StanCOG Transportation Model Program

Adopted By the StanCOG Policy Board
March 17, 2010

General Summary

What are Transportation Models?

Transportation Models are technical planning and decision support tools that simulate the "real world" and can be used to show the impact of changes on the transportation system (such as adding a new road or transit line, or increases in population or employment). Transportation models may be used to test the travel impacts of changes in land use, economic development, fuel and parking cost, and new highway or transit system capacity.

There are three important ingredients that are part of any model used for transportation analysis:

- The key base-year information, or current-year characteristics of travelers and the transportation system, described in terms of quantifiable variables (e.g., the number of highway travel lanes, transit service headways, household size and income, number of vehicles per household, employment patterns by type and job classification, etc.).
- The information that ties the relationship between these variables and the travel behavior of individuals (e.g., the more automobiles per household, the greater the number of automobile trips per household). This relationship is most often expressed in mathematical terms and algorithms.
- The future-year forecasts of key traveler and transportation system characteristics. This relationship is the same for all individuals and is constant over time.

The validity of transportation models often focus on one of these three assumptions.

The StanCOG Transportation Modeling Program has undergone major improvements over the past year by which the models components have been updated to address Federal and State Planning requirements for the Regional Transportation Plan (RTP), the Federal Transportation Improvement program (FTIP), and corresponding Air Quality conformity determination, and the Congestion Management Process (CMP). The summary of modeling information presented herein are based upon the upgraded data and modeling components that have been used for these purposes. The benefits of the Model improvements include an accurate measure of trip generation (trips being produced) based on updated land use and demographic data in the region, a detailed road and highway network that reflect the region's trip patterns and levels of congestion and AM, PM and off Peak periods. Additional Model details are included in the following documentation. The StanCOG Model Program will continue to be updated in 2011 with the 2010 Census household travel data, through-trip survey data and multi-modal user survey data. The StanGOG Transportation Model Program was updated last in the years 1993 and 2000, respectively. The Model data presented herein are approximate measures and comparable to Model information presented in previous RTP/FTIP and Air Quality Conformity updates. The Model upgrade is performed in CUBE Version 5.2 (2009).

What is the four-step modeling process?

For the past 40 years, transportation professionals have used a four-step approach in modeling transportation demand. The StanCOG Transportation Model utilizes the four-step modeling process. Once an understanding has been established as to what the land use, population, and employment levels are in a study area, the four modeling steps are:

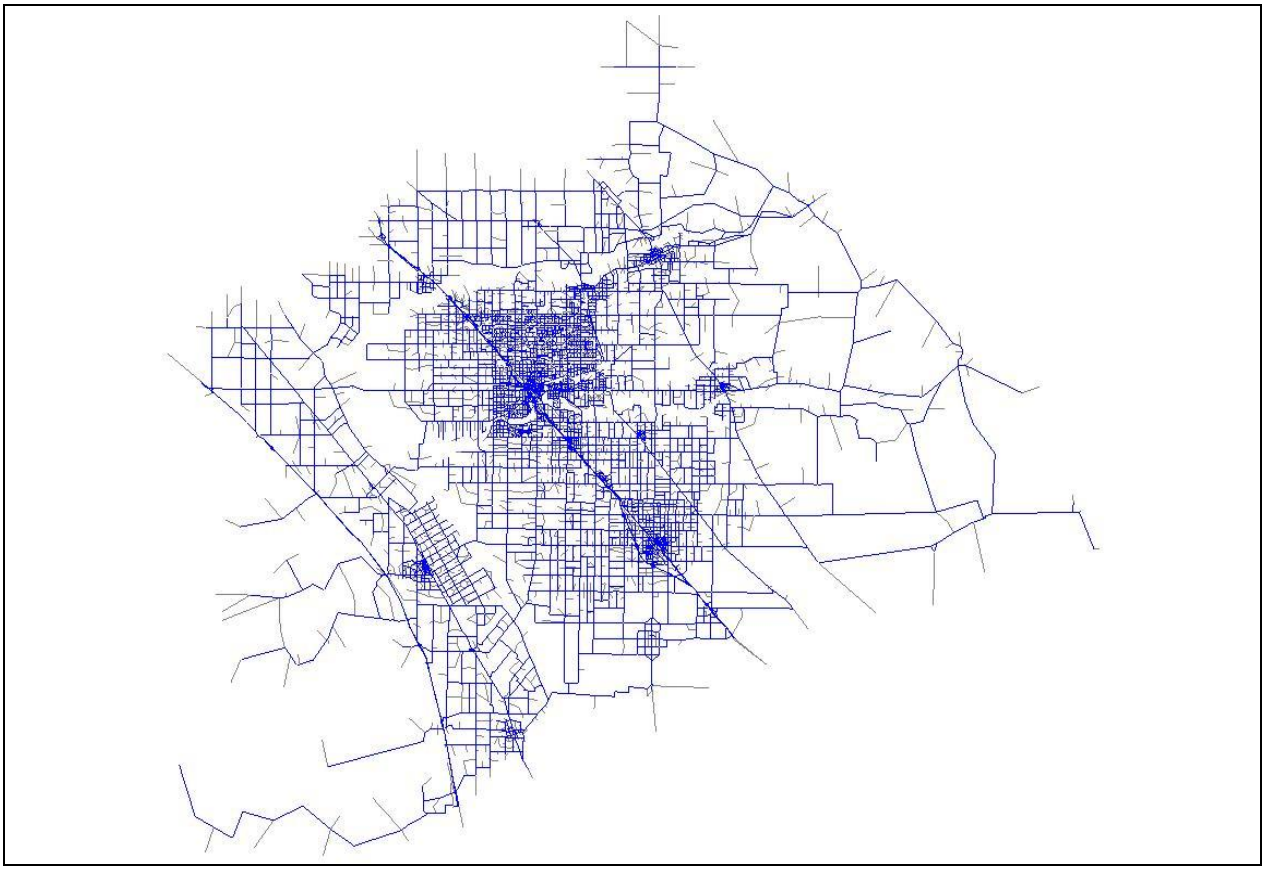
- **Trip generation:** The estimation of the number of trips generated in a small geographic area, called a zone, or at a particular location, and attracted to another zone or particular location. The trips generated are based on the assumed relationship among socio-economic factors, land use characteristics, and the number of trips. Trip generation then leads to:
- **Trip distribution:** The estimation of the number of trips that have origins (beginning) in every zone in the study area, and their destinations (ending) in every other zone. The result is a trip table that is used in:
- **Mode split:** The estimation of the number of trips predicted between each origin and destination and the number of trips made via each type of mode that is available for that trip. As an example, "x" percent are likely to drive alone, "y" percent are likely to take transit, "z" percent are likely to ride-share, etc. Mode split leads to:
- **Network assignment:** The estimation of the number of trips, using a particular mode that will take specific paths through a road or transit network. When all trips have been assigned to a network, the network assignment is an estimate of the total number of trips that will use each link in the network. When compared to the capacity of this link, planners can forecast the level of congestion that will occur at that location. This becomes the basis for assessing the performance of the transportation system.

What should decision-makers consider when presented with the results of a transportation model?

Results of a model are still only estimates—they cannot provide a definitive picture of what will happen in the future. Much like economic projections, transportation forecasts are based on the best available information and can be greatly affected by the long-term economic health and attractiveness of the region, by population changes, and by the individual behavior of each person using the transportation system, which no one can predict.

Model results are only as good as the data that go into the model. Metropolitan Planning Organizations (MPOs) such as StanCOG must use the most current socioeconomic and census data available, especially if the region is growing rapidly. StanCOG must make every effort to explain the information and assumptions that went into creating the model in plain, understandable terms. Finally, it is important that the models periodically be validated against observed conditions. The State, MPO, and transit operators should have a schedule for a periodic re-survey of the usage and performance patterns of their systems (e.g. transit onboard and roadside origin/destination surveys).

The StanCOG Transportation Model Network



The StanCOG Transportation Model network was upgraded from 550 traffic analysis zones (TAZ) to 3500. The network was reconstructed over a center line coverage provided by the State of California in State Plane Coordinate System: NAD 83. The representation provides an opportunity to model all collector and minor roads, intersections and junctions in the model study area. The model network was expanded to include the southern part of San Joaquin County and the northern part of Merced County because some travel patterns are common with Stanislaus County and the adjacent counties and the opportunity to select practical gateways. The adjacent counties travel data are excluded from estimates for Stanislaus County in the modeling process.

1. Highway System centerline/lane mileage by functional class.

The road and Highway network shown above is based on centerline information provided by the State of California in a GIS format; it was used to upgrade StanCOG's model network. The lane miles based on this network will change when projects are added or deleted during the CMP and RTP project selection process. Lane mile estimates are expressed for the following years at this time:

Estimates Lane Miles in the StanCOG Transportation Model

	2011	**2014**	**2035**
Lane Miles (Local+Collector+ Major+Freeway)	**3,550 Miles**	**3,711 Miles**	**4,836 Miles**

2. Transit system by mode (e.g., bus vs. light rail).

Transit and light rail networks are not included in the StanCOG model program at this time. Simplistic assumptions about transit ridership are used in the model process to estimate people trips that may use transit based on the Census Transportation Planning Products (CTPP). However, StanCOG staff is collecting transit network routes in GIS, transit stops and headway information that will be coded in the StanCOG transportation model.

3. Other transport modes - pedestrian and bike paths.

Pedestrian and bicycle networks are not included in the StanCOG model program at this time. Factors are used to estimate people trips accounted for in bicycle and pedestrian modes. StanCOG staff is collecting bicycle and pedestrian information for use in the mode choice model component that will be constructed next year. Bicycle networks and assignments may be included in the model, if budgets permit. People trips that use bike and walk will be a critical component in the mode choice model.

ii. Population - total population/households, and geographic distribution.

Single family and multi family dwelling units and population data were collected from the State Department of Finance and arranged geographically using Census Tiger boundaries by city, community and the unincorporated regions in Stanislaus and zip code. The data were collected from the year 2006. They are shown in Exhibit A. with job data also used by the model program.

Existing Demographics by City, Community and Unincorporated Area (2006)										
	POP	DU	SF	MF	Retail	Service	EDU	GOV	other	Total
County Control Total (D.	511,617	171,721	135,562	36,159	28,244	48,214	725	25,791	74,182	177,156
County Total	511,622	171,721	135,562	36,159	28,244	48,214	16,052	10,660	74,010	177,180
Bret Harte	5,510	1,331	1,097	235	-	-	14	1	161	175
Bystrom CDP	4,823	1,492	1,229	263	469	164	104	41	343	1,121
Ceres city	40,723	12,641	10,200	2,441	1,639	1,605	1,418	587	3,358	8,607
Del Rio CDP	1,247	446	368	79	-	27	-	-	188	215
Denair CDP	3,679	1,238	1,020	218	44	20	109	8	120	302
East Oakdale CDP	2,927	1,099	905	194	-	17	8	-	188	213
Empire CDP	4,167	1,293	1,065	228	24	65	83	3	422	597
Grayson CDP	1,150	309	254	54	-	-	-	-	-	-
Hickman CDP	488	158	130	28	29	-	85	3	107	224
Hughson city	6,092	1,911	1,621	290	120	6	55	10	580	771
Keyes CDP	4,884	1,567	1,291	276	50	-	131	7	343	531
Modesto city	206,993	73,501	55,948	17,553	12,519	27,833	7,958	6,154	14,152	68,616
Newman city	10,084	3,092	2,704	388	287	187	281	49	281	1,085
Oakdale city	17,761	6,639	5,230	1,409	825	1,328	597	268	3,091	6,109
Patterson city	19,171	5,414	5,072	342	362	534	436	329	674	2,334
Riverbank city	21,099	6,257	5,606	651	634	613	432	168	1,664	3,510
Riverdale Park CDP	1,168	337	277	59	-	-	-	-	140	140
Salida CDP	13,409	3,984	3,281	702	360	551	428	84	1,309	2,732
Shackelford CDP	5,520	1,549	1,276	273	290	134	5	13	604	1,046
Turlock city	67,519	23,084	16,850	6,234	4,000	8,004	2,388	2,606	7,335	24,333
Waterford city	8,171	2,448	2,072	376	83	41	294	29	40	486
Westley CDP	797	161	132	28	-	-	3	20	-	23
West Modesto CDP	6,508	1,939	1,597	342	-	-	74	-	398	472
							-	-		
Stanislaus Unincorporate	57,732	19,832	16,336	3,496	6,509	7,085	1,150	282	38,512	53,538

Exhibit A.

iii. Employment - total number of jobs, and their geographic distribution.

Employment data were collected from employer payrolls in Stanislaus County in year 2006. The Employment Development Department (EDD) provided job data for retail, service, education, and other; the other job category include jobs in manufacturing, food processing and telecommunications and utilities. Like the housing and population data above, the information were arranged geographically using Census Tiger boundaries by city, community and the unincorporated regions in Stanislaus in addition to zip code. See Exhibit A. for specific city and community and data type.

iv. Vehicle miles of travel - average daily and annual VMT by highway functional class.

Vehicle Miles of Travel were estimated using the travel model network and the land use descriptions and the other model enhancements as described. The VMT estimates below represent approximations of final model scenarios. Similarly, final land use may be modified somewhat to account for changes in DOF and EDD data in 2009-2010 when it becomes available. Key model input data will be revised according to data availability and the project selection process.

Estimates Vehicle Miles of Travel in the StanCOG Transportation Model (in millions)

	2011 VMT	2014 VMT	2035 VMT
Local	1.2	1.2	1.6
Collector	2.8	3.0	1.2
Major Art.	3.5	3.7	6.1
Freeway	4.3	4.4	8.4
Total	12.0	12.5	17.4

v. Transit use - system wide transit ridership and share of regional trips made on transit (average daily and peak).

The StanCOG Transportation Model does not account for transit trips in specific corridors. A transit network and a mode choice component of the model are under development and will be available by Spring of 2012. The StanCOG Transportation Model utilizes a factor to account for people trips in the peak hours and the remaining 22 hours of the day. Transit ridership in Stanislaus County is less than one percent of all people trips in 2006 even though transit ridership is significant in key corridors.

vi. Congestion - description and duration of peak period (i.e., what criteria distinguish peak vs. off-peak travel (e.g., highway level of service).

In 1995, StanCOG staff accumulated hourly traffic data in 24 hour periods at select locations throughout Stanislaus County and its cities to build an AM and a PM peak hour model. Even though "peak hour" varied by segment, intersection and region, the AM period was on average between 7:15 am to 8:15 am; the PM peak hour was on average between 4:30 pm to 5:30 pm. In general, the peak hours described herein manage the greatest amount of traffic flow today; however, today, traffic volumes have increased significantly in the adjacent hours surrounding the peak hours and during the mid-day. In short, the highest traffic flow defines the peak hours in the StanCOG model. The peak hour traffic volumes included in the StanCOG Traffic Modeling program utilizes the Florida Level of Service methodology to calculate the severity of congestion. Many State highway segments and major arterial segments exhibit level of service D, E and F in Stanislaus County.

vii. Land use - amount and geographic distribution of total land area that is currently developed, available for development, or not developable.

Specific data are not available about acreage developed or undeveloped at this time. However, in November 2008, voters in Stanislaus County voted to restrict development in rural Stanislaus County with Measure E. Housing development was regulated to construction that was already planned prior to the law and construction that allows a family to build a second house on 40 acres. The development in Stanislaus County is planned primarily in the cities as defined by their general plans. Growth shown in the general plans for the cities are accounted for in the StanCOG model. Likewise, Measure E and its affect have been accounted for in the StanCOG land use files and its forecasts for use in the transportation model. Land use forecasts adopted by the StanCOG Board in December 2009 reflect the city's general plan assumptions and Measure E in addition to Valleywide Blueprint assumptions.

b. Planning Assumptions: The documentation of planning assumptions should, at a minimum, address the following expected changes in the study area:

i. Population change - expected change in regional population over the duration of the Transportation Plan. Population assumptions should be compared to past trends, and to statewide demographic control totals, where available.

Population growth in Stanislaus County has slowed from about 14,000 per year in 2003 to about 2,000 people per year in 2009. Earlier population and employment forecasts in the 2003 and 2004 period did not predict a decreasing trend as has been evident over the past 5-6 year. Similarly, State DOF projections did not predict a slowing of increasing growth. Stanislaus County passed Measure E to limit growth in the rural county. StanCOG staff regressed thirty nine years of historical data in Stanislaus County to develop a forecasting tool. The tool was used to develop a line of average relationship that could estimate population estimates from 2011 to 2040. In December, 2009 the StanCOG Policy Board adopted the method and the forecast population estimates. The forecast represent a significant decrease in population from earlier forecast. Planned growth in the City general plans are reflected in the forecast in addition to a significant reduction in housing in the county caused by Measure E. Previous forecast estimates show about 821, 963 people in Stanislaus County in 2030 compared with the new forecast that show about 722,766 people. Growth is controlled in the transportation model by city, community and the unincorporated area in the same manner the 2006 information is accounted.

ii. Employment change - expected change in regional employment over the duration of the Transportation Plan. Employment assumptions should be compared to past trends, and to statewide economic growth control totals, where available.

Job growth in Stanislaus County has slowed from about 1000 jobs per year to no growth per year in 2006. Job growth is negative in 2007. 2008 and 2009. Like population projections, StanCOG employment projections did not predict a decreasing job rate. StancCOG staff regressed 25 years of historical job data provided by the Employment Development Department to estimate a line of average relationship over time. The line was used to estimate future job growth to 2040. The method and the Forecast were adopted by the StanCOG Board in December 2009. Previous forecast estimates show about 293,940 jobs in Stanislaus County in 2030 compared with the new forecast that

show about 239,479 jobs. Growth is controlled in the transportation model by city, community and the unincorporated area in the same manner the 2006 information is accounted.

iii. Regional distribution of future population, employment and land use - the procedures used to allocate future population, employment and other activity generators within the metropolitan area.

Job and population growth in the StanCOG transportation model are consistent with General Plans provided by the cities, the communities and the unincorporated county. The growth in jobs and population is specific to jurisdictions and within jurisdictions where defined by specific plans. In some cases, the general plans have not been updated to reflect some of the changes described in this document such as Measure E. However, the forecasts were developed in concert with the jurisdictions planning staff and the Blueprint Planning process that occurred in 2008-09.

iv. Demographic changes - changes in the demographic characteristics of the study area population that would significantly impact aggregate trip-making behavior and/or travel patterns. Demographic changes might include, auto ownership, household income, household size, multi-worker households, minority households, etc.

The StanCOG Transportation Model was updated with a cross classification trip generation program in 2008 and 2009. The primary generator of productions in the model are single family and multi family dwelling units. Furthermore, trip generation rates are specific to the number of people per household and the number of autos per household. The StanCOG Transportation Model uses auto ownership as a proxy for income as compared to other transportation models. The StanCOG Transportation Model is sensitive to density in so far as the people per dwelling unit and the housing units per traffic analysis zones are strictly accounted. Attraction rates are based on statistical references from the Institute of Transportation Engineers.

v. Travel behavior changes - changes in the trip-making behavior of travelers and households that would significantly impact aggregate trip-making behavior and/or travel patterns. Travel behavior changes might include telecommuting, Internet shopping, trip chaining, etc.

The travel model is not sensitive to changes in trip making caused by internet use nor internet shopping or telecommuting. Fewer trips would be reflected in observed traffic counts if alternative shopping and telecommute options became a significant factor in the Stanislaus region. Improved data collection techniques will be needed to collect trip chaining and some other types of trips. On the other hand, StanCOG is engaged in a household travel survey, a survey of University and school trips, an onboard transit survey and gateway surveys of through trips and Internal External trips. These surveys may reveal structural changes in trip patterns next year.