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

July 2020

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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-related GHG emissions reductions targets for 2020 and 2035 set by the California Air Resources Board (CARB). 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 16, 2018, the Kern Council of Governments (COG), which serves as the MPO for the Kern County region, adopted its 2018 SCS. Kern COG's 2018 SCS estimates a 12.5 percent and 12.7 percent decrease in per capita GHG emissions from light-duty passenger vehicles by 2020 and 2035 compared to 2005, respectively. The region's per capita GHG emissions reduction targets are 5 percent by 2020 and 10 percent by 2035, compared to 2005 levels. This report reflects CARB's technical evaluation of whether Kern COG's 2018 SCS GHG quantification would meet the 2020 and 2035 targets, when implemented.

CARB DETERMINATION

ACCEPT

Based on a review of all available evidence, CARB accepts Kern COG's determination that its 2018 SCS would meet the targets of a 5 percent reduction in GHG per capita emissions from light-duty passenger vehicles in 2020 and a 10 percent reduction in 2035, compared to 2005 levels, when fully implemented.

Kern COG's 2018 SCS includes increases in residential and commercial development near transit, transit and active transportation trip length, development of multi-family housing, and travel choices for environmental justice (EJ) communities. However, while Kern COG's 2018 SCS demonstrates a decrease in per capita vehicle miles traveled (VMT) by 2035 compared to 2005 (similar to GHG reductions), it also shows per capita VMT starting to increase again between 2015 and 2035.

CARB's SB 150 Report[1], released in November 2018, assessed on-the-ground progress in reducing relevant transportation GHG emissions since regions began developing SCSs and found that California was not on track to meet the GHG reductions expected under SB 375. As a result, the Kern region may not realize the expected GHG reductions associated with the SCS projects and may not meet the 2020 or 2035 targets, if the plan is not fully implemented.

CARB looked for qualitative evidence that Kern COG has put in place enabling project investments, programs, incentives, or guidance to support the implementation of its 2014 and 2018 SCS policies and programs. CARB was able to identify a number of planning, investment, and assistance actions taken in the region since 2014 that were generally supportive of SCS GHG reduction goals, however, the 2018 SCS remains unclear about what specific actions, milestones, and investments are needed to support its full implementation. For the third round SCS, CARB will need Kern COG to provide specific information on what key supporting actions and investments the region will pursue to support implementation of its SCS.

SCOPE AND METHODOLOGY

CARB examined Kern COG'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 July 2011 document entitled *Description of Methodology for ARB Staff Review of Greenhouse Gas Reductions from Sustainable Communities Strategies Pursuant to SB 375*.[2] CARB evaluated model inputs and assumptions based on the latest available data, examined Kern COG's model according to available research by evaluating its sensitivity, and assessed model outputs of regional land use and transportation performance relative to expected trends in the research literature.

In addition, as Kern COG's 2018 SCS is an update to its adopted 2014 SCS, CARB performed a qualitative review of Kern COG's implementation actions over the past four years. CARB looked for evidence that Kern COG has put in place enabling project investments, programs, incentives, or guidance to support the implementation of the

[1] California Air Resources Board. 2018 Progress Report: California's Sustainable Communities and Climate Protection Act. November 2018. Available at: https://ww2.arb.ca.gov/sites/default/files/2018-11/Final2018Report_SB150_112618_02_Report.pdf.
[2] Available at: https://www.arb.ca.gov/cc/sb375/scs_review_methodology.pdf.

first SCS, as well as whether Kern COG has established a foundation for continued implementation of policies and programs reflected in both its 2014 and 2018 plans.

CHANGES FROM THE REGION'S PREVIOUS SCS GHG QUANTIFICATION

CARB focused its review on identifying and evaluating changes Kern COG made between the current 2018 SCS and the previous 2014 SCS[3] with the potential to affect land use, transportation, and the SCS GHG emissions quantification. Kern COG describes the 2018 SCS as a continuation of its previous plan, focusing on maintaining, fixing, and finishing what they already have in the region. CARB staff reviewed changes made to demographic assumptions, the land use and transportation strategies included within the SCS, the modeling methods used to calculate passenger travel-related GHG emissions, as well as expected trends based on regional land use and transportation performance indicators.

Table 1 summarizes the changes in plan assumptions for demographic characteristics, employment, land use, and transportation.

LAND USE AND TRANSPORTATION STRATEGIES

Kern COG's 2018 SCS maintains a set of land use and transportation strategies that are similar to those in its previous 2014 SCS, with updates to assumptions used in the adopted scenario for land use and transportation investments, as further explained below. The adopted scenario focuses on growth in high-quality transit corridors and existing communities, improving bike and pedestrian infrastructure, and advancing economic development opportunities for EJ communities.

The 2018 SCS incorporates minor updates to the region's forecasted population, employment, and housing growth. Table 1 summarizes these changes and provides CARB's assessment. The assessment is conducted based on evaluating the consistency of the plan's assumptions with evidences and facts that can support these assumptions.

[3] CARB's acceptance and technical evaluation of Kern COG's first SCS was completed in July 2015, and contains detailed information about the methods Kern COG used to quantify GHG emissions. That information is still relevant for this technical evaluation and can be accessed at: https://www.arb.ca.gov/cc/sb375/kerncog_staff_evaluation_final.pdf?_ga=2.254503244.558770138.1548694813-299696842.1545083563

Table 1. Summary of Demographics, Land Use, and Transportation Changes in Kern COG's 2018 SCS Compared to the 2014 SCS[4]

Action	CARB Assessment	Finding
Revised Regional Growth Forecast	Reasonable	Kern COG updated population, housing, and employment growth projections for its 2018 SCS. In 2035, population, housing, and employment are forecasted to be about 0.6 percent, 7 percent, and 5.6 percent lower in the 2018 SCS compared to the 2014 SCS, respectively. These revisions are within the range of DOF projections available at the time of plan development. See Appendix A: Further Discussion of 2018 SCS Changes, for a detailed discussion regarding the changes in Kern COG's 2018 SCS.
Updated Land Use Scenario	Reasonable	Kern COG updated the SCS land use assumptions by adjusting total growth based on the region's latest growth forecast, as well adjusting assumptions for where growth would occur based on latest local planning assumptions and the results of Kern COG's SCS public engagement activities.[5] These updates to the land use scenario resulted in an approximate 5 percent increase in the number of housing units located within a half-mile of transit in its 2018 SCS compared to its 2014 SCS. See Appendix A: Further Discussion of 2018 SCS Changes, for a more detailed discussion regarding the changes in Kern COG's 2018 SCS.

[4] The findings in this table refer to the results of modeling and forecasting, not the actual changes on the ground.

[5] As part of its SCS public engagement process, Kern COG engaged county residents in a 2017 Quality of Life Survey. The survey results indicated that residents believed providing a variety of housing choices, as well as improved access to transit was very important to enhancing their quality of life. https://www.kerncog.org/wp-content/uploads/2009/11/community_survey_2017.pdf

Action	CARB Assessment	Finding
Updated Revenue Projections and Project List	Reasonable	The 2018 SCS updates both transportation revenue projections and expenditures. Compared to the previous plan, the total transportation budget increased from $11.6 billion to $13.3 billion, which is mostly attributable to increased funding available from State sources, including the Road Repair and Accountability Act of 2017 (SB 1). As a result, transportation investments are different from the previous plan with increases in the portion of investments devoted to roads and highways, which grew by $1.7 billion (26 percent increase in investment), primarily for operations and maintenance purposes. Investments in transit, high-occupancy vehicle lanes, and aviation increased by $14 million (0.3 percent increase in investment). Bike and pedestrian project investments also increased by $35 million (5 percent increase in investment) compared to the last plan. See Appendix A: Further Discussion of 2018 SCS Changes, for a more detailed discussion regarding the changes in Kern COG's 2018 SCS.

MODEL CALCULATIONS

Kern COG used an updated version of its modeling tool to evaluate its 2018 SCS with refined input data that slightly affected the quantification of model outputs of GHG emissions.

Table 2 summarizes these changes along with CARB's assessment and findings based on consistency with available information, modeling practice, and research results.

Table 2. Key Changes in Model Processes of Kern COG's 2018 SCS

Modeling Component	CARB Assessment	Finding
Travel Demand Model	Reasonable	Kern COG used the Valley Model Improvement Program 2 (VMIP 2) model for its 2018 SCS, which is an updated version of the model Kern COG used in its previous plan. The VMIP 2 model used data from the most recent Census, American Community Survey, California Household Travel Survey, and traffic counts.
Sensitivity Analysis	Somewhat Reasonable	Kern COG updated one sensitivity analysis to show the responsiveness of VMT to residential density. This test result shows that changes in per capita VMT were directionally sensitive to the changes in density. In addition, all changes in VMT for the metropolitan Bakersfield area fall partially within the

Modeling Component	CARB Assessment	Finding
		expected results from the literature.[6] CARB staff considers the sensitivity analysis results as somewhat reasonable. Although the results are directionally sensitive to the changes in density, they are not completely within the expected results from the literature. See Appendix B: Travel Demand Model Sensitivity Analyses, for more detailed information regarding the sensitivity analysis.
Adjustment to EMFAC Outputs	Reasonable	Kern COG followed the procedure demonstrated in CARB's memo titled *Methodology to Calculate CO_2 Adjustment to EMFAC Output for SB 375 Target Demonstrations.* EMFAC2011 is used for Kern COG's 2014 SCS, and EMFAC2014 is used for Kern COG's 2018 SCS, as recommended in CARB's memo[7].

REGIONAL LAND USE AND TRANSPORTATION PERFORMANCE INDICATORS

CARB also re-analyzed several land use and transportation modeled indicators against relationships expressed in the empirical literature between various metrics and VMT and/or GHG emissions to understand whether changes in the metrics were consistent with forecasted GHG emissions reduction trends. 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 the target years 2020 and 2035.

Table 3 shows a summary of Kern COG's 2018 SCS performance indicators. Data for this analysis came from Kern COG's SCS data table (see Appendix C: Data Table). Supporting data and charts for performance indicators are also provided in Appendix D: Performance Indicators.

[6] For more information, see Appendix D: Performance Indicators and the following policy brief: https://ww3.arb.ca.gov/cc/sb375/policies/density/residential_density_brief.pdf

[7] For the memo, see the Final Sustainable Communities Strategy Program and Evaluation Guidelines, Appendix D: Guidance on Technical Issues, Page 24-28. See the following link: https://ww2.arb.ca.gov/sites/default/files/2019-11/Final%20SCS%20Program%20and%20Evaluation%20Guidelines%20Appendices.pdf

Table 3. Summary of Performance Indicators[8]

Residential Density	Consistent with reducing VMT/ GHG	Kern COG projects a 5 percent increase in residential density in 2035 compared to 2015 (3.8 to 4 housing units per residential developed acre).
Housing and Employment Near Transit	Consistent with reducing VMT/ GHG	Kern COG projects a 21 percent and 55 percent increase in the number of housing units within a 1/2-mile of transit stations, stops, and routes by 2020 and 2035 respectively, compared to 2015. Kern COG projects a 49 percent and 82 percent increase in the number of jobs within a 1/2-mile of transit stations, stops, and routes by 2020 and 2035 respectively, compared to 2015.
Mode Share	Consistent with reducing VMT/ GHG	Kern COG projects the transit and non-motorized mode share to increase by about 0.2 percent and 0.8 percent in 2020 and 2035 respectively, compared to 2015.
Per Capita Passenger VMT	Somewhat consistent with reducing GHG	Kern COG's 2018 SCS shows a 3 percent reduction of per capita VMT in 2035 compared to 2005, from 17.6 miles/day to 17.1 miles/day. However, the plan also projects a 2 percent and 5 percent increase in per capita VMT in 2020 and 2035, respectively, compared to 2015, from 16.3 miles/day in 2015 to 16.6 miles/day in 2020, and 17.1 miles/day in 2035.

[8] While SB 375 requires that GHG reductions be considered relative to a 2005 baseline, the MPOs do not have data for all of the performance indicators for 2005. The base year that Kern COG used in its modeling results was 2015. As a result, in the absence of 2005 data, CARB staff compared Kern COG's modeling results for 2020 and 2035 with their modeling base year (i.e., 2015) results.

OTHER FINDINGS AND RECOMMENDATIONS

In reviewing Kern COG's SCS submittal, CARB staff identified what new information it needs from Kern COG for its upcoming third round SCS development and documentation process based on the *Final SCS Program and Evaluation Guidelines*[9] published November 2019. The following items provide information on the major changes to the third round SCS submittal package, what information the MPO is missing based on what it has shared with CARB for its second round SCS evaluation, and what additional information is needed in the MPO's next SCS evaluation submittal. For a complete understanding of what is needed for the third round SCS evaluation submittal, please reference 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.

As shown in Table 3, the modeling assumption trends for residential density, housing and employment near transit, and mode share are consistent with reducing VMT and GHG in the region. However, CARB staff is concerned about the modeling output per capita VMT trend. While CARB staff finds that the overall decline in per capita passenger VMT relative to 2005 levels is consistent with the planned performance of Kern COG's SCS for GHG emissions reductions, CARB staff has concerns with the increase in VMT per capita toward the later years of the plan. This trend is inconsistent with the State's identified need for continued and deeper GHG emissions reductions from this program over time. It is also concerning when considering that the latest observed statewide VMT data and other data-supported metrics specific to Kern COG have indicated that actual GHG emissions and VMT per capita have already not declined as forecasted for 2020. CARB's SB 150 Report[10] explores these trends in more detail and suggests that accelerated action is crucial to successfully respond to concerns related to public health, economic vitality, equity, and climate.

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[9] California Air Resources Board. Final Sustainable Communities Strategy Program and Evaluation Guidelines. November 2019. Available at: https://ww2.arb.ca.gov/sites/default/files/2019-11/Final%20SCS%20Program%20and%20Evaluation%20Guidelines%20Report.pdf.

[10] California Air Resources Board. 2018 Progress Report: California's Sustainable Communities and Climate Protection Act. November 2018. Available at: https://ww2.arb.ca.gov/sites/default/files/2018-11/Final2018Report_SB150_112618_02_Report.pdf.

Assessing performance indicator trends will continue to be a part of CARB's third round SCS evaluations. While the information submitted for this round of review (i.e., the second round) give CARB staff a minimum level of confidence in Kern COG's quantification results for this evaluation round, for the next SCS evaluation round which will address new, more aggressive reduction targets, CARB will need Kern COG to quantify and report changes from its next SCS plan base year to the SCS target years for the eight performance metrics identified below, as CARB will be using these for the Trend Analysis determination in the third round SCS evaluations. CARB staff will be checking whether the reported directionality for the following RTP/SCS performance indicators are trending as expected.[11]

- Household vehicle ownership: The average number of light-duty vehicles registered (i.e., LDA, LDT1, LDT2, and MDV vehicle categories) per household.
- Mode split: The percentage of average daily trips by travel mode, including single-occupant vehicle, high-occupancy vehicle or carpool, transit, ride-hailing or transportation network company (TNC), bike and walk.
- Travel time by mode: The regional average travel time (minutes) by trip purpose (e.g., for commute and non-commute trips), by travel mode.
- Transit ridership: The total number of one-way linked or unlinked average daily transit passenger trip boarding on public transportation per day.
- Average vehicle trip length: The regional average daily trip distance (miles/day) of driving.
- Seat utilization: The average daily percentage of occupied vehicle seats on the roadway network, including for passenger vehicles and transit buses.
- Household VMT: The average daily light-duty vehicle VMT from each household within the MPO, excluding group quarters and visitors.
- GHG per capita: The average daily CO2 emissions of individuals within the MPO from light duty vehicles.

Specifically, CARB will need Kern COG to report the following additional metrics for the trend analysis of the third SCS: travel time by mode, trip ridership, and seat utilization. Developing these metrics may require further improvement of Kern COG's data collection and travel demand modeling.

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[11] For expected directionality of performance indicators for the Trend Analysis, see the Final Sustainable Communities Strategy Program and Evaluation Guidelines, Table 4, Page 39. See the following link: https://ww2.arb.ca.gov/sites/default/files/2019-11/Final%20SCS%20Program%20and%20Evaluation%20Guidelines%20Report.pdf

Policy and Investment Analysis

For all third round SCSs, CARB is shifting its evaluation focus to assessing 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 concerning 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.

Key supporting actions should correspond to each strategy, and in general, actions should be measurable and can 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 Kern COG's key strategies is to promote a sustainable development pattern, which, when integrated with the transportation network and other transportation policies and measures, will reduce emissions from automobiles and light-duty trucks. For the third round SCS, Kern COG 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 SCS preferred growth areas.

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 Kern COG 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).

These elements of the submittal will be especially important for helping to address the concerning trend with the 2018 SCS of increasing VMT. While the SCS includes policies to promote sustainable development patterns, the 2018 SCS continues to assume additional growth in areas outside the city centers that can induce VMT, if not paired with other transportation options. Furthermore, the investment pattern of the 2018 SCS is such that the category of roads and highways has the largest increase in investment both in total and as a percentage. These patterns of development and investment combined can put the region at risk of not meeting its GHG emission

reduction targets. For the third round SCS, CARB will be looking for Kern COG to submit clearly described strategies, associated key supporting actions, and a set of investments, that when considered together can help reverse the current SCS' VMT trend.

Tracking Implementation and Plan Adjustment

In the third SCS evaluation round, CARB staff will be looking at how an MPO's previous SCS strategies and actions are performing and what MPOs are doing in the third round SCS, if the previous plans are not performing as expected. CARB's SB 150 Report 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.

Analysis of Induced Demand (Short-Term and Long-Term) Effects

Induced demand is demand that has been generated due to improvements made to transportation infrastructure. Increased capacity can lead to increased VMT in the short-term such as rerouting from congested roads to longer uncongested roads or shifting people from other modes to driving or drivers making more frequent trips. Longer-term effects may also occur if households and businesses move to more distant locations or if development patterns become more dispersed in response to the capacity increase. Induced demand is important to analyze as it can affect VMT and GHG emissions. Currently, long-term induced demand is not well accounted for by the travel demand model and this may underestimate per capita GHG increases. MPOs will need to explore methods to better analyze long-term induced demand in future SCSs. There are tools available to help MPOs evaluate the effects of induced travel. Examples include, but are not limited to, University of California, Davis National Center for Sustainable Transportation's Induced Travel Calculator[12] and Impact of Highway Capacity and Induced Travel on Passenger Vehicle Use and Greenhouse Gas Emissions.[13]

[12] Available at: https://ncst.ucdavis.edu/research/tools/
[13] Available at: https://www.arb.ca.gov/cc/sb375/policies/hwycapacity/highway_capacity_brief.pdf

Quantification of Off-Model Strategies

Kern COG should quantify off-model strategies that are implemented or considered in the region that are currently not quantified. The following are examples of some of these strategies:

- Kern COG is planning to implement over 4,000 charging stations in collaboration with other agencies to improve air quality and reduce GHG emissions;
- Kern COG implemented Rule 9410, a set of measures that an employer chooses to encourage employees to use ridesharing and alternative transportation for its commuters;
- Kern COG's 2018 SCS introduces vanpooling as one of its strategies for providing a mobility option to the employment centers located in areas outside of the urban core; and
- Kern COG supported Commute Kern, an online travel demand management tool, to facilitate vanpooling, carpooling, and transit use.

CARB staff recommends that Kern COG quantify its off-model strategies in future SCSs, referring to the off-model evaluation framework described in the SCS Evaluation Guidelines. This may include discussing the hours of operations for vanpool programs, the number of employees participating in telecommute programs or the details of operation for EV networks. Counting off-model strategies can help Kern COG account for strategies that result in GHG or per capita VMT reductions in future RTP/SCSs. Specifically, CARB identified the need for the following additional documentation for evaluation to receive GHG emissions reduction credits:

- Detailed quantification methods and assumptions for each strategy that document the strategy as surplus; and
- Identification of funding commitments or local policies that support the implementation of each strategy.

Use Discrete Housing Projection Values

The current land use model (UPlan) and the forecasted outputs provide the number of housing units for each housing type (e.g., multi-family or single-family units) in ranges rather than in discrete values. In some cases, this range is too broad and may not provide precise modeling results for each housing type. For example, the number of total single-family attached households in Kern COG's 2018 SCS is projected to be between 6,670 and 42,760 in 2035. In this case, the highest number is over six times larger than the lowest number in the range. Providing discrete numbers or providing numbers in smaller ranges can yield more informative results for policymaking.

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APPENDIX A: FURTHER DISCUSSION OF 2018 SCS CHANGES

This appendix describes the technical details of the changes to the 2018 SCS relative to the 2014 SCS, including demographic forecast, transportation investments, updates to the regional travel demand model, and adjustments to EMFAC outputs.

Revised Population, Employment, and Housing Growth Forecast

Kern COG updated the demographic growth forecast for its 2018 SCS in November 2015. The forecast uses a 2015 base year and projects trends for the core variables, including total population, number of households, number of housing units, and employment.[14] The forecast was developed primarily using observed data from 1990 to 2015.[15] The forecast also incorporates a cohort-component model for population by age group and an employment model. Table 4 below compares the population, housing, and employment used in the 2014 and 2018 SCSs. The 2018 SCS forecast for population, household, and employment is lower (between 1 and 9 percent) compared to the 2014 SCS.

Table 4. Comparison of Population, Household, Housing, and Employment Estimates in Kern COG's 2014 and 2018 SCSs

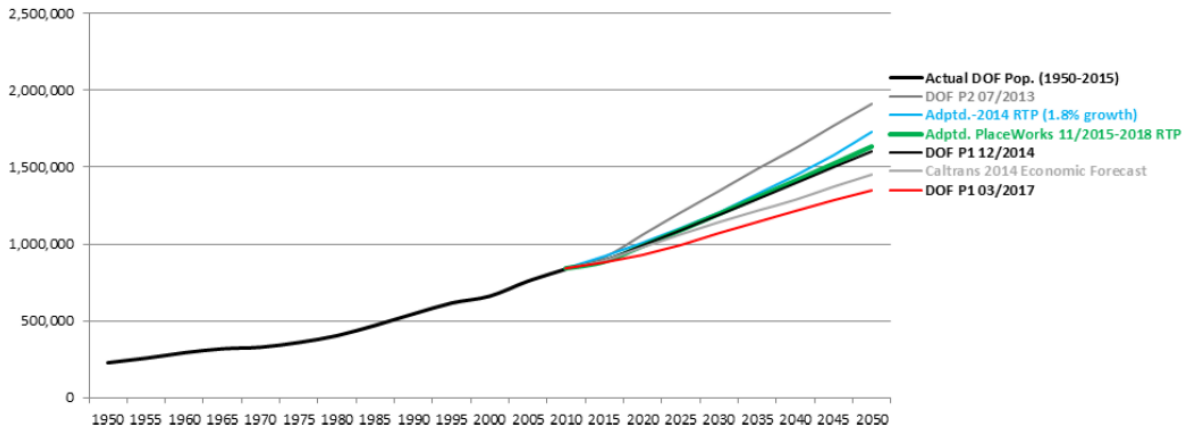
		1,010,800	988,900	-2%
		1,321,000	1,313,100	-1%
		319,200	292,000	-9%
		417,200	388,400	-7%
		365,700	349,600	-4%
		460,674	436,100	-5%

Source: Kern COG 2014 and 2018 SCS

[14] The housing-unit forecast considers the cohort-component model projection of households (as the housing-units-per-household ratio) and the employment trend projection (as jobs-to-housing units ratio).
[15] The forecast approach for each key variable differs slightly. For example, the estimate for population was derived by separately forecasting and then summing household population, prison-related group-quarters population, and other group-quarters population. The employment model considered key economic sectors independently and compared multiple curve-fitting approaches.

Demographic and population forecasts are important as they affect per capita VMT and GHG calculations. Kern COG's population forecast sits within a range of population growth alternatives from Department of Finance (DOF) and California Department of Transportation (Caltrans), as illustrated in Figure 1 below.[16]

Figure 1. Population Growth Alternatives Considered but Rejected from Further Consideration



Source: Kern COG, May 2018. Draft PEIR. Page 5.0-6.

Employment projections for the SCS sit within a range of forecasts created by the State of California agencies.[17] Kern COG's projection for 2035 is slightly higher (by approximately 2 percent) than that of Caltrans, and slightly lower than that of the California Employment Development Department (EDD).[18,19,20]

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[16] Kern COG 2018 RTP/ SCS. Accessed January 18 at: https://www.kerncog.org/wp-content/uploads/2018/10/2018_RTP.pdf

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[18] California Department of Transportation (Caltrans), Economic Analysis Branch Office of State Planning, prepared by The California Economic Forecast. 2015. California County-Level Economic Forecast 2015-2040. Accessed October 2018 at: http://dot.ca.gov/hq/tpp/offices/eab/docs/Full%20Report%202015.pdf.

[19] The population projections of the Department of Finance and the employment projections of Caltrans are derived using different methodologies and thus would not be expected to align. The fact that the SCS is higher than one source and lower than another is not considered an inconsistency.

[20] CARB reviewed information from the Employment Development Department (EDD) for 2014 to 2024. This forecast expects employment in the region to grow by a little over 12 percent by 2024, which if extended to 2035 would be a growth rate of 26 to 28 percent depending upon the method used. The SCS expects employment to grow by 26 percent from 2014 to 2035.

Kern COG's population and employment growth were then allocated to local jurisdictions within the region. This allocation changed between the 2014 and 2018 plans. Guided by the Transportation Modeling Committee (TMC) and Regional Planning Advisory Committee (RPAC), and consulting with each local member agency, Kern COG staff used the UPlan land use tool to distribute the residential and commercial growth across eight sub-areas.[21]

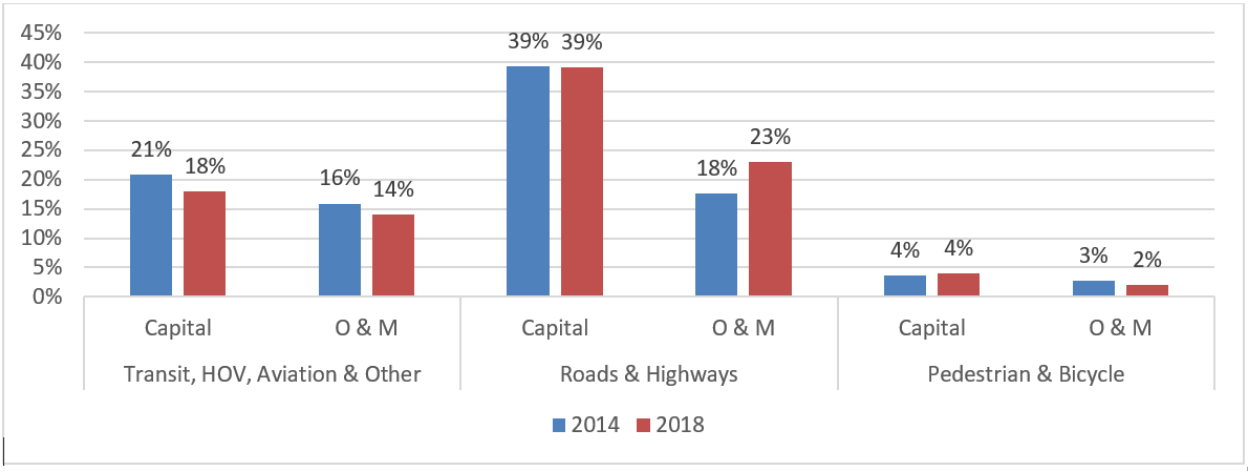
Revised Transportation Revenue Projections and Transportation Project List

For the 2018 SCS, Kern COG updated its transportation revenue projections and investment plan. Its total revenue forecast increased by nearly 15 percent, from approximately $11.6 billion to $13.3 billion.[22] The largest increase in the projected investment came from State sources, which grew by $1.3 billion (53 percent increase).[23] Close to 38 percent of the investment comes from local sources and 22 percent from federal sources, which do not show a major difference from the prior plan. The plan's investment pattern has changed.

Figure 2 shows the change in percentage of investment by mode in the 2018 SCS compared to 2014. As a share of total projected revenue, Kern COG plans to increase investment in the operations and maintenance of roads and highways and decrease investment in transit. There is not much change in the share of investment targeting pedestrian and bicycle projects or in capital expenditures for roads and highways relative to 2014.

[21] The sub-areas include the Bakersfield region, Westside Kern, North Central Kern, Greater Shafter, Frazier Park, Tehachapi, Southeast Kern, Lake Isabella, and Indian Wells Valley.
[22] All figures represent escalated Year of Expenditure dollar values.
[23] Major sources of State funding are State Highway Operation and Protection Program (SHOPP) ($1,136,000), State Transportation Improvement Program (STIP) ($1,125,000), State Transit Assistance (STA) ($566,000), and SB 1 ($546,000).

Figure 2. Kern COG SCS Transportation Investment by Mode (2014 vs. 2018)



Source: 2018 and 2014 Kern COG RTP, Page 6-6.

Updated Land Use Scenario

For the 2018 SCS, Kern COG updated its land use scenario reflecting slightly more infill development because of the Bakersfield High Speed Rail Station Area Plan. Table 5 summarizes the infill growth assumption differences between the 2018 and 2014 SCSs.

Table 5. Infill Growth Assumptions in 2018 and 2014 SCSs

Plan	% New Growth in Region That is Infill	% New Growth in Metro Bakersfield That is Infill
2018 SCS	19.0	38.0
2014 SCS	18.7	35.1

Source: 2018 Kern COG RTP PEIR, Page 5.0-8.

Travel Demand Model

The transportation demand model that Kern COG used is a trip-based model, VMIP2[24], which is an updated version of the VMIP1 model developed by the San Joaquin Valley Model Improvement Program (MIP) beginning in 2010. The modeling results in VMIP2 are more up-to-date as it incorporated the most recent Census, American Community Survey, and California Household Travel Survey (CHTS) data.

The 2018 RTP/SCS travel model validation was updated from a 2008 base validation year to 2015, including the incorporation of the 2012 CHTS characteristics as well as a modestly expanded and more accurate transit network. The CHTS included 1,700 responses for Kern with an oversampling of transit users of approximately 400.

Kern COG did not utilize any off-model adjustments in its 2018 SCS.

Adjustment to EMFAC Outputs

Kern COG used different versions of CARB's EMFAC model to quantify GHG emissions for its 2014 and 2018 SCSs. To allow for like-for-like comparison of the first and second round SCSs, CARB developed a methodology to calculate a carbon dioxide (CO_2) adjustment to EMFAC outputs for SB 375 target demonstrations if MPOs need to use a different version of EMFAC for the second SCS. 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 SCS. Kern COG followed the methodology, and its CO_2 per capita reduction results were adjusted accordingly.

[24] Model documentation for VMIP2 can be found here: http://www.kerncog.org/wp-content/uploads/2017/11/VMIP-2-Model-User-Guide.pdf

APPENDIX B: TRAVEL DEMAND MODEL SENSITIVITY ANALYSES

This appendix describes in more detail the travel demand model sensitivity analysis conducted by Kern COG. Sensitivity analysis tests the responsiveness of the travel demand model to changes in selected input variables. The responsiveness, or sensitivity, of the model to changes in key inputs, indicates whether the model can reasonably estimate the anticipated change in VMT and associated GHG emissions resulting from the policies in the SCS. This analysis usually assumes one input variable change at a time and examines the range of output changes.

Based on changes made to Kern COG's travel model, CARB requested Kern COG re-run the residential density sensitivity analysis. Residential density is usually defined as the number of housing units per acre. Increasing residential density has been considered an effective land use strategy to reduce VMT in a region because denser residential developments tend to be associated with fewer and shorter trips.

The sensitivity analysis shows improved model sensitivity in the 2018 travel model. Improvements were made to the 2018 travel model mode choice parameters and networks, resulting in improved model sensitivity for residential density. The Kern COG modeling for the 2018 RTP/SCS showed that changes in per capita VMT in the metropolitan Bakersfield area were directionally sensitive to changes in density. These changes, however, do not completely fall within the expected results based on literature (See Table 6).

Table 6. Residential Density Sensitivity Model Performance

Scenario	Residential density	Total Regional VMT	Delta of Regional VMT	Expected VMT Change
25% decrease in regional population density	9.56	23,026,587	443,105	451,669 to 1,072,715
2015 base	12.75	22,583,482	NA	NA
25% increase in regional population density	15.94	22,328,068	-255,414	-451,670 to -1,072,716
50% increase in regional population density	19.12	22,181,620	-401,862	-903,340 to -2,145,431

APPENDIX C: DATA TABLE

This Appendix shows the data table for Kern COG's 2018 SCS. It includes data for 2005 (if available), 2015 (the base year), 2020 (target year), 2035 (target year), and 2040 (RTP/SCS horizon year) in the following categories: demographic characteristics, land use, transportation system, trip data, mode share, travel measures, CO_2 emissions, EMFAC adjustment, investment, and transportation user costs.

Modeling Parameters	2005 (if available)	2015 (base year)	2020		2035		2040		Data Source(s)
			With Project	Without Project	With Project	Without Project	With Project	Without Project	
DEMOGRAPHICS									
Total population (used for per capita calculations)	762,000	884,800	988,900	988,900	1,313,100	1,313,100	1,469,500	1,469,500	Growth Forecast Inputs for Uplan
Group quarters population	34,200	32,600	35,000	35,000	41,400	41,400	44,400	44,400	Growth Forecast Inputs for Uplan
Total employment (employees)	286,432	324700	349,600	349,600	436,100	436,100	483,500	483500	Growth Forecast Inputs for Uplan
Average unemployment rate (%)	8.4%	10.2%	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	CA EDD 2015
Total number of households	232,600	265,500	292,000	292,000	388,400	388,400	443,700	443,700	Growth Forecast Inputs for Uplan
Persons per household	3.13	3.21	3.27	3.27	3.27	3.27	3.21	3.21	Growth Forecast Inputs for Uplan
Auto ownership per household	1.9	1.7	1.7	1.7	1.7	1.7	1.7	1.6	Kern COG TDM
Median household income	40,200	51,342	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Census ACS
LAND USE									
Total acres within MPO	5,227,647	5,227,647	5,227,647	5,227,647	5,227,647	5,227,647	5,227,647	5,227,647	GIS Analysis
Total resource area acres (CA GC Section 65080.01)	Not Available	2,148,051	2,147,739	2,144,297	2,144,885	2,128,151	2,142,468	2,118,283	FMMP, General Plan, & Uplan GIS Analysis
Total farmland acres (CA GC Section 65080.01)	Not Available	751,038	750,924	750,960	750,552	750,059	750,363	749,711	FMMP, General Plan, & Uplan GIS Analysis
Total developed acres	Not Available	155,388	164,885	164,774	191,083	198,747	202,144	222,200	FMMP Urban & Built-up Land (Base Year)

Modeling Parameters	2005 (if available)	2015 (base year)	2020		2035		2040		Data Source(s)
			With Project	Without Project	With Project	Without Project	With Project	Without Project	
Total commercial developed acres	Not Available	86,018	88,580	88,039	94,864	95,203	98,911	97,786	Non-Residential Kern Parcels within FMMP U&BL (Base Year); Uplan Output (Future Year)
Total residential developed acres	Not Available	69,370	76,305	76,735	96,220	103,544	103,233	124,414	Kern Parcels within FMMP U&BL (Base Year); Uplan Output (Future Year) w/ GIS analysis
Total households	Not Available	265,500	292,000	292,000	388,400	388,400	443,700	443,700	Growth Forecast Inputs for Uplan
Housing vacancy rate	10.1%	10.1%	8.4%	8.4%	7.9%	7.9%	7.8%	7.8%	2017 California Department of Finance; Growth Forecast
Total single-family detached households	Not Available	188,856	188,910 to 216,310	189,160 to 232,670	189,100 to 307,890	190,210 to 390,480	189,210 to 320,060	190,760 to 481,010	Uplan Data
Total small-lot single-family detached households (6,000 sq. ft. lots and smaller)	Not Available	21,605	188,860 to 195,750	188,860 to 191,510	188,860 to 224,960	188,860 to 201,580	188,860 to 255,920	188,860 to 207,370	(1) Uplan medium density can be either detached or attached.
Total conventional-lot single-family detached households (between 6,000 and 10,900 sq. ft. lots)	Not Available	121,510	135,237	143,418	181,027	222,321	187,110	267,587	Uplan Data
Total large-lot single-family detached households (10,900 sq. ft. lots and larger)	Not Available	45,741	45,794	46,041	45,987	47,096	46,097	47,648	Uplan Data
Total single-family attached households	Not Available	6,665	6,670 to 13,560	6,670 to 9,320	6,670 to 42,760	6,670 to 19,390	6,670 to 73,730	6,670 to 25,180	Uplan Data
Total multi-family households	Not Available	49,102	54,930 to 61,820	50,740 to 53,390	76,140 to 112,240	57,110 to 69,840	94,280 to 161,350	60,800 to 79,320	Uplan Data
Total mobile home households	Not Available	20,876	*21,640 to 22,280*	21,170 to 21,350	24,870 to 27,860	22,280 to 23,170	28,290 to 33,280	22,920 to 24,220	Maintains '15 MH/dtchd. ratio

Modeling Parameters	2005 (if available)	2015 (base year)	2020		2035		2040		Data Source(s)
			With Project	Without Project	With Project	Without Project	With Project	Without Project	
Total households within 1/4-mile of transit stations, stops and routes	Not Available	149,764	177,412	175,066	227,595	200,121	256,762	208,563	Uplan Output GIS Analysis
Total households within 1/2-mile of transit stations, stops and routes	Not Available	191,937	232,145	242,132	296,787	292,840	334,942	309,758	Uplan Output GIS Analysis
Total employment within 1/4-mile of transit stations, stops and routes	Not Available	143,242	212,934	183,462	260,514	223,420	289,900	233,415	Uplan Output GIS Analysis
Total employment within 1/2-mile of transit stations, stops and routes	Not Available	175,086	258,477	229,134	318,295	289,530	354,155	305,346	Uplan Output GIS Analysis
TRANSPORTATION SYSTEM									
Freeway general purpose lanes – mixed flow lane miles	Not Available	20,491	21,116	21,415	25,327	25,349	25,349	28,832	VMIP II 2018
Highway (lane miles)	Not Available	1,326	1,367	1,369	1,465	1,465	1,465	1,834	VMIP II 2018
Expressway (lane miles)	Not Available	197	207	230	228	228	228	273	VMIP II 2018
HOV (lane miles)	Not Available	-	-	-	16	-	16	-	VMIP II 2018
Arterial (lane miles)	Not Available	5,561	5,738	5,812	6,988	7,008	7,008	7,711	VMIP II 2018
Collector (lane miles)	Not Available	772	784	784	1,010	1,010	1,010	1,267	VMIP II 2018
Local (lane miles)	Not Available	12,519	12,900	13,100	15,500	15,500	15,500	17,600	maintains 2008 HPMS ratio
Freeway-Freeway (lane miles)	Not Available	116	121	121	136	138	138	146	VMIP II 2018
Local, express bus, and neighborhood shuttle operation miles	Not Available	16,952	16,952	13,391	25,877	13,415	25,877	13,415	VMIP II 2018

Modeling Parameters	2005 (if available)	2015 (base year)	2020		2035		2040		Data Source(s)
			With Project	Without Project	With Project	Without Project	With Project	Without Project	
Bus rapid transit bus operation miles	Not Available	0	2,742	-	2,789	-	2,789	-	Metropolitan Bakersfield Transit System Long-Range Plan
Passenger rail operation miles	Not Available	480	480	480	516	480	4,176	480	Kern COG GIS data (Amtrak 2015; Kern COG CRF Study - Rosamond; HSR 2012 Business Plan)
Transit total daily vehicle service hours	Not Available	1,241	1,303	1,243	1,368	1,249	1,436	1,257	Kern COG; w/o project ratio of transit operations
Bicycle and pedestrian trail/lane miles	Not Available	350	989	302	1,576	324	1,952	331	2018 RTP Plan; 2018 Kern Region Active Transportation Plan
Vanpool (total riders per weekday)	Not Available	1,539	1,709	1,722	2,237	2,297	2,460	2,559	2016 5-YR ACS (Base); ratio of HOV
TRIP DATA									
Number of trips by trip purpose		2,715,047	2,992,370	2,992,383	3,940,742	3,941,325	4,394,298	4,383,826	VMIP II 2018
Home-based work	Not Available	363,107	392,618	390,421	528,292	520,096	597,667	593,357	VMIP II 2018
Home-based shop	Not Available	243,044	272,455	273,901	363,239	368,939	409,757	420,119	VMIP II 2018
Home-based other	Not Available	1,036,810	1,168,008	1,160,518	1,557,654	1,522,332	1,735,175	1,709,967	VMIP II 2018
Home-based school	Not Available	181,702	201,755	201,233	268,396	268,418	296,386	301,087	VMIP II 2018
Home-based university	Not Available	45,145	45,323	45,535	60,824	61,438	67,591	68,592	VMIP II 2018
Non-home-based work	Not Available	240,620	260,468	261,429	326,374	329,375	362,421	366,575	VMIP II 2018
Non-home-based other	Not Available	604,620	651,742	660,916	835,963	843,354	925,302	945,116	VMIP II 2018
Average weekday trip length by trip purpose (miles)									
Home-based work	Not Available	11.4	11.8	11.6	11.9	12.1	12.0	12.8	VMIP II 2018

Modeling Parameters	2005 (if available)	2015 (base year)	2020		2035		2040		Data Source(s)
			With Project	Without Project	With Project	Without Project	With Project	Without Project	
Home-based shop	Not Available	5.6	5.8	5.8	6.8	7.0	6.7	8.4	VMIP II 2018
Home-based other	Not Available	8.4	8.8	8.7	9.4	9.4	9.6	9.9	VMIP II 2018
Home-based school	Not Available	3.8	3.5	3.6	3.8	3.9	4.0	4.1	VMIP II 2018
Home-based university	Not Available	15.9	14.5	14.6	14.6	14.6	14.7	14.7	VMIP II 2018
Non-home-based work	Not Available	7.2	7.5	7.5	7.9	8.1	7.9	8.4	VMIP II 2018
Non-home-based other	Not Available	5.5	5.7	5.8	6.0	6.2	6.0	6.4	VMIP II 2018
MODE SHARE									
Vehicle Mode Share (Peak Period)									
SOV (% of trips)	Not Available	34.6%	34.2%	34.2%	33.9%	34.1%	33.7%	34.2%	VMIP II 2018
HOV (% of trips)	Not Available	52.3%	52.6%	53.0%	52.3%	53.7%	51.6%	53.9%	VMIP II 2018
Transit (% of trips)	Not Available	0.5%	0.5%	0.5%	0.6%	0.4%	0.7%	0.3%	VMIP II 2018
Non-motorized (% of trips)	Not Available	12.5%	12.7%	12.3%	13.2%	11.8%	14.0%	11.6%	VMIP II 2018
Vehicle Mode Share (Whole Day)									
SOV (% of trips)	Not Available	38.8%	38.3%	38.4%	37.9%	38.3%	37.7%	38.4%	VMIP II 2018
HOV (% of trips)	Not Available	46.7%	47.0%	47.4%	46.8%	48.0%	46.1%	48.1%	VMIP II 2018
Transit (% of trips)	Not Available	1.8%	1.9%	1.9%	2.1%	1.9%	2.2%	1.9%	VMIP II 2018
Non-motorized (% of trips)	Not Available	12.6%	12.8%	12.4%	13.2%	11.8%	14.0%	11.6%	VMIP II 2018
Average weekday trip length (miles)									
SOV	Not Available	8.6	8.8	8.7	9.3	9.3	9.4	9.9	VMIP II 2018
HOV	Not Available	7.0	7.3	7.3	7.8	7.9	7.9	8.4	VMIP II 2018
Transit	Not Available	11.5	14.0	11.2	13.1	12.5	12.9	13.1	VMIP II 2018

Modeling Parameters	2005 (if available)	2015 (base year)	2020		2035		2040		Data Source(s)
			With Project	Without Project	With Project	Without Project	With Project	Without Project	
Walk	Not Available	2.1	2.1	2.1	2.2	2.1	2.2	2.1	VMIP II 2018
Bike	Not Available	4.2	4.1	4.1	4.3	4.4	4.4	4.5	VMIP II 2018
TRAVEL MEASURES									
Total VMT	13,390,628	17,687,091	19,958,091	19,919,349	26,906,807	27,121,207	29,666,126	31,239,071	VMIP II 2018
Total II (Internal) VMT per weekday for passenger vehicles (miles)	11,396,528	11,245,516	12,933,031	12,879,843	18,161,357	18,413,638	20,466,693	22,020,942	VMIP II 2018
Total IX/XI VMT per weekday for passenger vehicles (miles)	1,994,100	3,220,741	3,501,512	3,515,990	4,312,270	4,273,794	4,556,003	4,573,042	VMIP II 2018
Total XX VMT per weekday for passenger vehicles (miles)	Not Available	3,220,835	3,523,548	3,523,516	4,433,181	4,433,776	4,643,429	4,645,086	VMIP II 2018
Congested Peak Hour VMT on freeways (Lane Miles, V/C ratios >0.75)	Not Available	93,535	93,716	103,675	575,628	374,461	934,357	629,262	VMIP II 2018
Congested Peak VMT on all other roadways (Lane Miles, V/C ratios >0.75)	Not Available	138,952	113,317	101,398	247,228	232,902	381,758	310,736	VMIP II 2018
CO_2 Emissions									
Total CO_2 emissions per weekday for passenger vehicles (ARB vehicle classes LDA, LDT1, LDT2, and MDV) (tons)	6357	8,540	9,304	9,290	12,168	12,241	13,414	14,096	VMIP II 2018
Total II (Internal) CO_2 emissions per weekday	4,176	5,430	6,029	6,007	8,213	8,311	9,254	9,937	VMIP II 2018

Modeling Parameters	2005 (if available)	2015 (base year)	2020		2035		2040		Data Source(s)
			With Project	Without Project	With Project	Without Project	With Project	Without Project	
for passenger vehicles (tons)									
Total IX / XI trip CO_2 emissions per weekday for passenger vehicles (tons)	2,181	1,555	1,632	1,640	1,950	1,929	2,060	2,064	VMIP II 2018
Total XX trip CO_2 emissions per weekday for passenger vehicles (tons)	Not Available	1,555	1,643	1,643	2,005	2,001	2,100	2,096	VMIP II 2018
INVESTMENT									
Total RTP Expenditure (Year of Expenditure $)	$7,898,000,000	$13,342,186,000	$1,067,374,880	$631,840,000	$8,405,577,180	$4,975,740,000	$3,869,233,940	$2,290,420,000	Investment comparison figures based primarily on forecasted annual revenue extrapolated from historic trends consistent with federal guidance.
Highway capacity expansion ($)	$3,723,482,000	$3,236,861,000	$258,948,880	$297,878,560	$2,039,222,430	$2,345,793,660	$938,689,690	$1,079,809,780	
Other road capacity expansion ($)	$1,311,000,000	$1,172,000,000	$93,760,000	$104,880,000	$738,360,000	$825,930,000	$339,880,000	$380,190,000	
Roadway maintenance ($)	$1,559,500,000	$3,092,750,000	$247,420,000	$124,760,000	$1,948,432,500	$982,485,000	$896,897,500	$452,255,000	
BRT projects ($)	$0	$52,500,000	$4,200,000	$0	$33,075,000	$0	$15,225,000	$0	
Transit capacity expansion ($)	$103,800,000	$2,336,600,000	$186,928,000	$8,304,000	$1,472,058,000	$65,394,000	$677,614,000	$30,102,000	
Transit operations ($)	$605,500,000	$1,883,500,000	$150,680,000	$48,440,000	$1,186,605,000	$381,465,000	$546,215,000	$175,595,000	
Bike and pedestrian projects ($)	$37,500,000	$790,475,000	$63,238,000	$3,000,000	$497,999,250	$23,625,000	$229,237,750	$10,875,000	
Transportation Demand Management ($)	$557,218,000	$777,500,000	$62,200,000	$44,577,440	$489,825,000	$351,047,340	$225,475,000	$161,593,220	

Modeling Parameters	2005 (if available)	2015 (base year)	2020		2035		2040		Data Source(s)
			With Project	Without Project	With Project	Without Project	With Project	Without Project	
TRANSPORTATION USER COSTS									
Vehicle operating costs (Year 2009 $ per mile)	0.1134	0.18	0.18	0.18	0.14	0.14	0.15	0.15	VMIP II 2018
Gasoline price (Year 2009 $ per gallon)	2.52	3.68	4.04	4.04	4.79	4.79	5.18	5.18	VMIP II 2018
Average transit fare (Year 2009 $)	Not Available	$1	$1	$1	$1	$1	$1	$1	VMIP II 2018
Parking cost (Year 2009 $)	Not Available	Varies	No Change	No Change	No Change	No Change	No Change	No Change	VMIP II 2018
EMFAC ADJUSTMENT									
% change in per capita GHG due to EMFAC 2011 to EMFAC2014 adjustment (%)	Not Available	Not Available	12.5%	12.7%	12.7%	12.0%	13.6%	8.1%	VMIP II 2018
ADDITIONAL ROWS									
Total households within 1/2-mile of rail transit stations and high frequency (<15 min.) transit routes	Not Available	44,572	53,798	45,069	138,019	46,878	162,329	47,916	GIS Analysis (Without Project includes existing transit system; consistent growth from Pre-SCS)
Total employment within 1/2-mile of rail transit stations and high frequency (<15 min.) transit routes	Not Available	71,418	80,234	71,459	187,123	71,600	207,549	71,677	GIS Analysis (Without Project includes existing transit system; consistent growth from Pre-SCS)

Note: VMIP II modeling for "With" and "Without Project" scenarios is based on modeling for the current 2018 RTP environmental document alternatives. The document included plan and no project alternatives. The plan alternative was used for the With Project scenario. A No Project alternative was modified to meet the ARB specifications for a Without Project scenario. Both the With/Without Projects scenarios use the same MIP II model and parameters. The Without Project uses the same forecast and passenger rail network as the No Project alternative from the environmental document. The model network was modified to include previously planned highway projects such as a partial beltway system. Also the transit network was modified to reflect a pre-SCS network. Additional modeling years were added for 2020 and 2035 and not used in the environmental document. Kern COG RTP modeling documentation can be accessed here: http://www.kerncog.org/category/data-center/transportation-modeling/

APPENDIX D: PERFORMANCE INDICATORS

This appendix describes in more detail the changes in key non-GHG, modeled indicators that explain SCS performance. These indicators are examined to determine if they can provide qualitative and quantitative evidence that the SCS, when implemented, could meet the GHG targets. The evaluation looked at the directional consistency of the indicators with Kern COG's modeled GHG emissions reductions, as well as the general relationship between those indicators and GHG emissions reductions, based on the empirical literature. The SCS performance indicators evaluated include the share of housing types, housing and employment near transit, trip length and mode share for transit and active transportation, daily transit service hours, and per capita VMT.

LAND USE INDICATORS

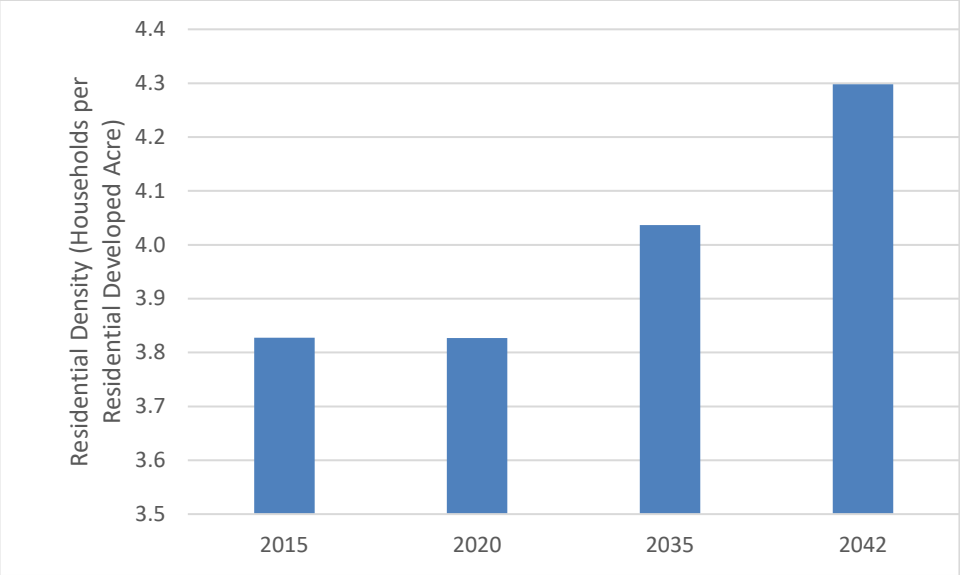
Land use influences the travel behavior of residents including both mode choice and trip length. The evaluation focused on two land use-related performance indicators to determine whether they support Kern COG's land use strategies and forecasted GHG emissions forecast: residential density and housing and employment near transit.[25]

Residential Density

Figure 3 shows residential housing density in the Kern COG region or households per residential developed acre for 2015, 2020, and 2035, based on data and projections provided by Kern COG for its 2018 SCS. Kern COG projects that with the SCS residential density will increase from 3.8 to 4 households per developed residential acre between 2015 and 2035.

[25] The analysis in this section is done based on Kern COG's 2018 data table (See Appendix C: Data Table).

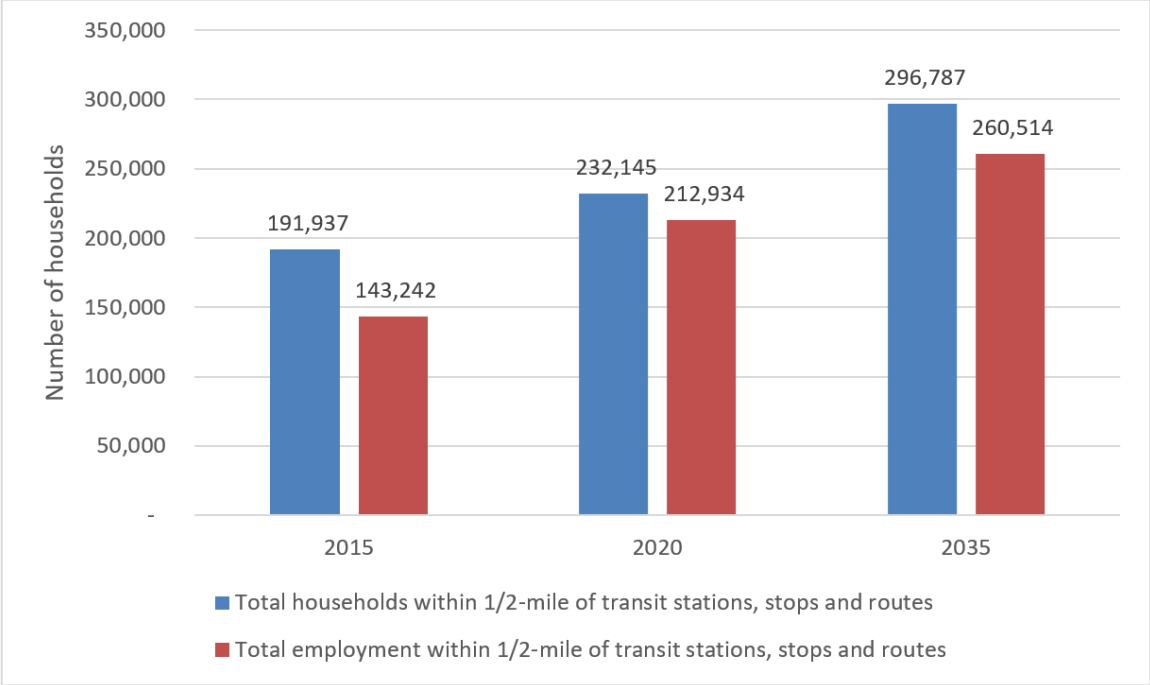
Figure 3. Residential Density Forecast



Housing and Employment near Transit

As shown in Figure 4, Kern COG projects that the number of households near transit (i.e., within ½-mile of transit stations, stops, and routes) will increase by 104,851 from 2015 to 2035.

Figure 4. Total Number of Households and Jobs within 1/2-Mile of Transit Stations, Stops, and Routes



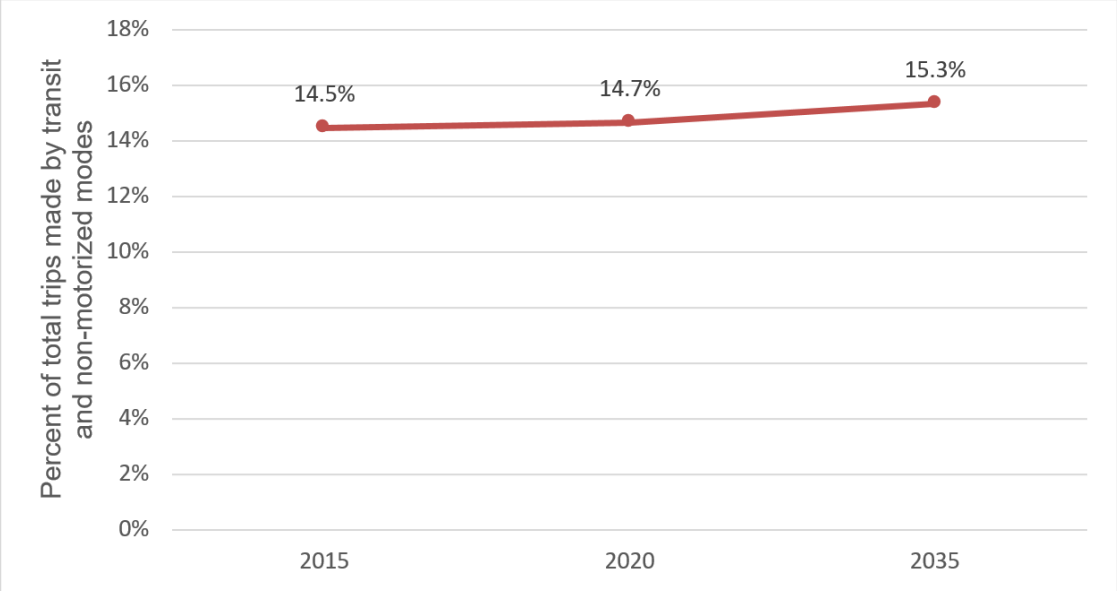
TRANSPORTATION INDICATORS

CARB staff evaluated three transportation-related performance indicators to determine whether the trends support Kern COG's transit strategies and the reported GHG emissions reductions, including mode share and per capita VMT.

Mode Share

Figure 5 shows the portion of total trips made by transit and non-motorized modes in 2015, 2020, and 2035. Kern COG projects that transit, bike and walk trips will increase by 0.8 percent by 2035 with the SCS.

Figure 5. Transit and Non-Motorized Trips



Per Capita VMT

Kern COG's 2018 SCS shows a declining trend in per capita passenger vehicle VMT in 2020 and 2035 compared to 2005, but an increase compared to 2015. Specifically, per capita VMT is estimated to go up by about 5 percent between 2015 and 2035 as shown in Figure 6. Based on CARB staff's review of Kern COG's 2018 SCS, Kern COG's 2015-2050 Growth Forecast Update, and subsequent conversations with Kern COG staff, a contributing factor to this trend is increased employment growth for areas located outside of the Bakersfield region relative to 2005 levels.[26]

[26] For example, the average annual growth forecast for employment in the Bakersfield region is expected to slow down by about 0.6 percent for 2017-2042 compared with 1980-2017. However, this rate is going up by approximately 2.7 percent in Arvin, 3.6 percent in Shafter, 0.7 percent in Taft, and 1.3 percent in Tehachapi.

Figure 6. Per Capita Passenger VMT (Miles)