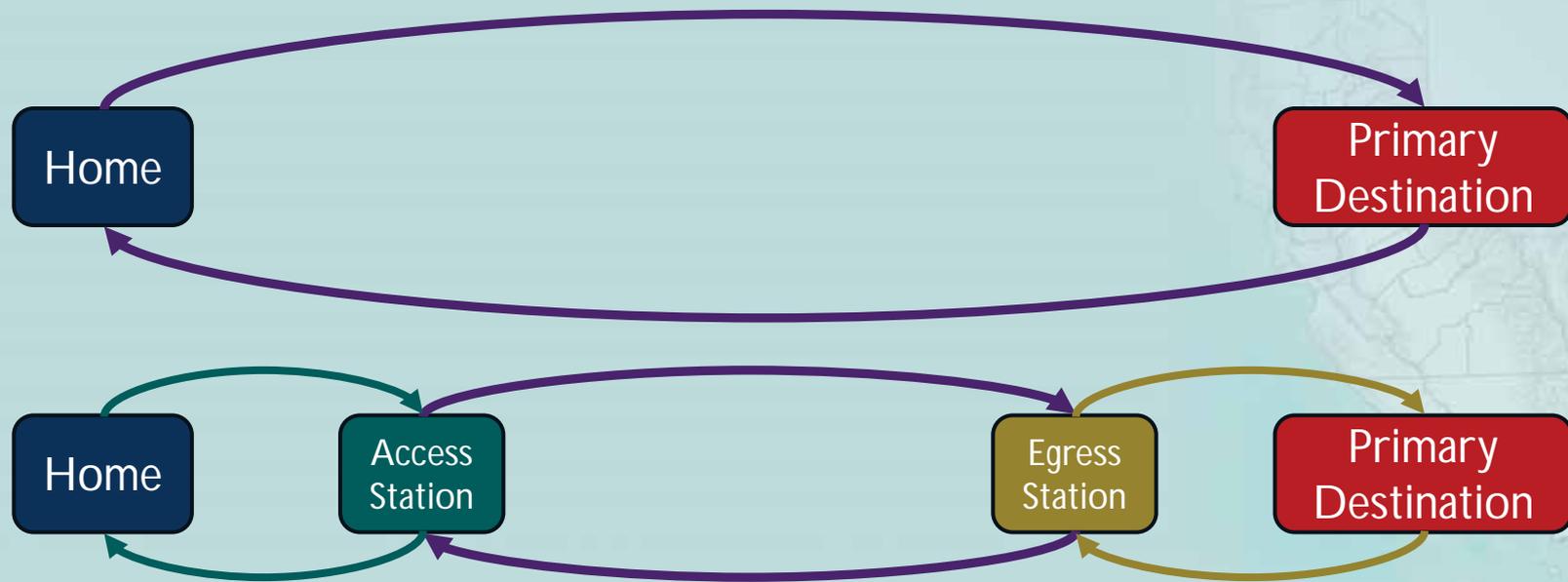
- New model based primarily on CHTS data
  - » Harris Interactive Survey + LAX Air Passenger Survey
- Tour-based disaggregate simulation approach
- Model of:
  - Tours to/from primary destinations >100 miles from home
    - Straight line distance
  - On fall/spring weekdays
  - Within California



# Long Distance Personal Travel Model Design



# Long distance tour examples



- Includes travel to and from a primary destination
- Includes access and egress modes for air and rail modes
- Does not include “visiting” travel made at the destination or additional stops made on tour



# External Travel Model

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# External Travel Model

External crossings are an exogenous input to the model

Truck crossings will be obtained from CSFFM

- Trip Segmentation

- » Car Local
- » Car Long
- » Medium Commercial Vehicles
- » Heavy Commercial Vehicles
- » External to External

- External Station Districts

- » CA/OR
- » Northern CA/Nevada
- » Southern CA/Nevada
- » CA/Arizona
- » CA/Mexico
- » Ports



# Other Tasks

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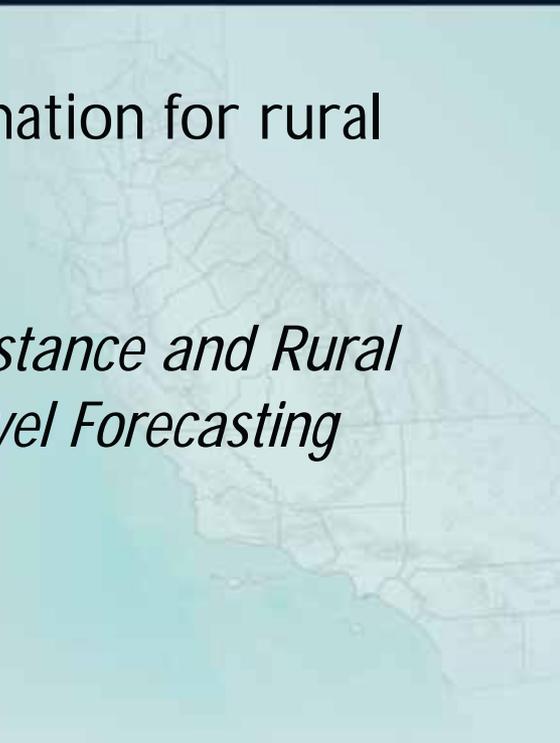
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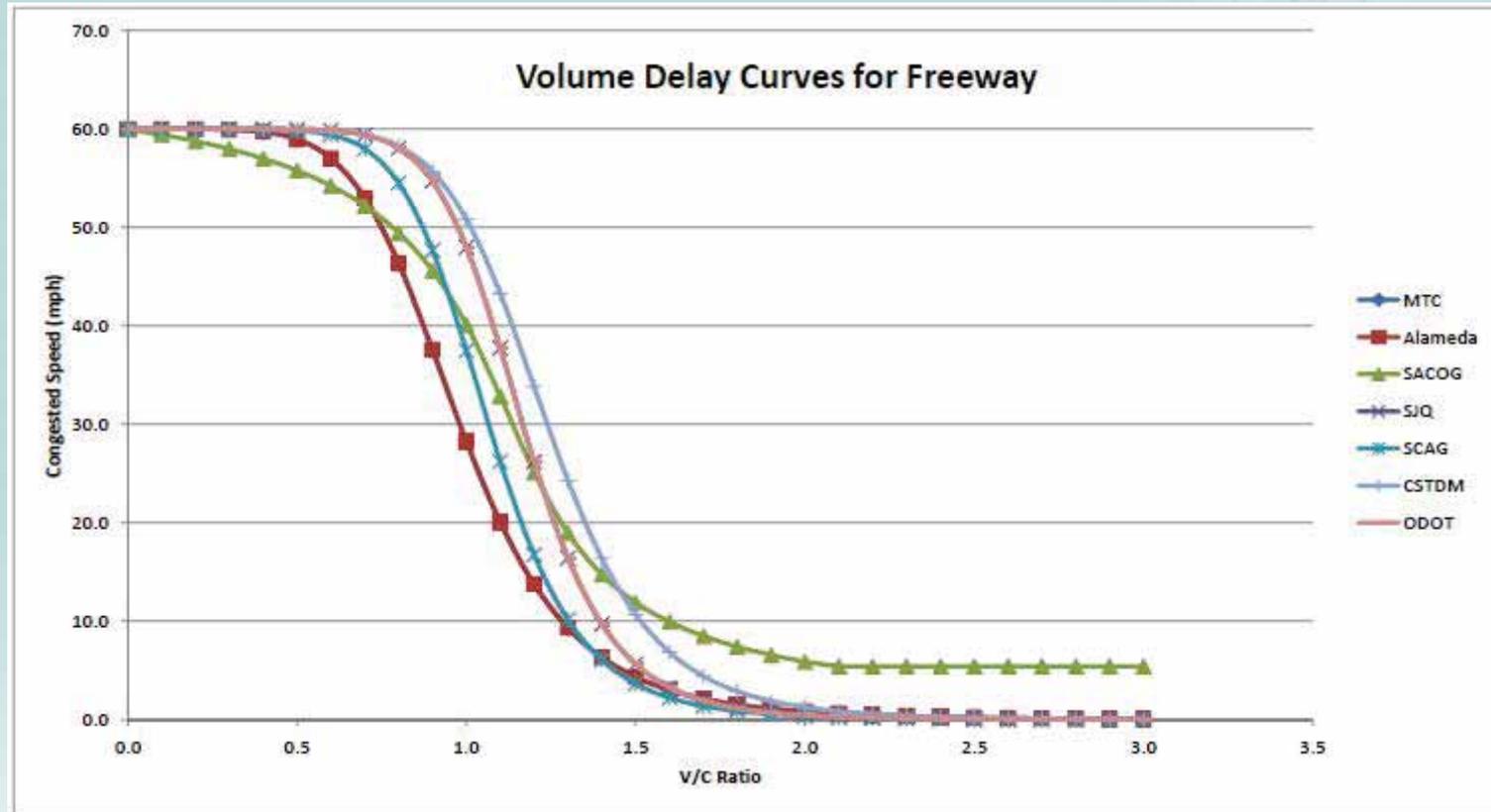


# Transferable Parameters

- New task to provide additional model information for rural areas
- Based on NCHRP 8-84/ Report 735: *Long-Distance and Rural Travel Transferable Parameters for Statewide Travel Forecasting Models*

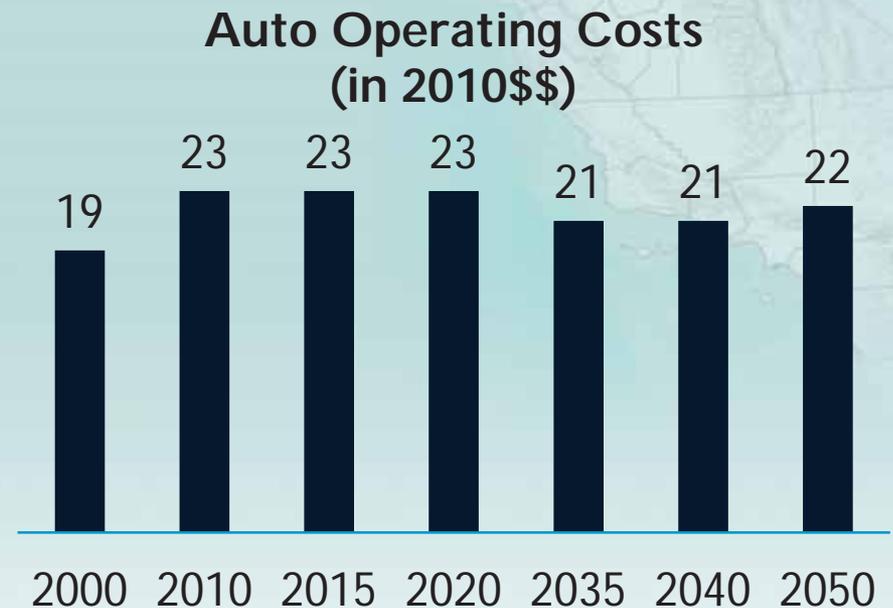


# Volume Delay Functions



# Auto Operating Costs

- Based on the most recent EIA forecasts of future fuel costs and fuel efficiency.
- Non-fuel auto operating costs are assumed to remain constant at \$0.09 per mile from 2010 onward.



# CSTDM Update Other Activities

- Update value of time, if necessary (currently in progress)
- 3+ vehicle occupancy rates (currently in progress)
- Fuel consumption model
- Sensitivity testing



# CSTDM Update Project Milestones

Kickoff

Month 1 (July 2012)

CHTS

Month 10 (March 2013)

Final Version of Model for all Years

Month 22 (March 2014)



Q & A