TECHNICAL EVALUATION OF THE GREENHOUSE GAS EMISSIONS REDUCTION QUANTIFICATION FOR STANISLAUS COUNCIL OF GOVERNMENTS' SB 375 2018 SUSTAINABLE COMMUNITIES STRATEGY

September 2020

CALIFORNIA AIR RESOURCES BOARD

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Background

The Sustainable Communities and Climate Protection Act of 2008 (SB 375) is intended to support the State's broader climate goals by encouraging integrated regional transportation and land use planning that reduces greenhouse gas (GHG) emissions from passenger vehicle use. California's metropolitan planning organizations (MPO) develop regional Sustainable Communities Strategies (SCS) containing land use, housing, and transportation strategies that, when implemented, can meet the per capita passenger vehicle GHG emissions reductions targets for 2020 and 2035 set by the California Air Resources Board (CARB or Board). Once an MPO adopts an SCS, SB 375 directs CARB to accept or reject an MPO's determination that its SCS, when implemented, would meet the targets.

On August 15, 2018, the Stanislaus Council of Governments (StanCOG), which serves as the MPO for the Stanislaus County region, adopted its 2018 SCS.[1] A complete submittal of the 2018 SCS and all necessary supporting information were provided to CARB for review on May 8, 2020. StanCOG's 2018 SCS estimates a 7.1 percent and 11.1 percent decrease in GHG per capita emissions from light-duty passenger vehicles by 2020 and 2035, respectively, compared to 2005. The region's per capita GHG emissions reduction targets are 5 percent in 2020 and 10 percent in 2035, compared to 2005 levels, as adopted by the Board in 2010.[2] This report reflects CARB's technical evaluation of StanCOG's 2018 SCS GHG quantification.

CARB Determination

ACCEPT

Based on a review of all available evidence and in consideration of CARB's July 2011 document entitled Description of Methodology for ARB Staff Review of Greenhouse Gas Reductions from Sustainable Communities Strategies Pursuant to SB 375 (2011 SCS Evaluation Methodology),[3] CARB accepts StanCOG's determination that the 2018 SCS would meet the Stanislaus regional targets of a 5 percent reduction in GHG per capita emissions from light-duty passenger vehicles by 2020 and a 10 percent reduction by 2035, compared to 2005 levels, when fully implemented.

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[1] StanCOG. 2018 Regional Transportation Plan/Sustainable Communities Strategy.

[2] CARB. Board Resolution 10-31 (Sept. 23, 2010).

[3] CARB. 2011 methodology for CARB review of SCSs.

StanCOG's 2018 SCS contains nearly the same strategies[4] and similar quantification methods and tools as StanCOG's first SCS,[5] which CARB reviewed and accepted as meeting the targets in June 2015. The 2018 SCS also included several new strategies, summarized and discussed in this evaluation. Therefore, this evaluation incorporates the analysis from CARB's review of the 2014 SCS[6] and adds analysis of changes StanCOG made to the current 2018 SCS with the potential to affect land use, transportation, and the SCS GHG emissions quantification.

CARB staff reviewed StanCOG's 2018 SCS to verify that changes in the demographic assumptions, as well as the model and off-model methods used to calculate passenger travel-related GHG emissions, reflected the latest information and planning practices.[7] CARB staff also reviewed land use and transportation strategies to confirm that the 2018 SCS strategy commitments did not backslide from StanCOG's 2014 commitments. In addition, CARB staff reviewed StanCOG's reported regional land use and transportation performance indicators to confirm that they were trending in a direction that is consistent with forecasted GHG emissions and/or vehicle miles traveled (VMT) reduction trends, as expressed in the empirical literature.

Based on these evaluations, CARB accepts StanCOG's determination that its 2018 SCS would meet the targets when implemented. CARB's analysis and assessment of changes to StanCOG's 2018 SCS and GHG quantification are documented in the "Changes from the Region's Previous SCS" section of this evaluation. Background information on the 2018 SCS changes, including demographic forecast, transportation investments, updates to the regional travel demand model, land use scenario modeling, and new strategies are documented in Appendix B: Discussion of 2018 SCS Changes.

CARB has identified issues with StanCOG's 2018 SCS submittal that StanCOG will need to address in its upcoming third-round SCS development and documentation process based on the *Final Sustainable Communities Strategy Program and Evaluation Guidelines*[8] published in November 2019. Specifically, StanCOG submitted new

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[4] See Appendix A: StanCOG 2018 SCS Strategy Table for a list of strategies included in the SCS and how they compare with the 2014 SCS.

[5] StanCOG. 2014 Regional Transportation Plan/Sustainable Communities Strategy.

[6] CARB's acceptance and technical evaluation of StanCOG's first SCS was completed in June 2015, and contains detailed information about the methods StanCOG used to quantify GHG emissions. See, CARB Technical Evaluation of StanCOG 2014 SCS.

[7] CARB examined modeling inputs and assumptions, model responsiveness to variable changes, model calibration and validation results, and performance indicators using the general method described in CARB's July 2011 methodology for reviewing SCSs.

[8] CARB. Final Sustainable Communities Strategy Program and Evaluation Guidelines. (November 2019).

strategies for credit that lacked sufficient documentation of quantification methods and local funding commitment. StanCOG's 2018 SCS submittal also shows minimal change in key performance indicators, and remains unclear about what specific actions, milestones, and enabling project investments are needed to support full implementation of its SCS policies and programs. These items are problematic given CARB's recent assessment of on-the-ground progress since regions began developing SCSs[9], which found that California was not on track to meet the GHG reductions expected under SB 375. As a result, the Stanislaus region may not realize the forecasted GHG reductions in the SCS for 2035, if the plan is not fully implemented. California needs strong commitments to implement VMT reduction strategies to meet the SB 375 GHG commitments and support the statewide effort to successfully mitigate the worst forecasted impacts of climate change. CARB's concerns and suggested remedies are documented in the "Recommendations" section of this evaluation.

Changes from the Region's Previous SCS

StanCOG's 2018 SCS includes new strategies and retains the same strategies and tools as the 2014 SCS with some modifications. The following sections summarize changes made to the underlying 2018 SCS assumptions and strategies, quantification tools and methods, resulting SCS performance indicator metrics, and CARB's assessment of the specified actions.

CARB examined StanCOG's modeling inputs and assumptions, model responsiveness to variable changes, model calibration and validation results, and performance indicators using the general method described in CARB's 2011 SCS Evaluation Methodology.

Land Use and Transportation Strategies

StanCOG's 2018 SCS maintains a set of land use and transportation strategies that are similar to those adopted in its 2014 SCS, with updates to assumptions for land use and an increase in transit and active transportation investments. The 2018 SCS also incorporates three new strategies, as well as updates to the region's growth forecast. Table 1 summarizes these changes and provides CARB's assessment based on consistency with best available information and practice.

[9] Prepared pursuant to Senate Bill (SB) 150 (Allen, Chapter 646, Statutes of 2017); CARB. 2018 Progress Report: California's Sustainable Communities and Climate Protection Act (November 2018).

Table 1. Summary of Demographic, Land Use, and Transportation Changes in StanCOG's 2018 SCS Compared to the 2014 SCS

Action	CARB Assessment	Finding
Revised Regional Growth Forecast	Reasonable	StanCOG revised population, housing units, and employment growth estimates for its 2018 SCS. Population in the year 2035 is forecasted to be approximately 7 percent lower in the 2018 SCS compared to the 2014 SCS. Housing and employment forecasts in the 2018 SCS are about 1 percent lower compared to the 2014 SCS. The change in population is due to lower birthrates and people moving out of the County post-recession, which also have an effect on housing and employment. Per the 2011 Evaluation Guidelines, CARB reviewed these revisions and found them to be consistent with the 2014 DOF forecasts, which were the latest available at the time of plan development. See Appendix B: Discussion of 2018 SCS Changes for more detail.
Updated Land Use Scenario	Reasonable	StanCOG updated the SCS land use assumptions. Per the 2011 Evaluation Guidelines, CARB reviewed StanCOG's land use update process and found that it appropriately adjusted for total growth based on the region's latest growth forecast, as well as adjusted assumptions for where growth would occur based on latest local planning assumptions in consultation with its members. See Appendix B: Discussion of 2018 SCS Changes for more detail.

Action	CARB Assessment	Finding
Updated Revenue Forecasts and Transportation Investments	Reasonable	The 2018 SCS updates both transportation revenue forecasts and investments. Per the 2011 Evaluation Guidelines, CARB reviewed overall changes to StanCOG's SCS transportation project investments and found them generally consistent with changes to forecasted resources. Compared to the 2014 SCS, total revenues and investments increase from $4.46 billion to $7.23 billion, or approximately 62 percent. The increased funding is partially attributable to the available funding provided by the Road Repair and Accountability Act of 2017 (SB 1). Additional funding is also provided by Measure L, a half-cent sales tax measure passed in November 2016 to fund transportation improvements and SB 132, which provides funding for the Altamont Commuter Express (ACE) extension to Modesto, Ceres, and Merced. As a result, transportation investments are different from the 2014 SCS with increases in transit project investment, which grew from 33 to 36 percent between plans. Investments devoted to road expansion fell from 61 to 50 percent between plans, and active transportation investments increased from 5 to 6 percent. See Appendix B: Discussion of 2018 SCS Changes for more detail.
New Strategies: ACE Rail Service Extension, Vanpool, and Active Transportation	Somewhat Reasonable	StanCOG's 2018 SCS includes three new strategies: the extension of ACE passenger rail service, regional commuter vanpool program (CalVans), and active transportation projects. While all strategies are creditable toward the SB 375 targets, and StanCOG took the appropriate step of developing separate off-model methodologies to quantify the GHG reduction benefits for these strategies, the quantification methodologies StanCOG used for these strategies need further improvement to better capture region-specific benefits. See **Error! Reference source not found.** for more detail.

Model Calculations

StanCOG used updated modeling tools to evaluate its 2018 SCS with updated 2005 base year input data that affected the quantification of model outputs of VMT and GHG emissions compared to its 2014 SCS. For the 2018 SCS, StanCOG also accounted for GHG emission reductions from four strategies outside its travel demand model. Table 2 summarizes these changes along with CARB's assessment and findings based on consistency with best available information and modeling practice.

Table 2. Key Changes in StanCOG's 2018 SCS Modeling

Modeling Component	CARB Assessment	Finding
Travel Demand Model	Reasonable	StanCOG used the VMIP 2 model for the 2018 SCS, which is an updated version of the MIP 1 model used in the 2014 SCS. Per the 2011 Evaluation Guidelines, CARB reviewed StanCOG's updated model documentation and found that updates to incorporate data from the most recent Census, American Community Survey, California Household Travel Survey, and traffic counts improved the model's ability to represent current conditions, which are then reflected in travel forecasts used for GHG emissions quantification. For the 2018 SCS, StanCOG also updated its methodology and input data for the 2005 model year to address concerns CARB identified in the 2014 SCS review (e.g., auto operating cost and interregional travel). Further, StanCOG also updated the 2005 socioeconomic dataset using historical 2005 Census, American Community Survey, and Longitudinal Employer-Household Dynamics (LEHD) data, instead of using the back-cast methodology it employed for its 2014 SCS. These changes affected the distribution of socioeconomic data to the transportation analysis zones (TAZ) used by the travel demand model, and VMT estimates, which have led to less GHG reductions compared to the 2014 SCS. The updated 2005 VMT estimates are also more closely aligned with Highway Performance Monitoring Data. See Appendix B: Discussion of 2018 SCS Changes for more detail.

Modeling Component	CARB Assessment	Finding
Adjustment to EMFAC Outputs	Reasonable	StanCOG used EMFAC 2014 (an emissions estimation model) to estimate GHG emissions. CARB reviewed StanCOG's calculations and found that they appropriately followed the procedure demonstrated in CARB's memo titled Methodology to Calculate CO2 Adjustment to EMFAC Output for SB 375 Target Demonstrations. See Appendix B: Discussion of 2018 SCS Changes for more detail.
Adjustments for GHG Reductions from Rule 9410	Somewhat Reasonable	StanCOG accounted for GHG reductions from San Joaquin Valley Air Pollution Control District Rule 9410's employer trip-reduction program in the 2018 SCS. CARB staff determined that the level of GHG reductions StanCOG attributes to this strategy is consistent with other San Joaquin Valley MPOs who have claimed benefits from this program. It is expected that this valley-wide program will result in comparable levels of commute trip reductions among MPOs in the San Joaquin Valley. However, CARB staff determined that StanCOG's methodology to quantify GHG reductions from this strategy is oversimplified and needs improvement to more accurately capture the region-specific benefits of the program. See the "Recommendations" section for additional discussion.
Adjustments for GHG Reductions from Additional Strategies	Somewhat Reasonable	StanCOG developed quantitative methodologies outside of its travel demand model to estimate GHG reductions associated with the region's CalVans vanpool program, planned ACE rail service extension, and active transportation projects. While the total GHG reductions claimed from these strategies are relatively small, the methods StanCOG used to estimate these program benefits are oversimplified. Improvements are needed to show how these methodologies forecast and apportion strategy penetration across the region, which will help StanCOG more accurately estimate the region-specific GHG emissions reduction benefits of these strategies. See the "Recommendations" section for additional discussion.

Regional Land Use and Transportation Performance Indicators

To better understand whether StanCOG's key modeled land use and transportation performance indicators are trending in a direction consistent with forecasted GHG emissions and/or VMT reduction trends, CARB re-analyzed several of these indicators against relationships expressed in the empirical literature. Depending on what regional data were available, CARB compared changes in the metrics across either 2005 and the target years of 2020 and 2035 or the RTP/SCS plan base year of 2015 and target years 2020 and 2035.

Table 3 shows a summary of StanCOG's 2018 SCS land use performance indicators and Table 4 shows a summary of StanCOG's 2018 SCS transportation performance indicators. Data for this analysis came from StanCOG's SCS data table provided in Appendix C. Supporting data and charts for performance indicators are provided in Appendix D.

Table 3. Summary of Land Use Performance Indicators

Performance Indicator	CARB Assessment	Finding
Residential Density	Consistent with reducing VMT/ GHG	StanCOG's 2018 SCS forecasts an increase of 18 percent in residential density in 2035 compared to 2015 (2.8 to 3.3 housing units per residential developed acre). Per the 2011 Evaluation Guidelines, CARB finds this trend supportive and consistent with the relationship shown in the empirical literature that increasing residential density helps to increase non-auto mode shares and reduce VMT and GHG emissions.
New Housing Mix	Consistent with reducing VMT/ GHG	StanCOG's 2018 SCS forecasts the proportion of total housing units that are multi-family units will increase to 27 percent in 2020 and 32 percent in 2035. Per the 2011 Evaluation Guidelines, CARB finds this trend supportive and consistent with the relationship shown in the empirical literature that increasing the proportion of new development that is multi-family units increases residential density and accessibility to destinations, and helps reduce VMT and GHG emissions.

Table 4. Summary of Transportation Performance Indicators

Performance Indicator	CARB Assessment	Finding
Per Capita Passenger VMT	Consistent with reducing VMT/ GHG	StanCOG's 2018 SCS forecasts a reduction of per capita VMT from 14.3 miles per day in 2005 to 12.0 miles per day in 2035. Per the 2011 Evaluation Guidelines, CARB finds this trend supportive and consistent with the relationship shown in the empirical literature that per capita GHG emissions follow the same trend directionally as per capita VMT.

Recommendations

In reviewing StanCOG's 2018 SCS submittal, CARB staff identified what new information StanCOG will need to provide to CARB for its upcoming third-round SCS development and documentation process based on the *Final Communities Strategy Program and Evaluation Guidelines* published in November 2019.[10] The following sections provide information on what additional information will be needed in the MPO's third-round SCS evaluation submittal beyond what was shared with CARB in StanCOG's second-round SCS. For a complete understanding of what is needed for the third-round SCS evaluation submittal, please refer to the Guidelines document.

Trend Analysis

CARB staff currently uses land use and transportation system performance indicator trends to assess whether an SCS supports GHG emissions over time. This assessment will continue to be a part of CARB's third-round SCS evaluations. While StanCOG's submittal included some performance indicators that were directionally supportive of certain strategies and estimated GHG reductions, data provided to evaluate the performance of key strategies in the SCS were limited.

Given that StanCOG's third SCS must address new, more aggressive reduction targets, CARB staff will need StanCOG to quantify and report changes from its next SCS base year to the SCS target years for the eight performance metrics identified

[10] CARB. Final Sustainable Communities Strategy Program and Evaluation Guidelines (November 2019).

below. CARB will use these for the Trend Analysis determination in the third round, which includes checking whether the reported directionality for the following RTP/SCS performance indicators are trending as expected.[11] The metrics not provided by StanCOG for this evaluation are noted and italicized below.

1) Household vehicle ownership: The average number of light-duty vehicles registered (i.e., LDA, LDT1, LDT2, and MDV vehicle categories) per household. (StanCOG did not provide this metric.)
2) Mode split: The percentage of average daily trips by travel mode, including single-occupant vehicle, high-occupancy vehicle or carpool, transit, ride hailing or TNC, bike and walk.
3) Travel time by mode: The regional average travel time (minutes) by trip purpose (e.g., for commute and non-commute trips), by travel mode.
4) Transit ridership: The total number of one-way linked or unlinked average daily transit passenger trip boardings on public transportation per day. (StanCOG did not provide this metric.)
5) Average vehicle trip length: The regional average daily trip distance (miles/day) of driving.
6) Seat utilization: The average daily percentage of occupied vehicle seats on the roadway network, including for passenger vehicles and transit buses. (StanCOG did not provide this metric.)
7) Household VMT: The average daily light-duty vehicle VMT from each household within the MPO, excluding group quarters and visitors. (StanCOG did not provide this metric.)
8) GHG per capita: The average daily CO2 emissions within the MPO from light-duty vehicles per person.

Policy and Investment Analyses

For all third-round SCSs, CARB is shifting its evaluation focus to assess whether SCS strategies for GHG emissions reduction are likely to be implemented, and are therefore reasonable for inclusion and credit toward target achievement. To assess this, CARB staff needs MPOs to provide clear descriptions of each SCS strategy with regard to applicable geographic scope, with specific locations if known; implementation timeframes; and what key supporting actions the MPO and its member agencies will undertake to support and track strategy implementation.[12]

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[11] For expected directionality of performance indicators for the Trend Analysis, see CARB Final Sustainable Communities Strategy Program and Evaluation Guidelines, Table 4 at page 39.

[12] For more information on the Policy Analysis, see CARB Final Sustainable Communities Strategy Program and Evaluation Guidelines, at pages 40-42.

Key supporting actions should correspond to each individual strategy, and in general, actions should be measurable, and should include identification of the region's specific investment commitments; policy and/or financial incentives; technical assistance; and if legislative action is needed, partnership activities to advance needed statutory changes. Each action should be clear about its scope, who will be involved, and anticipated timeline. For example, one of StanCOG's key strategies is to promote future residential growth within existing urban areas, with higher-density, mixed-use development focused at city cores and along major transportation corridors to help reduce emissions from automobiles and light-duty trucks. For the third-round SCS, StanCOG will need to identify what key supporting actions it is committing to in order to help implement this strategy. This could include identifying specific funding or other incentive programs the region will have to reward local jurisdictions that are investing in the SCS preferred growth areas, including any actions StanCOG plans to take to improve local connectivity to the ACE extension project.

For the third-round SCS, CARB staff will also be evaluating how transportation investments are dispersed throughout the region and whether these investments support or put at risk the GHG reduction benefits of the SCS. To assess this, CARB staff needs StanCOG to provide the complete list of transportation projects identified in the second- and third-round SCSs. Projects need to be tabulated by project type (road expansion, road maintenance, active transportation, transit, or other), cost, funding source (if known), project time period (e.g., base year through 2020, 2020 through 2035, or beyond 2035), and location including jurisdiction, intersections, and roadway segments (if available).

Tracking Implementation and Plan Adjustment

In the third-round SCS evaluation, CARB staff will look at how an MPO's previous SCS strategies and actions are performing, in compliance with SB 150, and what MPOs are doing in the third-round SCS, if the previous plans are not performing as expected, as directed by the Board.[13, 14] CARB's *2018 Progress* Report*: California's Sustainable Communities and Climate Protection Act*, provides some information in this area based on the latest observed statewide data and trends. For the next SCS, CARB staff needs MPOs to compare available observed data to the development pattern and travel assumptions used in their previous SCS to achieve its targets. If the observed data do not align with the plan assumptions, an MPO should document what priority adjustments and changes it is making in the third-round SCS to get the region on track to achieve its SB 375 targets.

[13] See, CARB Final Sustainable Communities Strategy Program and Evaluation Guidelines, at pages 37-38 and 43-44.

[14] Gov. Code § 65080 (b)(2)(J)(iv); CARB Board Resolution 18-12 (Mar. 22, 2018).

CARB staff needs StanCOG to clearly document how they are using data to track implementation progress of their SCS, as well as justify any adjustments they make to the underlying baseline assumptions. In particular, CARB encourages StanCOG to gather more detailed land use, transit, and active transportation data to help better assess the effectiveness of the land use and transit service expansion strategies in the SCS. These data could also inform StanCOG's process to quantify GHG reduction estimates outside the travel demand model (e.g., ACE ridership).

Analyze Induced Travel (Short-term and Long-term) Effects

Induced travel is the increase in VMT due to roadway capacity expansion. Roadway expansion projects can lead to increases in travel due to changes in the number of trips and trip distances (destination changes); shifts in travel modes, the time-of-day travel occurs, and routes; as well as changes in residence and workplace locations. Induced travel is important to analyze as it can affect VMT and GHG emissions.

CARB staff recommends StanCOG explore methods for better analyzing the short- and long-term induced travel from roadway expansion projects in future SCS cycles. StanCOG included roadway expansion projects in the 2018 SCS that can lead to short- and long-term induced travel in the region. Currently, long-term induced travel is not well accounted for by StanCOG's travel demand model and may underestimate per capita GHG emissions. CARB staff has identified available tools to help StanCOG evaluate the effects of induced travel.[15] Examples include, but are not limited to, University of California, Davis National Center for Sustainable Transportation's Induced Travel Calculator[16] and Impact of Highway Capacity and Induced Travel on Passenger Vehicle Use and Greenhouse Gas Emissions.[17]

Improve Strategy Calculation Methods

StanCOG discussed a number of strategies with VMT and GHG reduction impacts in the 2018 SCS that could not be captured by its model. These included the SJVAPCD Rule 9410 employer trip reduction program, CalVans vanpool service, ACE passenger rail service extension, active transportation projects, increasing investment in bicycle and pedestrian projects, reducing investment in roadway capacity projects, and increasing electric vehicle infrastructure. CARB received varying levels of documentation for these strategies as part of the 2018 SCS submittal.

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[15] For more information on the Transportation Policy Analysis where induced travel is discussed, see CARB Final Sustainable Communities Strategy Program and Evaluation Guidelines, at pages 40-41.

[16] See, University of California at Davis. NCST Tool.

[17] CARB. Highway Capacity Brief.

For the third-round SCS evaluation, the following additional documentation is needed, for each strategy that is quantified off-model, before GHG emissions reduction credit can be received:[18]

- A more comprehensive description of all off-model strategies, including the scope of the strategies, the target users, the timeline of implementation, and current status of the strategies;
- Detailed quantification methods and assumptions for each strategy that document the step-by-step analysis of the strategy benefits;
- Identification of funding commitments or local policies that support implementation of each strategy; and
- The efforts to collect local data and monitor implementation.

Conduct Modeling Sensitivity Analysis

CARB understands that MPOs periodically update travel models with newer input data and methods to keep the model compatible and consistent with socioeconomic trends and changes to the transportation network. If StanCOG makes significant changes to its travel model that can affect its sensitivity to RTP/SCS strategies, CARB staff recommends StanCOG conduct a sensitivity analysis of the model. The analysis is important for validating and calibrating the model so that outputs can be compared against observed data. The analysis also helps to explain how the modeling outputs used to estimate GHG per capita and total VMT may change in response to land use and transportation strategies.

[18] For more information on quantifying GHG emissions off model, see CARB Final Sustainable Communities Strategy Program and Evaluation Guidelines, Appendix E.

Appendix A: StanCOG's 2018 SCS Strategy Table

This appendix shows a table provided by StanCOG to CARB as part of its SCS submittal that summarizes strategies included in its 2018 SCS, the quantification method used, whether the strategy existed in its previous 2014 SCS or is new, along with descriptive comments.

Table 5. StanCOG's 2018 Strategy Table[19]

SCS Strategy	On/Off Model	Carryover from Last SCS or New	Comments
Higher density residential and employment uses, in addition to mixed-use designations, at a city's core and along major transportation corridors	On Model	Carryover w/ updates	Compared to the 2014 plan, the 2018 SCS forecasts more growth in key corridors due to updates in local general and specific plans, as well as updated jurisdiction-specific demographic growth forecasts.
More compact, mixed-use and infill development as compared to General Plan/Business as Usual Scenario	On Model	Carryover w/ updates	As compared to General Plan Trend/ Business as Usual Scenario (Scenario 1), which used the local jurisdiction's general plans as a baseline.

[19] StanCOG provided CARB with a Policy Matrix (April 9, 2020) showing the strategies: increasing spending on bicycle/pedestrian improvements, decreasing spending on roadway capacity as accounted for "On Model". In follow up correspondence between CARB and StanCOG staff, StanCOG stated that its transportation demand model did not directly account for GHG emission reductions attributed to these strategies. Thus, these two strategies are indicated here as "Not Analyzed".

SCS Strategy	On/Off Model	Carryover from Last SCS or New	Comments
Greater investment in multi-family versus single-family residential development, especially in downtown areas	On Model	Carryover w/ updates	The increased focus on multi-family housing in the 2018 RTP/SCS preferred scenario (Scenario 2), as well as a relative emphasis on smaller-lot, single-family homes over large-lot, single-family homes, means that the residential densities associated with new development are generally greater than those listed in the local agency general plans. Under the preferred scenario (Scenario 2), residential densities average 15.9 dwelling units per acre, an increase as compared to 12 dwelling units per acre under Scenario 1.
Increases spending on bicycle/pedestrian improvements as compared to General Plan Trend/Business as Usual Scenario	Not Analyzed	Carryover w/ updates	Consistent with having more infill development for housing and jobs in downtown areas and along major transportation corridors, Scenario 2 increases spending on bicycle/pedestrian improvements over Scenario 1, the General Plan Trend/Business as Usual Scenario.

SCS Strategy	On/Off Model	Carryover from Last SCS or New	Comments
Reduces the amount of relative spending on new roadway capacity as compared to General Plan Trend/Business as Usual Scenario	Not Analyzed	Carryover w/ updates	As compared to General Plan Trend/Business as Usual Scenario (Scenario 1), which used the local jurisdiction's general plans as a baseline.
Electric Infrastructure Implementation Study for promotion and continued market penetration of electric vehicles	Not Analyzed	New	The 2018 RTP/SCS adds a new Electric Infrastructure Implementation Study to the 2018 RTP/SCS list of projects. This study will be conducted to identify opportunities for implementation of electrification infrastructure for the promotion and continued market penetration of electric vehicles county-wide.

SCS Strategy	On/Off Model	Carryover from Last SCS or New	Comments
Extension of ACE Forward - Altamont Commuter Express (ACE) rail service to Modesto, Ceres, and Turlock	Off Model	New	StanCOG's analysis is based on the San Joaquin Regional Rail Commission's (SJRRC's) phased improvement plan (ACE Forward), which identified the planned service expansion, station enhancements and track improvements for extending ACE service to the cities of Manteca, Modesto, Ceres, Turlock and Merced to support the analysis.
Active Transportation Project Off-Model VMT Benefits	Off Model	Carryover w/ updates	StanCOG's analysis is based on the National Cooperative Highway Research Program (NCHRP) 552 Methodology - Guidelines for Analysis of Investment in Bicycle Facilities.

SCS Strategy	On/Off Model	Carryover from Last SCS or New	Comments
CalVans - Initiation of new vanpool service in Stanislaus County	Off Model	New	StanCOG joined as a member of the California Vanpool Authority (CalVans) to provide Stanislaus County residents and businesses with the use of a Farmworker Vanpool Program and a General Public Vanpool program. The Off-Model analysis is based on estimates provided by Ron Hughes, the CalVans Executive Director at the time of the RTP/SCS Update.
SJVAPCD Rule 9410 - Voluntary Employer-based Travel Demand Management Program	Off Model	Carryover, no updates	The 2014 RTP/SCS 2040 VMT reduction results were prorated to reflect 2020 and 2035 analysis years for the 2018 RTP/SCS.

Appendix B: Discussion of 2018 SCS Changes

This appendix describes changes in the 2018 SCS compared to the 2014 SCS in more technical detail, including the demographic forecast, transportation investments, updates to the regional travel demand model, and new strategies.

Revised Regional Growth Forecast

StanCOG updated the population, employment growth, household, and housing forecasts for the 2018 SCS (see, 2018 SCS Appendix J). The University of Pacific (UOP) Center for Business & Policy Research developed and completed forecasts for the Stanislaus region in 2016.[20] StanCOG's updated forecast anticipates less growth than what StanCOG forecasted in the 2014 SCS, and tracks closely with DOF population forecasts for the Stanislaus region in 2014, which was the latest available at the time of preparation. The 2018 SCS includes the same planning assumptions with regard to housing needs as the 2014 SCS because the Regional Housing Needs Assessment (RHNA) is conducted every eight years while the SCS cycle is every four years. The 2022 SCS will include updated housing assumptions since it will incorporate a new RHNA and growth forecast.

Table 6 below compares population, household, housing units, and employment estimates used in the 2014 and 2018 SCSs. The forecast for 2020 and 2035 anticipates less growth in population, housing, and employment than in the previous SCS. Compared to the 2014 SCS, between 2005 and 2035, StanCOG expects 7 percent less population growth and 2 percent fewer housing units built, while also expecting 0.2 percent less employment growth.

Table 6. Comparison of Population, Household, Housing, and Employment Estimates between StanCOG's 2014 SCS and 2018 SCS

Data Field	Year	2014 SCS	2018 SCS	Difference
Population	2020	594,000	571,139	- 4%
Population	2035	722,000	674,019	- 7%
Households	2020	188,467	187,171	-0.7%
Households	2035	223,541	221,186	-1%

[20] StanCOG. 2018 Regional Transportation Plan/Sustainable Communities Strategy, Appendix J Regional Demographic Forecast.

Data Field	Year	2014 SCS	2018 SCS	Difference
Housing Units	2020	194,388	196,529	1%
Housing Units	2035	237,185	232,246	-2%
Employment	2020	184,250	192,931	5%
Employment	2035	222,874	222,414	-0.2%

Updated Land Use Scenario

The process to identify the land use scenario adopted in the 2018 SCS builds on the last SCS. StanCOG developed four different combinations of land use patterns and transportation investments with input from its local member jurisdictions and stakeholders. StanCOG then analyzed each scenario to show how different sets of investments and land uses create different future outcomes. StanCOG selected Scenario 2 (Infill and Redevelopment) as the preferred scenario for the 2018 RTP/SCS.

The preferred scenario builds off the 2014 SCS scenario regarding where to locate new housing, new job centers, and new mixed-use areas relative to existing communities (e.g., infill vs. converted farmland or open space). StanCOG also considered the density of new development, which dictates the relative proportion of large-lot, single-family housing to small-lot, single-family housing and multi-family housing, and complementary uses, such as locating new housing near services and employment centers.

The preferred scenario prioritized more development in infill areas and used higher density development types, and as a result forecasted a development footprint that was smaller and more compact relative to the other three scenarios.

Revenue Forecasts and Transportation Investments

For the 2018 SCS, StanCOG updated its transportation revenue forecasts and investments. Total revenues are forecasted at $7.2 billion, an increase by nearly 63 percent from the 2014 SCS (approximately $4.5 billion). The change in investments by mode between the 2014 and 2018 plans by total amount are shown in Figure 1, while the change in percent of total expenditures between plans is shown in Figure 2.

The pattern of transportation investments and spending also changed with overall increases in transit and active transportation projects. StanCOG dedicates $900,000 to fund various studies, including a transportation technology strategy and electric vehicle implementation study for the Stanislaus region. The 2018 SCS also dedicates approximately $2.6 billion to transit, the largest increase in investment from the 2014 SCS (33 to 36 percent). Investments in roadways and highways ($2.5 billion in capacity and $1 billion in maintenance projects) totaled approximately $3.6 billion, decreasing from 61 to 50 percent of the overall 2018 RTP/SCS expenditures. Investments in active transportation projects totaled $487 million, and were proportionally similar between the 2014 to 2018 SCS (5 to 6 percent), however, the overall dollar allocation in bicycle and pedestrian project expenditures increased by $263 million. Furthermore, many roadway projects included complete street components with improvements to pedestrian facilities, extending bike paths, and new transit facilities.

Figure 1. StanCOG's Planned SCS Transportation Expenditures Between the 2014 SCS and 2018 SCS (Total Amount)

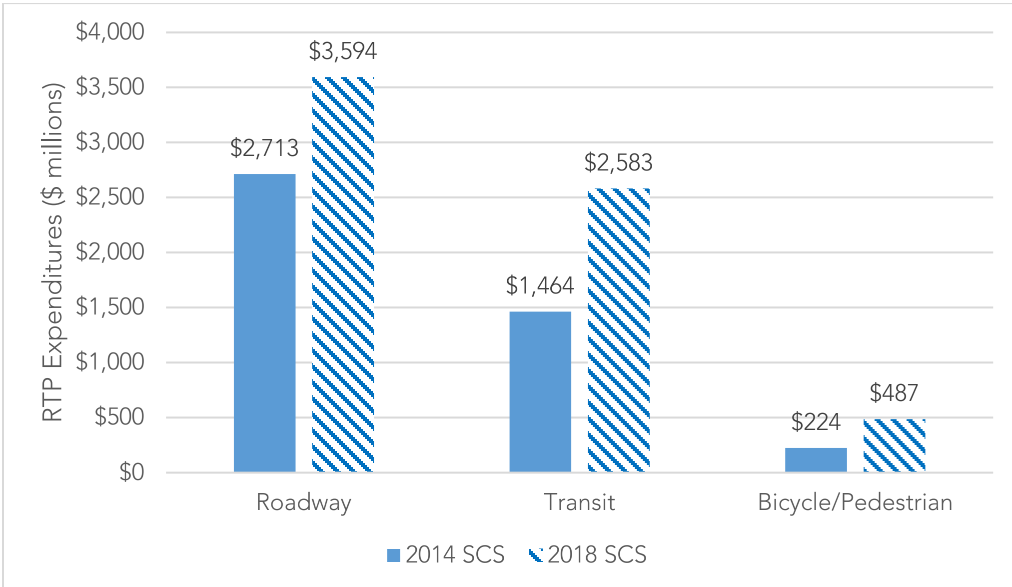
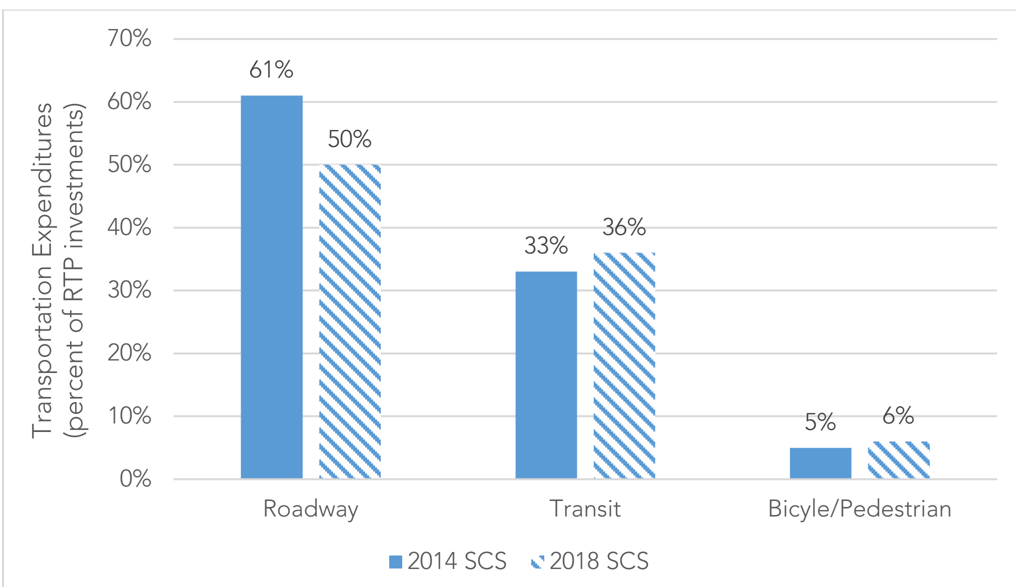


Figure 2. StanCOG's Planned SCS Transportation Expenditures Between the 2014 SCS and 2018 SCS (Percent of Expenditures)



New Strategies: ACE Forward, Active Transportation, and CalVans Vanpool

In the submittal, StanCOG claimed that the plan has included quantification of three new off-model strategies, namely enhanced ACE Forward, Active Transportation, and CalVans Vanpool. Although StanCOG has provided the information regarding these three strategies in Appendix W of the 2018 SCS, CARB staff found that the quantification methods, strategy assumptions and other supporting information for all these strategies were not adequate. While the total GHG reductions claimed from these three strategies are relatively small in amount, the current methods are oversimplified in a way that CARB cannot determine the accuracy of reported GHG emission reduction estimates from these strategies. For example, in the ACE Forward strategy, StanCOG did not provide sufficient information to support their mode shift assumptions.

Land Use Model

StanCOG used *Envision Tomorrow* for its scenario planning and land use allocation. *Envision Tomorrow* is a regional planning tool that forecasts future land use changes using a bottom-up approach. The land use planning process in *Envision Tomorrow* starts with allocating and forecasting the building types (e.g., office building, single-family house, commercial building) and development types (e.g., residential, mixed-use, industrial) in individual communities based on regional and local policies. Next, region-wide land use scenarios are then developed based on the combination of different community-level development types. Based on the regional growth forecast and local land use policies, StanCOG developed different land use scenarios for evaluation and comparison. The land use information corresponding to StanCOG's preferred scenario served as an input in to StanCOG's travel demand model.

Travel Demand Model

The primary travel demand model that StanCOG utilized is a trip-based model, VMIP2, which was updated based on the VMIP1 model developed by the San Joaquin Valley Model Improvement Program (MIP) beginning in 2010.

The main structure of the VMIP2 is the same as VMIP1 used from StanCOG's previous 2014 SCS. The VMIP2 incorporates the most recent Census, American Community Survey, and California Household Travel Survey data, so that the modeling results are more precise. The VMIP2 also enhances interregional travel, land use, auto ownership, trip generation rates, trip distribution, and mode choice, compared to VMIP 1 with updates in data sources. For example, interregional travel is updated based on the newly released California Statewide Transportation Demand Model and based on place and purpose. Mode choice is updated based on demographic data from the latest California Household Travel Survey and incorporates average vehicle occupancy. Auto ownership is updated based on the land use accessibility to different transportation modes (e.g., auto, bike, and transit) and household income. Considering the modeling structure of VMIP2 is still largely the same as VMIP1 used for StanCOG's 2014 SCS, and StanCOG's 2018 SCS did not include additional strategies quantified through the travel demand model, CARB staff finds it acceptable that StanCOG did not conduct any additional sensitivity analysis for this round.

In the 2018 SCS, StanCOG also revised its 2005 SB 375 base year data. StanCOG applied a new approach, which constructs a 2005 profile based on available 2005 Census, American Community Survey, and Longitudinal Employer-Household Dynamics (LEHD) datasets. This differs from the previous approach in the 2014 SCS, in which the 2005 profile was a "back-cast" of the 2008 model base year. While this change in methodology does not significantly change overall county totals for number of households and employment, it does affect the distribution of socioeconomic data to the TAZ), and thus VMT calculations in the travel demand model. The 2005 base year adjustment has led StanCOG to estimate a lower baseline VMT and GHG emissions in 2005. According to the 2018 SCS, StanCOG's 2005 base year per capita daily GHG is 14.0 lbs., which is 11 percent lower than the base year per capita GHG reported in the 2014 SCS. Therefore, the new SCS with the adjusted base year data reports less GHG reductions in the region between 2005 and the SB 375 target years.

Adjustment to EMFAC Outputs

The EMFAC adjustment factor for StanCOG is -2.5 percent in 2020 and -3.2 percent in 2035. StanCOG used different versions of CARB's EMFAC model to quantify the GHG emissions for its 2014 and 2018 SCSs. To allow an "apples to apples" comparison of the first- and second- round SCSs, CARB developed a methodology to adjust the calculation of percent reduction in per capita CO_2 emissions when using different versions of EMFAC. This adjustment factor neutralizes the changes in fleet-average emission rates between the version of EMFAC used for the 2014 SCS (EMFAC 2011) and the version used for the 2018 SCS (EMFAC 2014). The goal of the methodology is to hold each MPO to the same level of stringency in achieving its targets, regardless of the version of EMFAC used for its second-round SCS. StanCOG followed the methodology and its CO_2 per capita reduction results were adjusted accordingly.

Appendix C: Data Table

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Total population	503,191	540,794	571,139	571,139	674,019	674,019	720,568	720,568	University of the Pacific (b)
Group quarters population	NA (a)	6,516	6,921	6,921	8,168	8,168	8,732	8,732	DOF.ca.gov/ Forecasting /Demographics /Estimates/E-5/
Total employment (employees)	172,800	180,056	192,931	192,931	222,414	222,414	235,307	235,307	University of the Pacific (b)
Average unemployment rate (%)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Total number of households	160,808	175,251	187,171	187,171	221,186	221,186	235,471	235,471	University of the Pacific (b)
Persons per household	3.08	3.05	3.01	3.01	3.01	3.01	3.02	3.02	Calculation

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Auto ownership per household	2.86	2.87	2.95	2.95	3.03	3.03	3.09	3.09	Stanislaus County Economic Forecast (PDF), DOF, 2016
Mean household income	NA (a)	$52,363	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	https://datausa.io/profile/geo/stanislaus-county-ca/
Total acres within MPO	957,450	957,450	957,450	957,450	957,450	957,450	957,450	957,450	https://www2.census.gov/geo/docs/maps-data/data/gazetteer/2018_Gazetteer/2018_gaz_counties_06.txt
Total resource area acres (CA GC Section 65080.01)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	California Department of Conservation Table A-41, Stanislaus County

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Total farmland acres (CA GC Section 65080.01)	NA (a)	425,378	424,267	423,804	420,934	419,082	419,378	416,878	California Department of Conservation Table A-41, Stanislaus County & RTP App. L
Total developed acres	NA (a)	66,230	67,341	67,804	70,674	72,526	72,230	74,730	California Department of Conservation Table A-41, Stanislaus County & RTP App. L
Total commercial developed acres	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Total residential developed acres	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Total housing units	167,050	184,013	196,529	196,529	232,246	232,246	247,245	247,245	University of the Pacific(b)

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Housing vacancy rate (%)	3.74%	4.76%	4.76%	4.76%	4.76%	4.76%	4.76%	4.76%	University of the Pacific(b)
Total single-family detached housing units	131,254	136,810	144,116	146,229	156,787	167,459	161,683	172,960	VMIP2
Total small-lot single-family detached housing units (5,500 sq. ft. lots and smaller)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Total conventional-lot single-family detached units (between 5,500 and 10,900 sq. ft. lots)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Total large-lot single-family detached units (10,900 sq ft. lots and larger)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Total single-family attached housing units	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Total multi-family housing units	26,696	34,839	42,775	40,662	64,137	53,445	73,679	62,408	VMIP2
Total mobile home units & other	9,100	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Total infill housing units	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Total mixed-use buildings	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Total housing units within 1/4 mile of transit stations and stops	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Total housing units within 1/2 mile of transit stations and stops	NA (a)	NA (a)	NA (a)	NA (a)	109,009	94,487	128,961	125,823	2018 RTP/ SCS EJ Analysis
Total employment within 1/4 mile of transit stations and stops	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Total employment within 1/2 mile of transit stations and stops	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Freeway general purpose lanes – mixed flow lane miles	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Highway (lane miles)	25	39	28	44	28	44	28	44	VMIP2
Expressway (lane miles)	2,970	2,984	3,086	3,076	3,138	3,114	3,138	3,114	VMIP2
Arterial (lane miles)	409	435	512	538	615	617	615	617	VMIP2
Collector (lane miles)	973	981	983	998	991	1,004	991	1,004	VMIP2
Local (lane miles)	14	15	14	15	14	15	14	15	VMIP2
Freeway/Free way (lane miles)	270	270	260	270	293	303	293	303	VMIP2

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Local, express bus, and neighborhood shuttle operation miles	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Bus rapid transit bus directional route miles	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Passenger rail operation miles	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Transit total daily vehicle service hours	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Bicycle and pedestrian trail/lane miles	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Vanpool (total riders per weekday)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Number of trips - Home-Work	317,440	345,889	372,433	374,654	429,070	435,978	457,362	460,386	VMIP2
Number of trips - Home-Shop	641,345	705,644	760,009	765,077	884,223	899,061	938,183	946,986	VMIP2
Number of trips - Home-Other	782,767	824,914	864,672	863,995	952,447	951,864	993,028	985,441	VMIP2
Number of trips - Non-home-base Work	310,313	327,285	333,850	336,047	357,168	363,516	367,253	369,575	VMIP2
Number of trips - Non-home base other	580,825	630,849	656,514	659,560	719,932	728,233	754,498	750,437	VMIP2
Average weekday trip length (miles) - Home-Work	17.3	17.1	16.4	16.1	15.1	15.8	15.1	15.5	VMIP2

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Average weekday trip length (miles) - Home-Shop	7.5	7.2	7.0	7.1	7.2	7.0	7.1	6.8	VMIP2
Average weekday trip length (miles) - Home-Other	19.3	18.8	18.2	18.6	18.4	18.5	18.2	18.2	VMIP2
Average weekday trip length (miles) - Non-home-base work	6.7	6.6	6.4	6.5	6.5	6.4	6.4	6.3	VMIP2
Average weekday trip length (miles) - Non-home base other	8.5	8.6	8.1	8.6	8.4	8.2	8.2	8.0	VMIP2
Vehicle Mode Share (Peak Period) - Single Occupant Vehicle	35.8%	35.5%	35.5%	35.6%	35.3%	35.6%	35.2%	35.5%	VMIP2

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Vehicle Mode Share (Peak Period) - High Occupant Vehicle	56.6%	56.7%	56.6%	56.6%	56.9%	56.6%	57.0%	56.6%	VMIP2
Vehicle Mode Share (Peak Period) - Transit	1.5%	1.5%	1.4%	1.4%	1.3%	1.3%	1.3%	1.3%	VMIP2
Vehicle Mode Share (Peak Period) - Non-motorized	6.1%	6.3%	6.5%	6.4%	6.5%	6.5%	6.6%	6.6%	VMIP2
Vehicle Mode Share (Whole Day) - Single Occupant Vehicle	35.2%	35.0%	35.0%	35.0%	34.7%	35.1%	34.6%	34.9%	VMIP2
Vehicle Mode Share (Whole Day) - High Occupant Vehicle	55.7%	55.8%	55.8%	55.7%	56.0%	55.7%	56.1%	55.7%	VMIP2

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Vehicle Mode Share (Whole Day) - Transit	1.9%	1.8%	1.6%	1.8%	1.7%	1.6%	1.6%	1.6%	VMIP2
Vehicle Mode Share (Whole Day) - Non-motorized	7.1%	7.4%	7.7%	7.5%	7.6%	7.6%	7.7%	7.8%	VMIP2
Average weekday trip length (miles) - Single Occupant Vehicle	15.4	14.8	14.5	14.4	13.9	14	13.8	13.8	VMIP2
Average weekday trip length (miles) - High Occupant Vehicle	24.7	24.4	23.2	24	23.8	23.5	23.5	23.2	VMIP2
Average weekday trip length (miles) - Transit	8.7	8.7	8.6	8.7	8.8	8.9	8.9	9.1	VMIP2

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Average weekday trip length (miles) - Walk/Bike (c)	2.6	2.6	2.6	2.6	2.7	2.7	2.8	2.8	VMIP2
Total VMT per weekday for passenger vehicles (ARB vehicle classes of LDA, LDT1, LDT2 and MDV) (miles), (f)	8,568,834	NA (a)	9,503,955	9,965,167	11,153,978	11,654,263	12,185,619	12,204,190	VMIP2/ EMFAC2014; includes off model adjustments for 2020 and 2035
Total II (Internal) VMT per weekday for passenger vehicles (miles) (f)	5,436,242	NA (a)	5,966,886	6,138,988	7,100,496	7,151,916	7,454,304	7,360,801	VMIP2/ EMFAC2014; includes off model adjustments for 2020 and 2035
Total IX/XI VMT per weekday for passenger vehicles (miles) (f)	2,149,606	NA (a)	2,196,274	2,321,020	2,250,172	2,460,911	2,546,568	2,568,180	VMIP2/ EMFAC2014; includes off model adjustments for 2020 and 2035

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Total XX VMT per weekday for passenger vehicles (miles) (f)	982,987	NA (a)	1,340,795	1,505,159	1,803,310	2,041,436	2,184,746	2,275,208	VMIP2/ EMFAC2014; includes off model adjustments for 2020 and 2035
Vehicle Hours of Delay	34	NA (a)	58	60	69	87	84	105	VHD
Congested Daily VMT (f)	858,274	NA (a)	1,558,801	1,625,669	1,991,574	2,369,874	2,398,776	2,999,410	VMIP2
Uncongested Daily VMT (f)	8,755,026	NA (a)	9,946,437	9,915,891	11,400,781	10,765,344	11,781,965	10,742,879	VMIP2
Total CO2 emissions per weekday for passenger vehicles (ARB vehicle classes LDA, LDT1, LDT2, and MDV) (tons) (f)	3,987	NA (a)	4,251	4,501	4,831	5,054	5,291	5,309	EMFAC2014

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Total II (Internal) CO2 emissions per weekday for passenger vehicles (tons) (f)	2,530	NA (a)	2,669	2,773	3,075	3,102	3,237	3,202	EMFAC2014
Total IX / XI trip CO2 emissions per weekday for passenger vehicles (tons) (f)	1,000	NA (a)	982	1,048	975	1,067	1,106	1,117	EMFAC2014
Total XX trip CO2 emissions per weekday for passenger vehicles (tons) (f)	457	NA (a)	600	680	781	885	949	990	EMFAC2014

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
% change in per capita GHG due to EMFAC2011 to EMFAC2014 adjustment (%) (f)	NA (a)	NA (a)	-2.5	-2.5	-3.2	-3.2	-3.1	-3.1	CARB SCS Adjustment Methodology/ EMFAC2011/ EMFAC2014
Total RTP Expenditure (Year XXXX $ billions)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	7.227	4.456	2018 RTP/SCS Project List, Appendix K
Highway Capacity expansion ($ billions)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Other road capacity expansion ($ billions)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Roadway maintenance ($ billions)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	1.028	0.622	NA (a)

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Roadways (Highway Capacity/ Other Road Capacity) ($ billions) (d)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	2.566	1.697	2018 RTP/SCS Project List, Appendix K
BRT projects ($ billions)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Transit Capacity Expansion ($ billions)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Transit operations ($ billions)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Transit ($ billions) (e)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	2.583	1.465	2018 RTP/SCS Project List, Appendix K
Bike and pedestrian projects ($ billions)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	0.487	0.357	2018 RTP/SCS Project List, Appendix K

Modeling Parameters	2005	2015 (base year)	2020 With Project	2020 Without Project	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources
Vehicle operating costs (Year 2016 $ per mile)	$0.196	NA (a)	$0.245	$0.245	$0.226	$0.226	$0.237	$0.237	VMIP2
Gasoline price (Year 2016 $ per gallon)	$2.84	NA (a)	$4.10	$4.10	$4.87	$4.87	$5.26	$5.26	VMIP2
Average transit fare (Year XXXX $)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)
Parking cost (Year XXXX $)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)	NA (a)

(a) NA: Information not available - Either the dataset does not exist or is not easily developed. In either case, it is not a direct input into the methodologies, which resulted in the air quality forecast.

(b) "Stanislaus County Forecast Summary", University of the Pacific Eberhardt School of Business Center for Business and Policy Research, July 7, 2016.

(c) Bike and pedestrian data were not available as distinct categories. Total bike/pedestrian data are provided.

(d) Funding categories were provided as a total for highway capacity and other roadway capacity.

(e) Funding categories were provided as a total of transit capacity expansion and transit operations. Total expenditure includes other categories such as Operations, Safety, Studies, and Aviation projects for which there is no category on this table.

(f) The off-model adjustments are captured only in the Travel Measures (e.g., VMT) and CO_2 emissions sections of the data table; all other data provided in the Data Table do not reflect off-model adjustments.

Appendix D: Performance Indicators

This appendix describes in more detail changes in key non-GHG indicators that describe SCS performance. These indicators are examined to determine if they can provide qualitative and quantitative evidence that the SCS, when implemented, could meet its GHG targets. The evaluation looked at directional consistency of the performance indicators with StanCOG's modeled GHG emissions reductions, as well as the general relationships between those indicators and GHG emissions reductions, based on the empirical literature. The 2018 SCS performance indicators evaluated include residential density, housing mix, and per capita VMT.

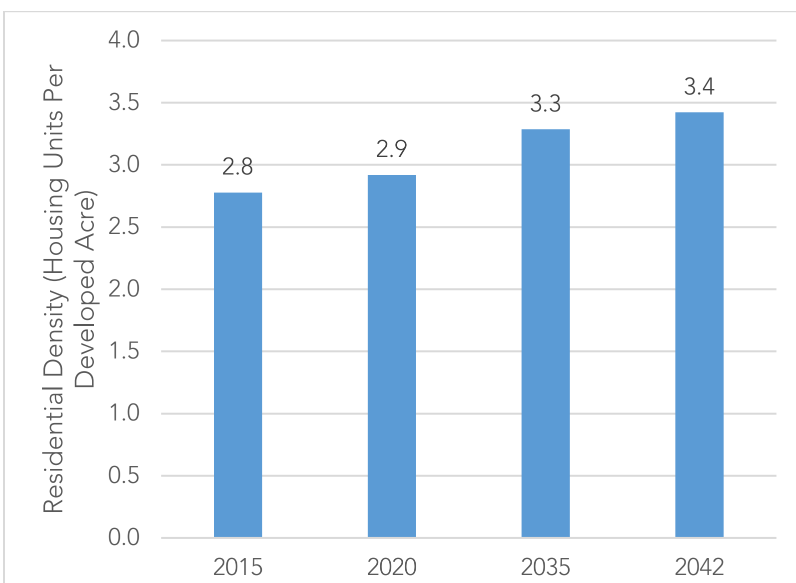
Land Use Indicators

Land use influences the travel behavior of residents including both mode choice and trip length. The evaluation focused on two land use-related performance indicators to determine whether they support StanCOG's land use strategies and forecasted GHG emissions forecast: residential density and mix of housing types.

Residential Density

Figure 3 shows that the residential density in Stanislaus County will increase from 2.8 units per acre in 2015 to 3.3 in 2035 and continue to increase to 3.4 units per acre in 2042. The residential density is calculated by dividing total housing units by the total residential developed acres in the region. Residential density can help reduce auto trip length and household VMT, which are supportive and consistent with StanCOG's GHG emissions reduction quantification.

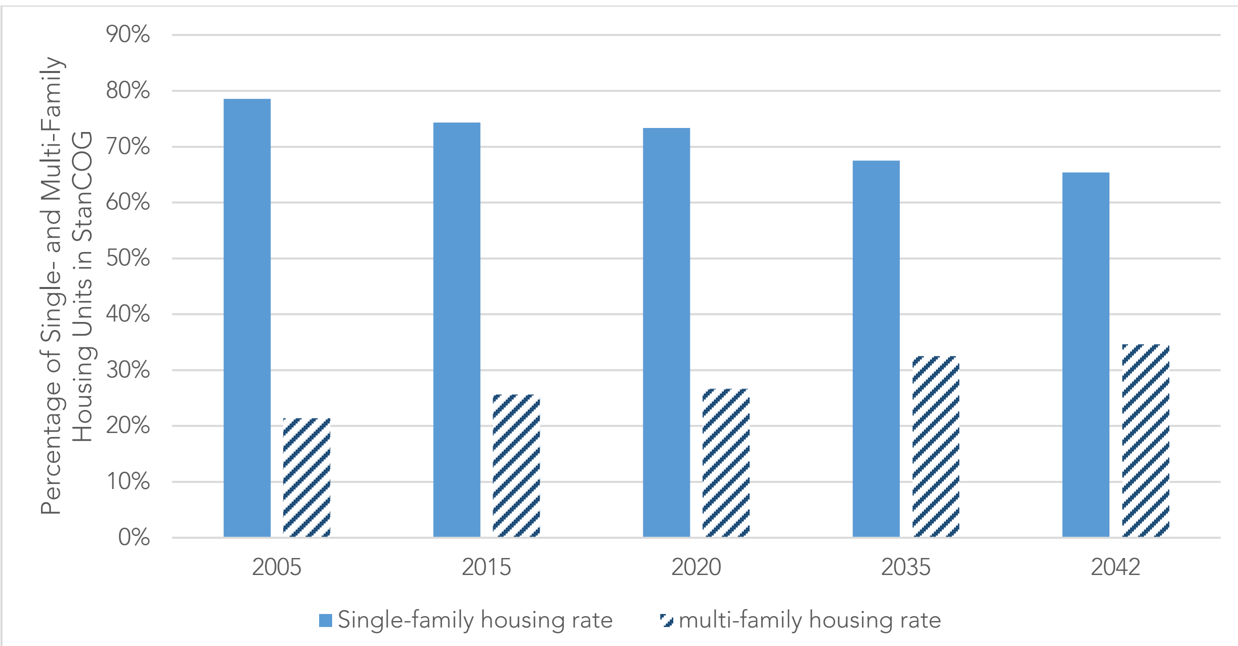
Figure 3. Residential Density Forecast in Stanislaus County



Mix of Housing Types

Figure 4 shows that among all housing units in the region, StanCOG projects multi-family housing units to account for 27, 32, and 35 percent of total housing units in the region in 2020, 2035 and 2042, respectively. This represents an increase over the 2005 baseline multi-family housing unit rate of 21 percent in the region. Building more multi-family housing units can help increase housing density and accessibility to destinations, which may reduce auto trip lengths and household VMT. Therefore, the increased share of new multi-family housing units is supportive and consistent with StanCOG's GHG emission reduction quantification.

Figure 4. Split of Total Single- and Multi-Family Housing Units



Transportation Indicators

CARB staff evaluated per capita VMT as a performance indicator to determine whether the trends support StanCOG's transportation strategies and the reported GHG emissions reductions.

Per Capita VMT

StanCOG's 2018 SCS shows a declining trend in per capita passenger vehicle VMT in 2020 and 2035, compared to 2005. However, the 2042 per capita VMT shows a slight increase. As shown in Figure 5, per capita VMT is modeled to decrease by 6.4 percent from 2005 to 2020, and by 11.2 percent from 2005 to 2035. A slight increase of 0.2 percent is observed in 2042 compared to 2035. Nevertheless, CARB staff found that the passenger vehicle VMT reduction is, in general, consistent with StanCOG's claimed GHG emissions reductions.

Despite the VMT reduction trends forecasted by StanCOG's 2018 SCS, the observed statewide VMT data and other data-supported metrics specific to StanCOG indicate that actual GHG emissions and VMT per capita have already not declined as forecasted for 2020. CARB's SB 150 Report explores these trends in more detail and suggests that accelerated action is crucial for public health, economic, equity, and climate success.

Figure 5. Per Capita Passenger Vehicle Miles Traveled