UCDAVIS
URBAN LAND USE AND TRANSPORTATION CENTER
of the Institute of Transportation Studies

The Synthetic Representation of Local Transit Services in the California Statewide Travel Demand Modeling Framework

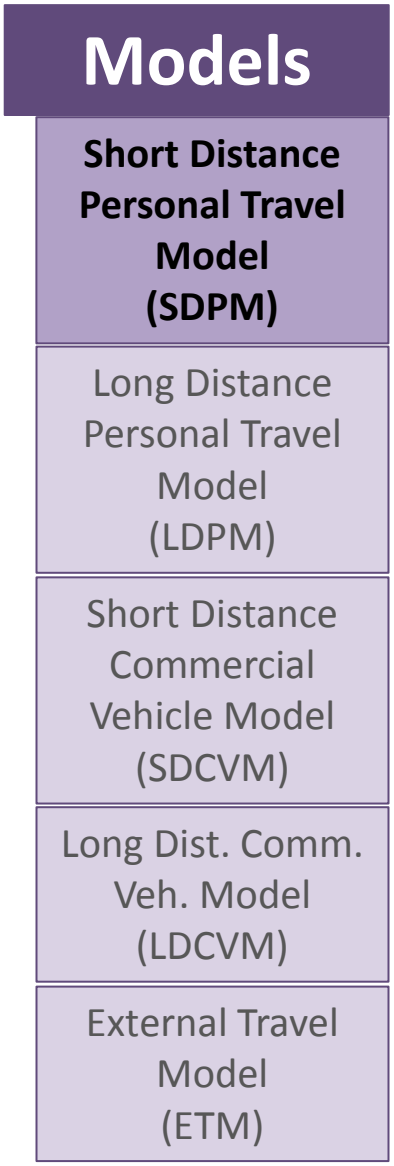
CSTDM 09 Tier 2 Training Workshop

March 8, 2011

Aim of the study

To develop a robust methodology for the synthetic representation of local transit services in the State of California to use in the CSTDM Statewide Modeling Framework.

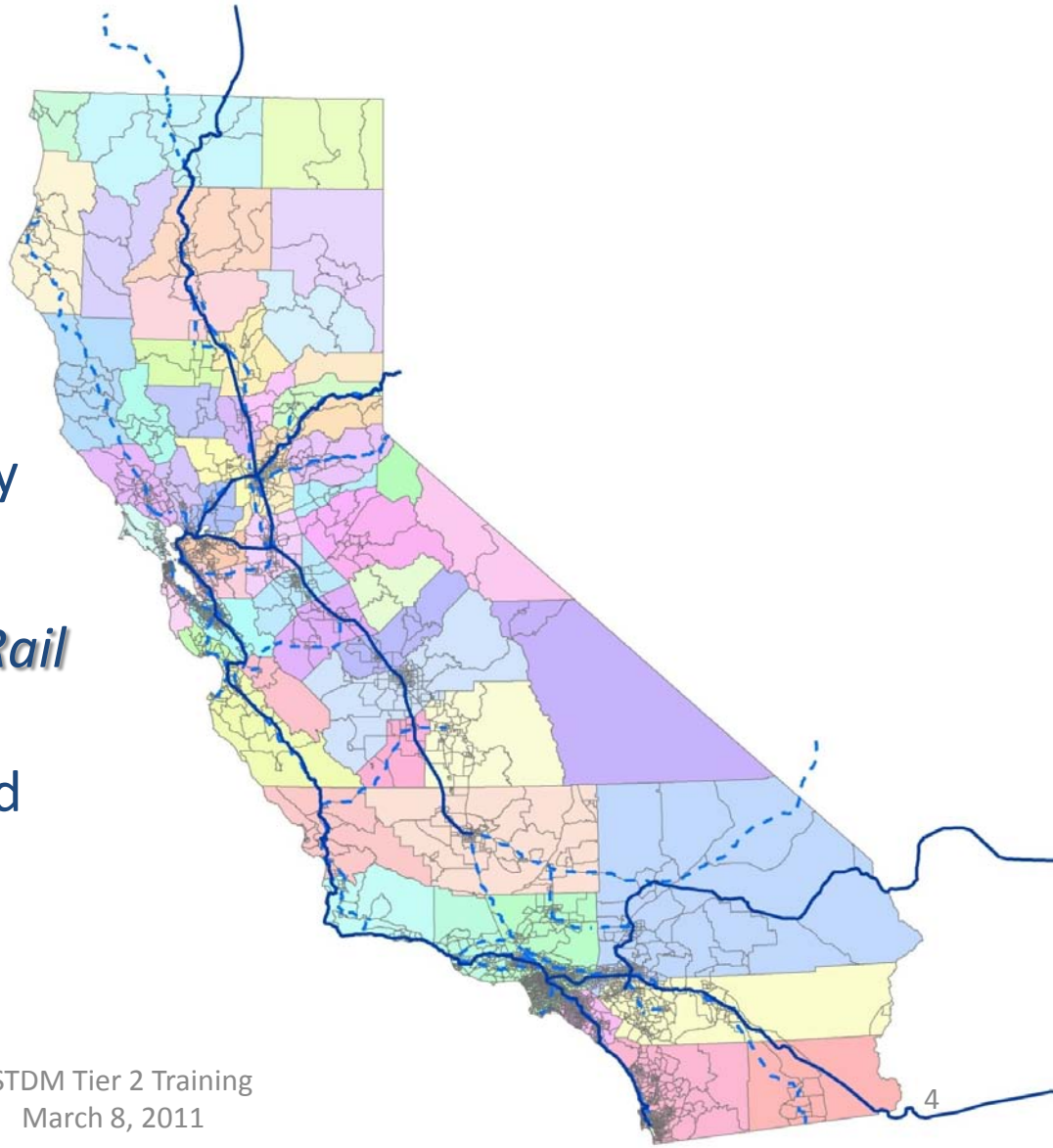
Objectives



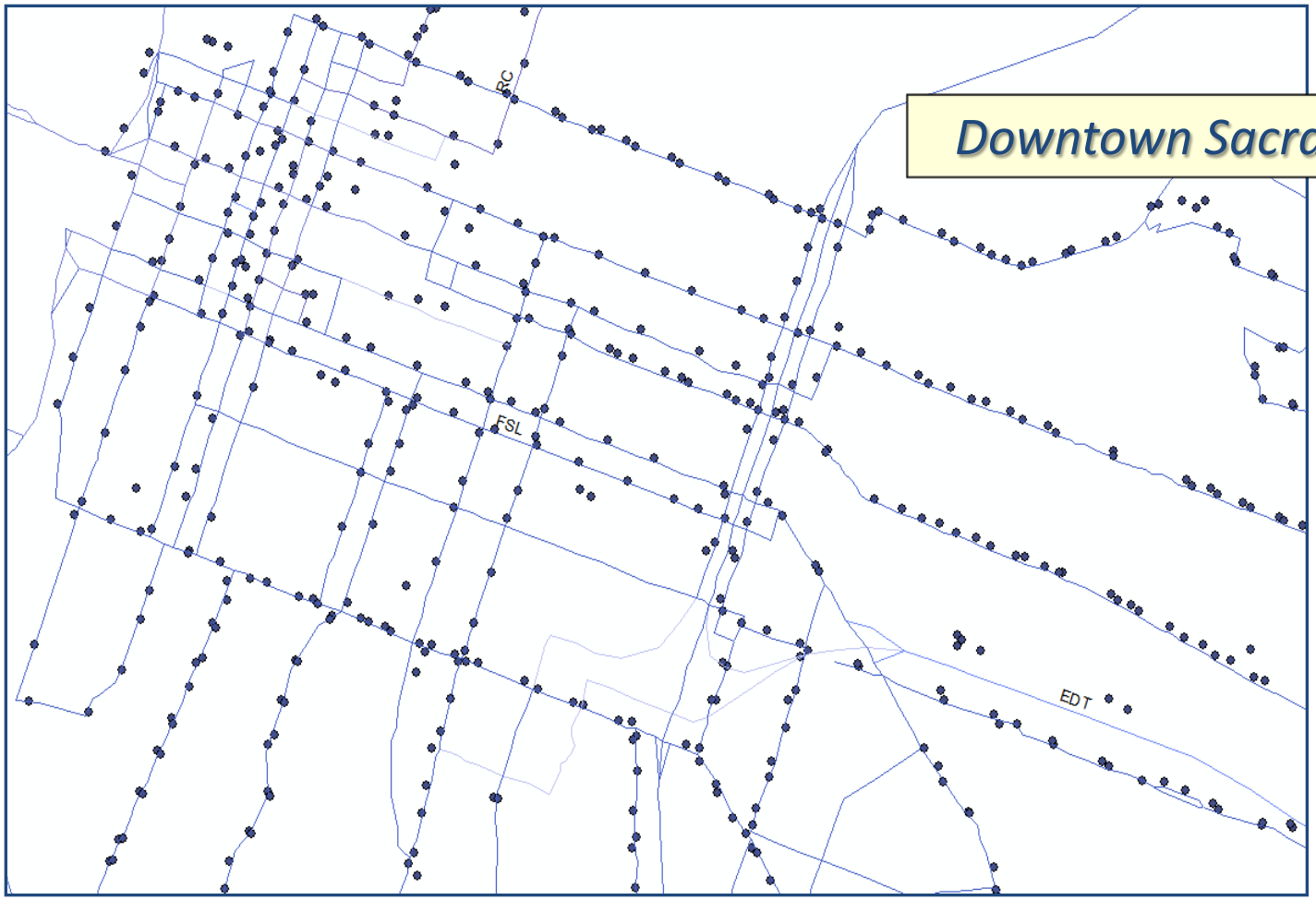
- To provide a ***realistic representation of local transit*** in the Short Distance PT Model (*component of the CSTDM*)
- To avoid the *explicit coding* of all local transit lines in the State
- To reduce the efforts required for the *update of the PT network*, when defining future scenarios in the CSTDM

Public Transportation in the CSTDM

- ***Limited railway services*** in California:
  - 3 IC railways
  - 4 commuter railways
  - Some light rail and subway systems
- ***Limited modifications in the Rail network*** – due to large investments for railways, fixed routes (tracks) and high sunk costs

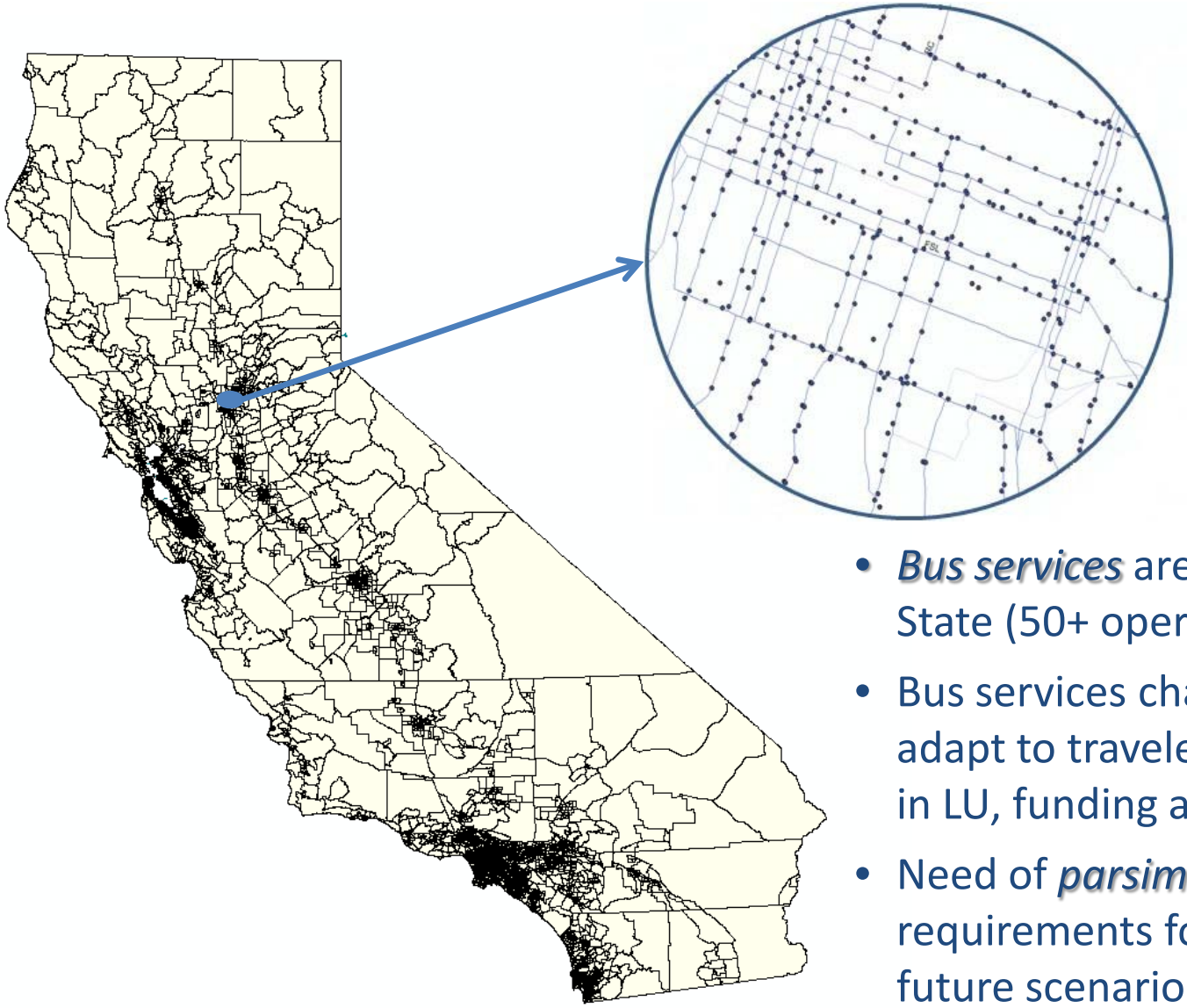


Bus Services in California



Downtown Sacramento, 2008

Bus Services in California (2)



- ***Bus services*** are quite common in the State (50+ operators, 1500+ bus lines)
- Bus services change frequently to adapt to travelers' demand, changes in LU, funding and subsidies
- Need of ***parsimony*** in reducing the requirements for network updates for future scenarios.

Local Transit services

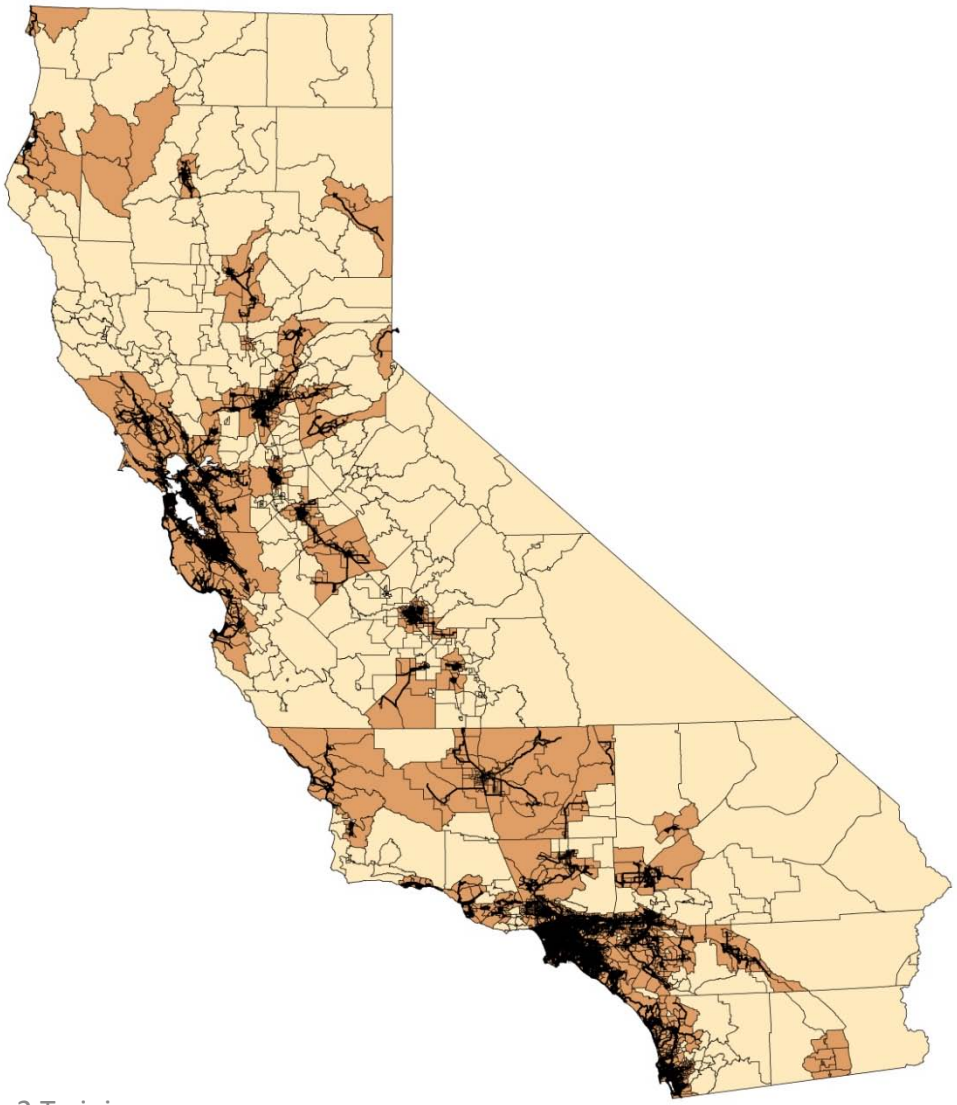
- In a Statewide model, there is *limited convenience in explicitly coding* every bus line in the State
- Very high ***costs of development*** and implementation of the model
- Difficulties in keeping the *network updated (**cost of maintenance**)* with modifications introduced by local operators
- Not justified by the ***scale of the project*** and the ***limited mode share*** for PT in California (→ *limited relevance in CSTDM project*)

Local Transit in the CSTDM framework

- Local bus attributes expressed as ***function of other variables*** in the model.
- Based on a ***service variable***, as well as ***network*** and ***zonal properties***.
- Model based on the estimation of two functions for ***In Vehicle Time (IVT)*** and ***Out-of-Vehicle time (OVT)*** for local transit.
- ***IVT*** and ***OVT functions*** estimated using ***observed data***.
- Model represents the dependence of public transportation characteristics from features of the ***road network*** (*distances*, *average speed*) and the ***land use*** (*densities*, *job locations*).

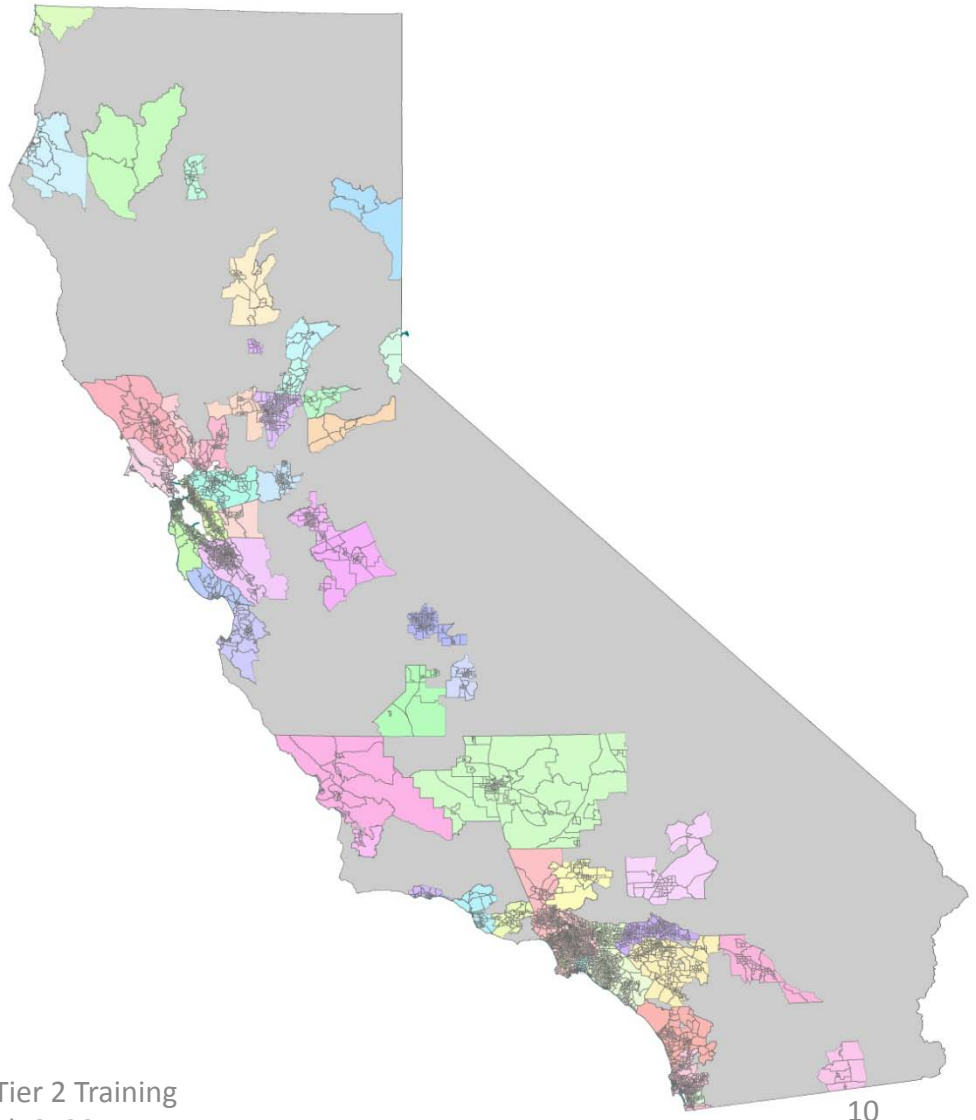
Local Transit in the CSTDM framework (2)

- Four key inputs are used:
  - ***Transfer Area***: area in which a person can travel
  - ***Service Area:*** area where transit services are generally operated by one operator
  - ***Level of Service:*** it represents the quality of local bus services in each service area
  - ***Fare:*** value (in dollars) paid by the travelers to use the transit services
- Division of the State of California in 32 ***Catchment Areas:*** area of influence (catchment) of bus operators and the easiness to transfer from a bus line to another

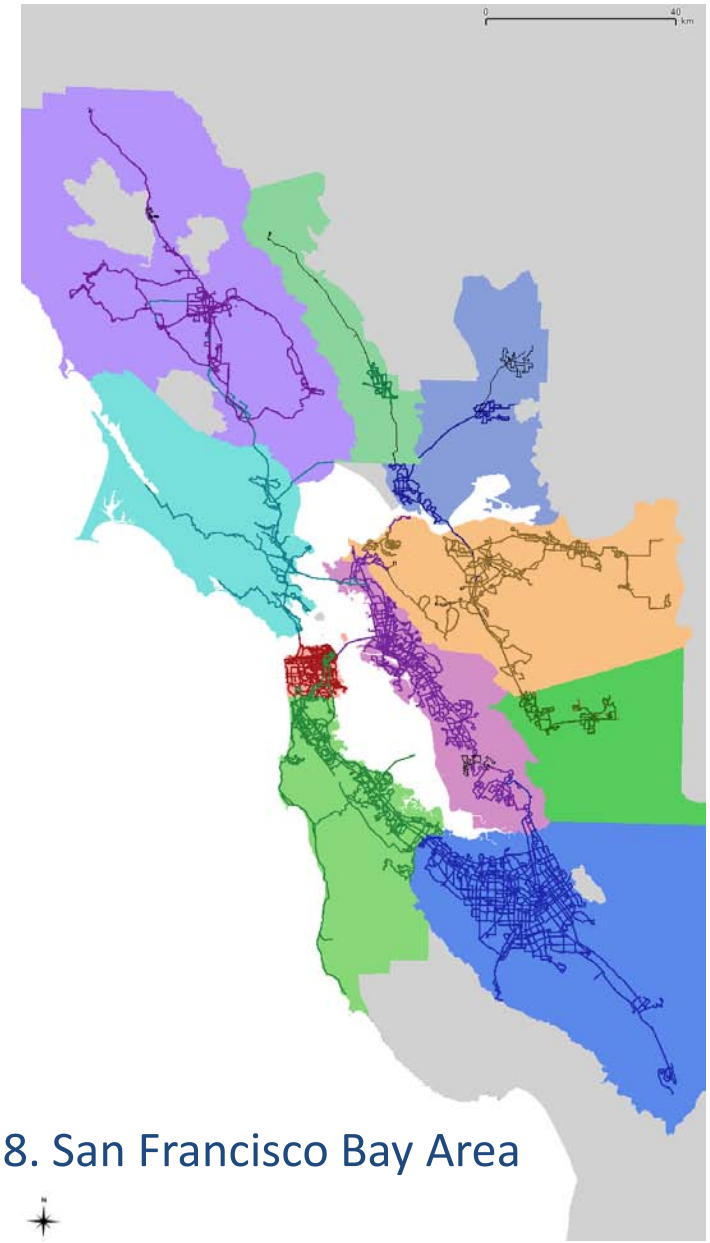


The catchment areas

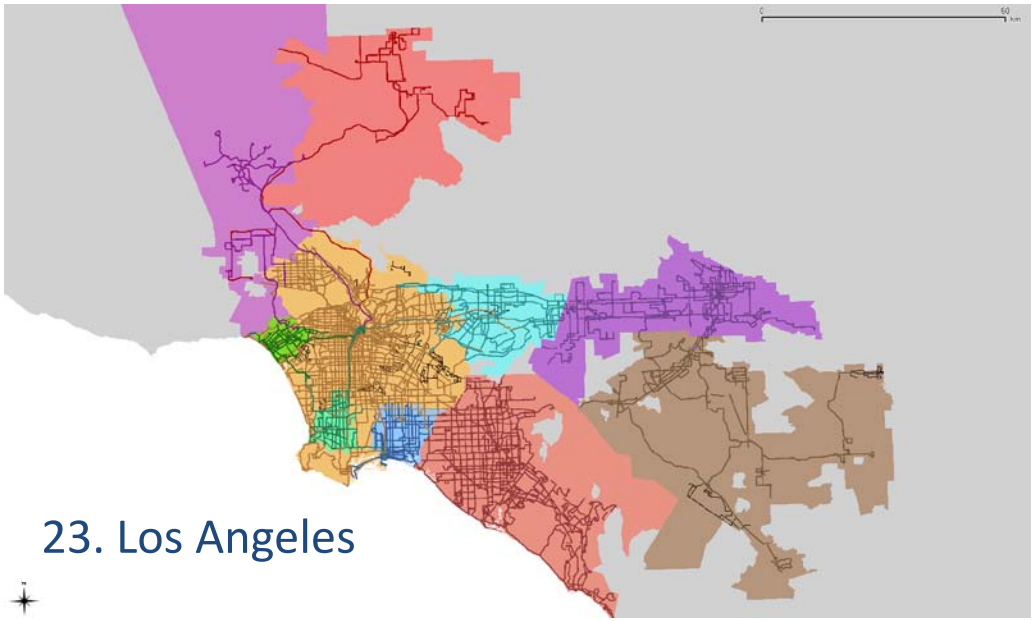
- The catchment areas account for the different ***levels of service*** and the easiness to transfer from one line to another
- Each TAZ is assigned to a catchment area, if at least one of the following conditions is true:
  - the proximity from the centroid to the closest bus lines < 3mi, *or*
  - at least one bus line passes through the TAZ
- Some TAZs are not served by any local transit service



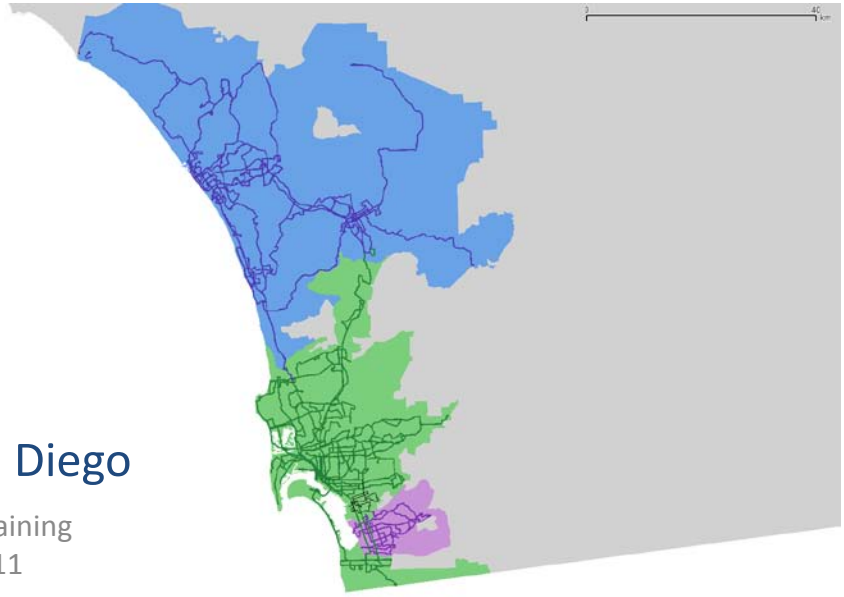
The catchment areas (2)



8. San Francisco Bay Area



23. Los Angeles



26. San Diego

Estimation of the model: Data

- IVT and OVT functions are estimated using observed data collected from the Google internet platform
- Total sample size: ***91,074 records*** collected for inter-zonal trips in ***29 service areas*** in the State of California
- Data referred to the four time periods (AM peak, Midday, PM peak, Off peak)
- Extraction of records from Google with the required information (IVT, OVT, catchment area, locations of origins and destinations, time of the day)
- Data merged with information available from other sources (Caltrans, other CSTDM components) to create the datasets for the estimation of the IVT and OVT functions

Local Transit Functions: In Vehicle Time (IVT)

- *IVT* depends on:
  - *speed of private vehicles* that share the road
  - *HOV3 congested speed* (*HOV lanes*, where available, can be used by buses)
  - *level of service LOS* (investments in the transit system and local conditions)
  - *time of the day*

PEAK IVT MODEL N= 50727

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
HOV3_Time	**2.8921040**	.01478	.88182	195.69460	.00000
HOV3_2	**-.0174477**	.00040	-.13566	-43.99996	.00000
LOSHOV3	**.0057270**	.00011	.20607	52.59453	.00000

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.95682	**0.915505304**	0.9155	14.44533

OFF-PEAK IVT Model N= 40347

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
HOV3_Time	**2.7813943**	.01734	.82159	160.42225	.00000
HOV3_2	**-.0029318**	.00055	-.01913	-5.29485	.00000
LOSHOV3	**.0046781**	.00013	.15756	35.90664	.00000

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.953631	**0.9094125**	0.909406	13.63288

Local Transit Functions: Out of Vehicle Time (OVT)

- *OVT* depends on:
  - *population and employment densities* at origin and destination
  - *HOV3 distance* between origin and destination (*HOV lanes*, where available, can be used by buses)
  - *level of service LOS* (investments in the transit system and local conditions)
  - *time of the day*

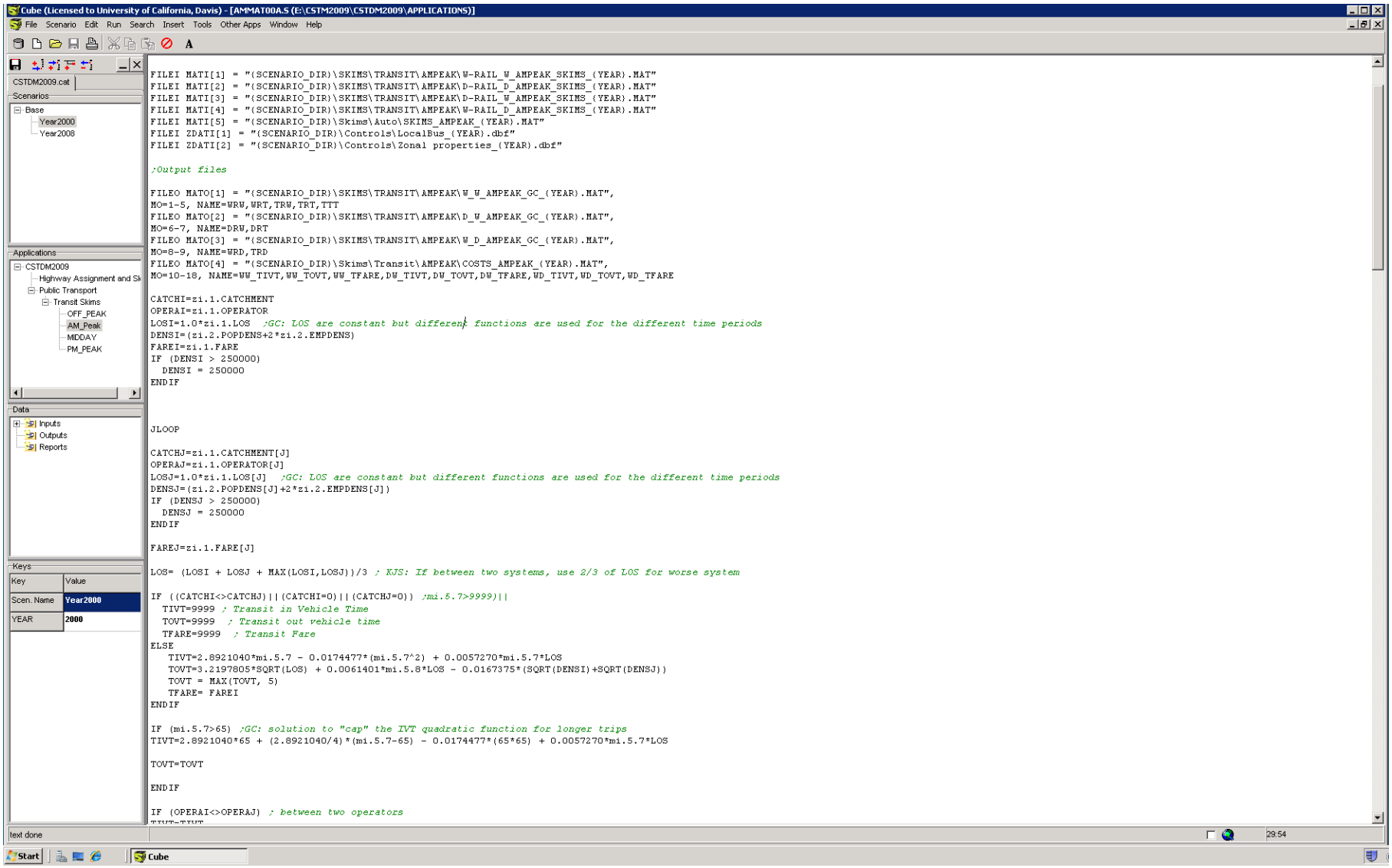
PEAK	OVT MODEL				N= 49263	
Model		Unstandardized Coefficients		Standardized Coefficients.		
		B	Std. Error	Beta	t	Sig.
	SQLOS	**3.219780**	0.018315	0.8152	175.796	**0**
	LOSDIST	**0.006140**	9.9E-05	0.1972	62.042	**0**
	SQP2EDENS	**-0.016737**	0.000669	-0.082	-25.020	**2.66E-137**

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.916336	**0.839672**	0.839663	16.2413

OFF-PEAK	OVT MODEL				N= 39467	
Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
	SQLOS	**3.087907**	0.0215319	0.7659	143.410	0
	LOSDIST	**0.007235**	0.0001239	0.2105	58.351	0
	SQP2EDENS	**-0.007630**	0.0007448	-0.0396	-10.244	1.34E-24

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.9108550	**0.829656**	0.8296439	16.78981

Implementation in the CUBE script



The control file for catchment areas and fares in CUBE

LocalBus_2008

TAZ	COUNTY	OPERATOR	CATCHMENT	LOS	FARE
100	Del Norte	1	1	200	1.12
101	Del Norte	1	1	200	1.12
102	Del Norte	1	1	200	1.12
103	Del Norte	1	1	200	1.12
104	Del Norte	0	0	9999	9999
105	Humboldt	2	2	200	1.35
106	Humboldt	2	2	200	1.35
107	Humboldt	2	2	200	1.35
108	Humboldt	2	2	200	1.35
109	Humboldt	0	0	9999	9999
110	Humboldt	2	2	200	1.35
111	Humboldt	2	2	200	1.35
112	Humboldt	2	2	200	1.35
113	Humboldt	2	2	200	1.35
114	Humboldt	2	2	200	1.35
115	Humboldt	2	2	200	1.35
116	Humboldt	2	2	200	1.35
117	Humboldt	0	0	9999	9999
118	Humboldt	0	0	9999	9999
119	Humboldt	0	0	9999	9999
120	Humboldt	2	2	200	1.35
121	Humboldt	2	2	200	1.35
122	Lassen	0	0	9999	9999
123	Lassen	0	0	9999	9999
124	Lassen	3	3	200	0.75
125	Lassen	3	3	200	0.75
126	Lassen	3	3	200	0.75
127	Lassen	3	3	200	0.75
128	Modoc	0	0	9999	9999

No need for explicit coding of updates in the local transit networks.

CSTDM runs the local transit model with 4 script files (the same for all scenarios).

The file ***LocalBus_{year}.dbf*** provides information for *catchment areas*, *LOS* and *fares* for each scenario.

The model allows ***policy testing*** on local transit system in future scenarios.

Documentation available on //ultrans.its.ucdavis.edu/resource/186



For any question, please contact:

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