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# TECHNICAL MEMORANDUM

Date: 6/6/2022

To: Elisabeth Hahn  
Deputy Director of Planning and Programming  
Stanislaus Council of Governments

CC:

From: Lawrence Liao, ETG

Subject: **StanCOG 2022-RTP Model Update Memo**

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This memorandum presents the development of the Stanislaus Council of Governments (StanCOG) travel forecast model in support of 2022 StanCOG regional transportation plans (RTP).

## INTRODUCTION

The previous StanCOG model was calibrated/validated to 2015 conditions and applied for 2018 RTP. It contains 2015, 2018, 2019, and 2042 model years.

Initially, 2020 was chosen as the base year for 2022-RTP model update. However due to the COVID-19 pandemic, it was decided the traffic data from 2019 would be more stable and representative, hence, 2019 was selected as the base year for 2022-RTP model update. The horizon year is 2046.

The 2022-RTP model area was revised from covering the northern three counties, namely, San Joaquin, Stanislaus, and Merced counties, to only the Stanislaus County area, to reduce model runtime.

The 2022-RTP model was calibrated so that the 2019 VMT is consistent with VMT forecasts from the 2018-RTP model to maintain consistency with previous Air Quality conformity analysis results.

## 2019 MODEL UPDATE

The 2019 model year from the 2018-RTP model was used as the starting point of this model update.

The model update includes three main components

1. Correct known model issues
2. Update 2019 socioeconomic data (SED) based on latest data
3. Revise to one-county model area



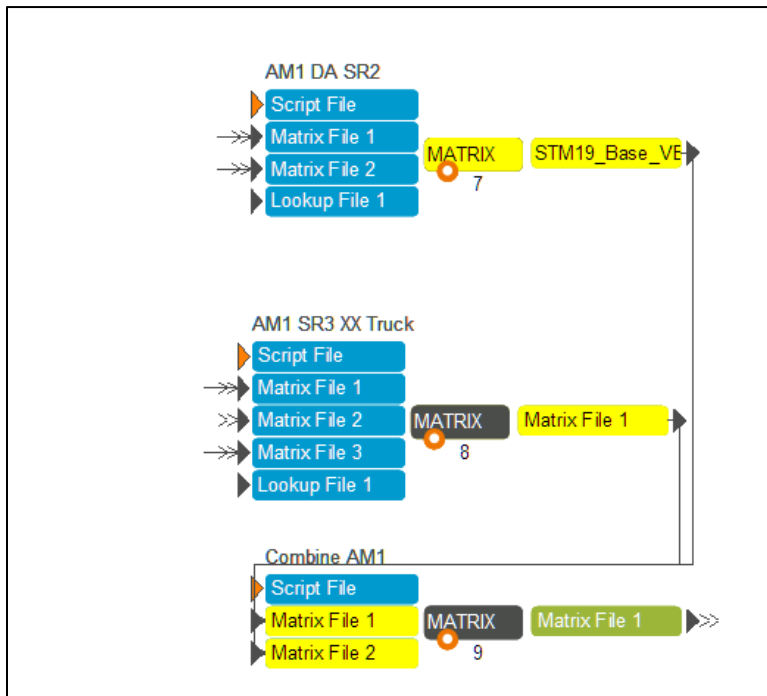
## 1. KNOWN MODEL ISSUES CORRECTION

Known issues in StanCOG 2018-RTP model include

- AM Peak Hour Trip Table Calculation error
- SED with “string values with spaces” error
- Master network coding issues

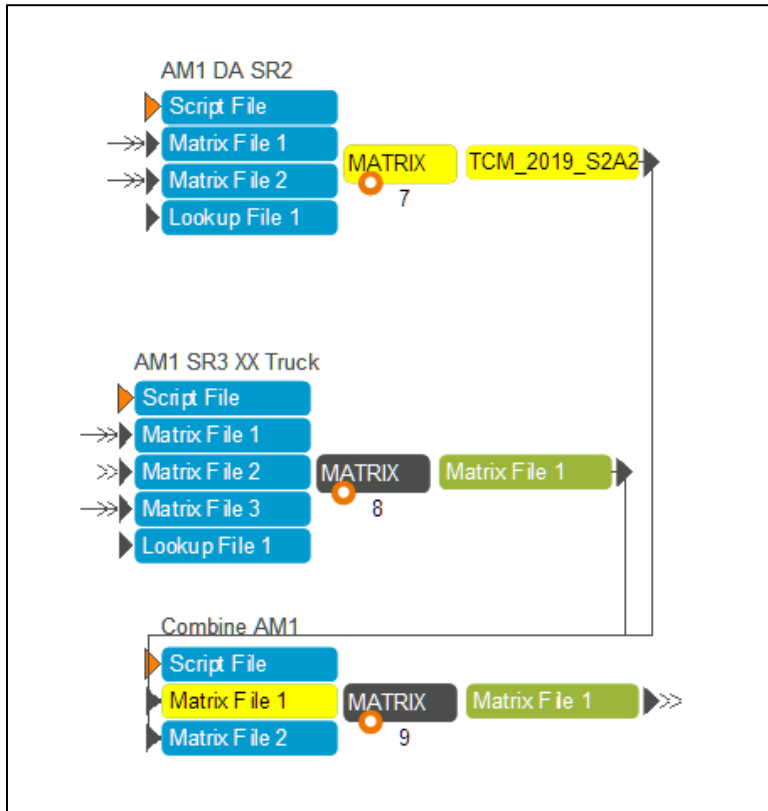
### ***AM Peak Hour Trip Table Calculation error***

The DA, SR2 tables were overwritten by SR3, XX tables in the calculation of AM Peak Hour (AM1) trip tables in 2018-RTP model, as shown in the screenshot below.





This error was corrected in the 2022-RTP model.



**SED with “string values with spaces” error**

The model scripts treat any white space in input data as a delimiter. This creates a problem when reading in SED files in comma-separated-values (CSV) format. For example, as seen in the following screenshot, the records where the CITY field has “Dos Palos” will have all subsequent fields shifted to the right by one field because the space in “Dos Palos” will cause it to be read in as two separate data “Dos” and “Palos”.



	TAZ	STATE	COUNTY	PUMA	CITY	TRACT	BLOCK	BLOCK	MODEL	PLACET	TOTHH	TOTPO	RUG1	RUG2	RUG3	RUG1SF	RUG2SF
62	161	CA	Merced	4701	Dos Palos	24023	6.05E+10	3029	TCM	0	112.3	329.56	106.39	5.91	0	0	0
63	162	CA	Merced	4701	Dos Palos	24022	6.05E+10	2056	TCM	0	139.83	414.49	112.88	26.95	0	0	0
64	163	CA	Merced	4701	Dos Palos	24023	6.05E+10	3029	TCM	0	86.91	255.04	82.46	4.45	0	0	0
65	164	CA	Merced	4701	Dos Palos	24023	6.05E+10	3029	TCM	0	154.12	452.27	146.03	8.09	0	0	0
66	165	CA	Merced	4701	Dos Palos	24023	6.05E+10	3029	TCM	0	153.45	450.32	145.39	8.06	0	0	0
67	166	CA	Merced	4701	Dos Palos	24022	6.05E+10	2056	TCM	0	36.79	109.06	29.61	7.18	0	0	0
68	167	CA	Merced	4701	Dos Palos	24023	6.05E+10	3029	TCM	0	43.15	127.41	37.2	5.95	0	0	0
69	168	CA	Merced	4701	Dos Palos	24022	6.05E+10	2056	TCM	0	55.14	163.4	44.68	10.46	0	0	0
70	169	CA	Merced	4701	Dos Palos	24023	6.05E+10	3029	TCM	0	38.18	112.05	36.16	2.02	0	0	0
71	170	CA	Merced	4701	Dos Palos	24011	6.05E+10	1170	TCM	0	0.18	0.54	0.16	0.02	0	0	0
72	171	CA	Merced	4701	Dos Palos	24022	6.05E+10	2056	TCM	0	38.82	115.06	31.32	7.49	0	0	0
73	172	CA	Merced	4701	Dos Palos	24022	6.05E+10	2056	TCM	0	124.27	368.42	100.01	24.26	0	0	0
74	173	CA	Merced	4701	Dos Palos	24024	6.05E+10	4046	TCM	0	86.82	255.2	80.35	6.47	0	0	0
75	174	CA	Merced	4701	Dos Palos	24024	6.05E+10	4046	TCM	0	153.71	451.79	142.21	11.5	0	0	0
76	175	CA	Merced	4701	Dos Palos	24024	6.05E+10	4046	TCM	0	1.3	3.82	1.22	0.08	0	0	0
77	176	CA	Merced	4701	Dos Palos	24024	6.05E+10	4046	TCM	0	1.13	3.32	1.06	0.07	0	0	0
78	177	CA	Merced	4701	Dos Palos	24022	6.05E+10	2056	TCM	0	65.42	193.77	53.52	11.9	0	0	0
79	178	CA	Merced	4701	Dos Palos	24024	6.05E+10	4046	TCM	0	324.06	952.55	299.68	24.38	0	0	0

This issue was resolved by replacing spaces in any string values with an underscore (“\_”) in the SED input files, as shown below.

	TAZ	STATE	COUNTY	PUMA	CITY	TRACT	BLOCK	BLOCK	MODEL	PLACET	TOTHH	TOTPO	RUG1	RUG2	RUG3	RUG1SF	RUG2SF
62	161	CA	Merced	4701	Dos_Palos	24023	6.05E+10	3029	TCM	0	113.9736	396.4393	107.9755	5.998076	0	0	0
63	162	CA	Merced	4701	Dos_Palos	24022	6.05E+10	2056	TCM	0	141.9139	498.6046	114.5622	27.35163	0	0	0
64	163	CA	Merced	4701	Dos_Palos	24023	6.05E+10	3029	TCM	0	88.20521	306.7966	83.68889	4.516318	0	0	0
65	164	CA	Merced	4701	Dos_Palos	24023	6.05E+10	3029	TCM	0	156.4168	544.0515	148.2063	8.210564	0	0	0
66	165	CA	Merced	4701	Dos_Palos	24023	6.05E+10	3029	TCM	0	155.7368	541.7058	147.5567	8.180117	0	0	0
67	166	CA	Merced	4701	Dos_Palos	24022	6.05E+10	2056	TCM	0	37.33828	131.1921	30.05127	7.287003	0	0	0
68	167	CA	Merced	4701	Dos_Palos	24023	6.05E+10	3029	TCM	0	43.79306	153.266	37.75439	6.038672	0	0	0
69	168	CA	Merced	4701	Dos_Palos	24022	6.05E+10	2056	TCM	0	55.96174	196.5596	45.34586	10.61588	0	0	0
70	169	CA	Merced	4701	Dos_Palos	24023	6.05E+10	3029	TCM	0	38.74899	134.7889	36.69889	2.050104	0	0	0
71	170	CA	Merced	4701	Dos_Palos	24011	6.05E+10	1170	TCM	0	0.182683	0.649585	0.162384	0.020298	0	0	0
72	171	CA	Merced	4701	Dos_Palos	24022	6.05E+10	2056	TCM	0	39.39853	138.4097	31.78676	7.601622	0	0	0
73	172	CA	Merced	4701	Dos_Palos	24022	6.05E+10	2056	TCM	0	126.122	443.1854	101.5004	24.62154	0	0	0
74	173	CA	Merced	4701	Dos_Palos	24024	6.05E+10	4046	TCM	0	88.11387	306.9891	81.54745	6.566422	0	0	0
75	174	CA	Merced	4701	Dos_Palos	24024	6.05E+10	4046	TCM	0	156.0007	543.4741	144.3293	11.67138	0	0	0
76	175	CA	Merced	4701	Dos_Palos	24024	6.05E+10	4046	TCM	0	1.319374	4.595213	1.238181	0.081192	0	0	0
77	176	CA	Merced	4701	Dos_Palos	24024	6.05E+10	4046	TCM	0	1.14684	3.993745	1.075797	0.071043	0	0	0
78	177	CA	Merced	4701	Dos_Palos	24022	6.05E+10	2056	TCM	0	66.39495	233.0928	54.3176	12.07734	0	0	0
79	178	CA	Merced	4701	Dos_Palos	24024	6.05E+10	4046	TCM	0	328.8894	1145.856	304.1461	24.74333	0	0	0



**Master network coding issues**

Caltrans District 10 provided a list of items pertaining to the Tri-County Model (TCM) that have been fixed by Caltrans D10 Forecasting as well as the list of items that have yet to be addressed due to time constraint (see “**List of fixes to the TCM made by D10 Forecasting and potential fixes still to be made 09222021.PDF**” in Appendix A). The master network was updated, accordingly.

**2. SOCIOECONOMIC DATA UPDATE**

The 2019 household (HH) and population (POP) for all three counties from the CA Department of Finance projections are shown below:

**Table 2: E-5 City/County Population and Housing Estimates, 1/1/2019**

County	City	POPULATION			HOUSING UNITS						
		Total	Household	Group Quarters	Total2	Single Detached	Single Attached	Two to Four	Five Plus	Mobile Homes	Occupied
Merced	County Total	280,441	273,349	7,092	86,955	63,311	2,760	7,643	7,552	5,689	80,410
San Joaquin	County Total	764,373	748,546	15,827	246,521	179,501	13,016	14,939	30,304	8,761	232,504
Stanislaus	County Total	553,131	546,490	6,641	182,514	136,523	7,492	12,398	17,492	8,609	172,053

Data Source: E-5 Population and Housing Estimates for Cities, Counties, and the State, 2011-2021 with 2010 Census Benchmark

The projected 2019 Employment (EMP) for the three counties in the EDD Data Library are shown below:

Area Name	Year	Month	Current Employment
Merced County	2019	July	82,100
San Joaquin County	2019	July	260,500
Stanislaus County	2019	July	196,900

The 2019 model SED were adjusted so that the total POP, HH and EMP by county would be consistent with the projections by DOF and EDD. For example, a countywide POP adjustment factor for Merced County was calculated by dividing the DOF projection POP (280,441) by the existing total POP (235,597). The POP adjustment factor (1.19) then was applied to all POP related SE data, such as, TOTPOP, POP0005, POP0514, POP1517, POP1824, POP2554, POP5564, POP6574, and POP75, in Merced County. The adjustment process was applied to POP, HH and EMP data for all three counties.

A comparison of total POP, HH and EMP from the updated 2019 model input SED and the projection data is shown below:

	Population		Households		Employment	
	Model	Data	Model	Data	Model	Data
<b>Merced</b>	283,408	280,441	86,955	86,955	84,242	82,100
<b>San Joaquin</b>	787,804	764,373	251,858	246,521	265,400	260,500
<b>Stanislaus</b>	542,291	553,131	177,177	182,514	191,767	196,900

The SED for Stanislaus County in the 2022-RTP model were further adjusted based on the projections in “**2021 Stanislaus County Demographic and Employment Forecast**”, June 7, 2021, by Center for Business & Policy Research at University of the Pacific.



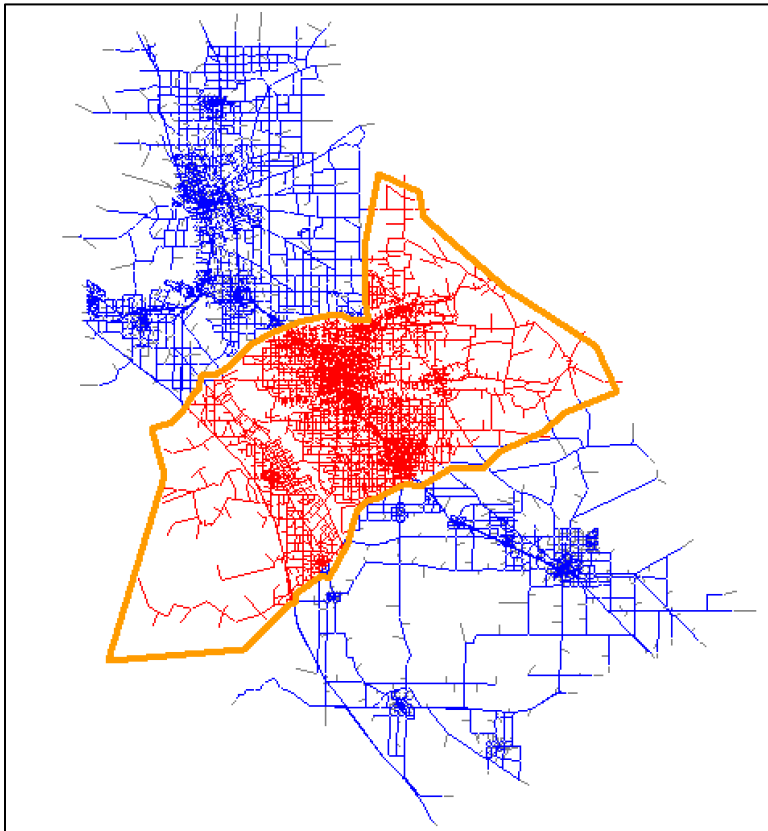
The final 2019 SED for Stanislaus County are

	HH	POP	EMP
<b>2019</b>	182,514	558,395	197,017

### 3. MODEL AREA REVISION

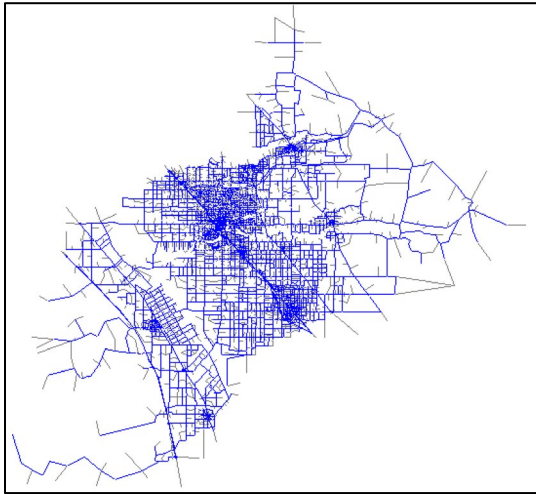
The 2022-RTP model area was revised from covering the northern three counties, namely, San Joaquin, Stanislaus, and Merced counties, to only the Stanislaus County area, to reduce model runtime.

A subarea of the Stanislaus County in the 2018-RTP model network was defined and a subarea extraction procedure in CUBE was performed.





A one-county network for StanCOG 2022-RTP model master network was created.



The model TAZs in the one-county network were revised to 1 to 805, where 1-100 are gateway zones, to improve model runtime.

The model scripts and input data were revised to fit the new TAZ structure.

### 2019 MODEL VALIDATION

The 2022-RTP model was calibrated so that the 2019 VMT is consistent with VMT forecasts from the 2018-RTP model to maintain consistency with previous Air Quality conformity analysis results.

The 2020 VMT from StanCOG 2021 FTIP Report using 2018-RTP model is 11.5 million.

**Table 2-2:  
Traffic Network Comparison for Horizon Years Evaluated in Conformity Analysis**

Horizon Year	Total Population	Employment	Average Weekday VMT (millions)	Total Lane Miles
2020	571,139	192,931	11.5	4,844
2021	577,919	195,012	11.6	N/A

The calibrated 2019 VMT was around 11.1 million.

Facility_Type	Year	StudyArea	AM_VMT	MD_VMT	PM_VMT	NT_VMT	Daily VMT
Freeway	2019	3	640123.3	1833869	802331.5	301518.8	
Highway	2019	3	37686.43	83411.63	39053.59	18091.26	
Expressway	2019	3	1135845	2433081	1185921	519063.9	
Arterial	2019	3	313489.2	710970	343389.5	136910.7	
Collector	2019	3	133439.7	276272.2	143197.3	57196.79	
Local	2019	3	92.43	186.2	102.97	51.73	
Freeway-Freeway	2019	3	0	0	0	0	
Slip	2019	3	1400.21	3702.41	1514.06	826.49	
Loop	2019	3	0	0	0	0	
<b>Total</b>	2019	3	2262076	5341493	2515510	1033660	<b>11,152,739</b>



## APPENDIX A

*List of fixes to the TCM made by D10 Forecasting and potential fixes still to be made 09222021.PDF*



Fixes made to the Tri-County Model (TCM) by Caltrans D10 Forecasting Unit (items with direct relevance to Stanislaus County are highlighted in yellow):

1. Change the reference to the new Master Network in the model input interface.
2. Comment out the portion of script written by LL (Lawrence Liao) that was meant to be a temporary fix in the input processing step that converts the Master Network to Scenario Network.
3. Remove ramps at the interchange of Dr. Martin Luther King Jr. Blvd. & SR-99, which would render this location no longer an interchange. Improvement Year: 2016.
4. Connect Dr. MLK Jr. Blvd to E. Main Street as a two-way road instead of one way. Improvement Year: 2016.
5. Construct interchange at S Golden Gate Ave. Improvement Year: 2018.
6. Close slip ramps at Farmington Road. Improvement Year: 2016.
7. Close slip ramps at Carpenter Road. Improvement Year: 2016.
8. Extend SR-4 to Navy Drive. Improvement Year: 2017.
9. Fixed the distances along I-205 to the “natural” distances since the model is to scale, which fixed the unrealistic volume drop going from east to west.
10. Removed the widening and adding of aux lanes along SR-99.
11. Construct SR 132 West. Improvement Year: 2020.
12. Widen SR 132 West to four lanes. Improvement Year: 2020.
13. Change the distance to Gate 71 (connecting SR-99 to south of Merced County) to 75 miles (more representing of the actual distance to origin/destination center of mass) from the original 1 mile.
14. Fix zero lanes Airport Interchange with SR 120. Improvement Year: 2036.
15. Fixed the distances of all links not connected to the gateways to be their “natural” distances since the model is to scale.
16. Fixed the alignment of North County Corridor and the roads surrounding it in accordance to the 2018 RTP project list.
17. Keep SR 99 at 6 lanes in the future (2042) since there is no explicitly funded construction project to widen it in the StanCOG 2018 RTP.
18. Put in/keep only the aux lanes on SR 99 that are either already constructed/set for construction or are in StanCOG 2018 RTP Tier 1 Project List to be constructed.
19. Fixed Hammer Lane connection west of I-5 in the Master Network where a link disappeared in the 2018 model year outputs which disconnected all development west of I-5 from the freeway.
20. Corrected missed connection at West Hammer Ln /I5, added Mossdale Rd/ I5 interchange, Manthey Rd/ I5 interchange.
21. Add in network details on both sides of I-5 leading to the ramps at Mossdale Rd and Manthey Rd.
22. In the land-use file, put underscore (“\_”) in between words in City and County names with multiple words, such as San Joaquin.
23. For a.m. peak hour assignment, fix the scripts, so that the first OD isn’t used as the second OD as well (doubling the 1<sup>st</sup> OD when combined, which is not correct).
24. Added McKinley Interchange at SR-120 for future year.

25. Fixed SR 99 / Golden Gate Ave and SR 99/ Mariposa Rd interchange, including changing the turn penalty file. (edited TCM20/TCM35 transit line files, edited TurnPen.csv file)
26. Corrected I5 SB on ramp @ Country Club Blvd (had incorrect direction) Connect NB Ramps with the Frontage Rd at Mokelumne, North of E Turner Rd interchange.
27. All interchanges between SR-4 and Arch Rd have been updated to reflect existing and future configurations.
28. Made network updates to a single Master Network to be used for existing and future years, instead of having multiple master networks for different model years, which defeats the purpose of having a master network.

Still need to be fix (or at least investigate):

1. Check project lists in all three MPO's RTP's against the TCM's updated master network, especially SJCOG and MCAG, and especially Tier 1 projects.
2. IX/XI trips not growing contributing to some gateway traffic not growing.
3. Gateway zones 65-67 in Merced County are not connected to the rest of the model network even though they all generate trips, which means these trips are not being assigned.
4. Many roadways in the model have facility type equal to zero either in the base year or in the improvement years.
5. Land-use in TAZ's not matching approved general plans or master plans. For instance, TAZ 2476 in Tracy has significantly less land-use than described in the approved EIR.
6. There are many areas where the Area Type is miscoded, for example: SR 99 along Merced County switches between Urban and Rural even along the same stretch, and many roadways in Modesto are miscoded as Rural.
7. There are two layers of TAZ node numbers right on top of each other at the exact same locations that make things very confusing and misleading.
8. The gateway-connector distance for Gateway 49 should have a distance of much greater than 1 mile, since that represents Patterson Pass Rd, which is used by commuters to the Bay Area.
9. In making the model calibrate/validate, one should explore the use of K-factors to adjust the Gravity model especially for homebased work trips so there will be strong attractions between the Bay Area and the Central Valley just like in reality. By only "hard-wiring" these gateway trips, the model may appear to validate, but it will overwhelmingly send work trips from future residential developments to within the valley rather than to the Bay Area. We don't expect today's commute patterns to completely reverse going into the future, because they're driven by social/economic factors (such as wage vs housing cost) not captured by an unadjusted gravity model. K factors can and are meant to capture these effects by making adjustments to the gravity model.
10. SR-132 West Extension from Dakota to Gates' new alignment needs to be reflected in the future year.
11. Bird Rd/SR-132 interchange needs to be coded into both the existing and future year models.
12. There are huge land-use drops throughout the TCM when comparing future year land-use versus the existing year land-use by TAZ in terms of households and employments, which can't be readily explained.

13. SB I-5 from off ramp to EB 120 to on-ramp from WB SJ 120 connector is missing.
14. There shouldn't be any slip ramps from the frontage roads onto SR-99 between Arch Rd and French Camp Rd interchanges.