TECHNICAL EVALUATION OF THE GREENHOUSE GAS EMISSIONS REDUCTION QUANTIFICATION FOR KINGS COUNTY ASSOCIATION OF GOVERNMENTS' SB 375 2018 SUSTAINABLE COMMUNITIES STRATEGY

June 2021

CALIFORNIA
AIR RESOURCES BOARD

This document has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the California Air Resources Board, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

Electronic copies of this document are available for download from the California Air Resources Board's internet site at:

https://ww2.arb.ca.gov/our-work/programs/sustainable-communities-climate-protection-program

In addition, written copies are also available. Please email California Air Resources Board program staff at sustainablecommunities@arb.ca.gov to place your request.

For individuals with sensory disabilities, this document is available in Braille, large print, audiocassette, or computer disk. Please contact CARB's Disability Coordinator at (916) 323-4916 by voice or through the California Relay Services at 711, to place your request for disability services. If you are a person with limited English and would like to request interpreter services, please contact CARB's Bilingual Manager at (916) 323-7053.

Table of Contents

List of Tables

Background

The Sustainable Communities and Climate Protection Act (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) – as part of their regional transportation plans (RTP) – which contain 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 22, 2018, the Kings County Association of Governments (KCAG), which serves as the MPO for the Kings County region, adopted its 2018 SCS, known as the *2018 Regional Transportation Plan / Sustainable Communities Strategy* (2018 SCS).[1] KCAG provided for CARB staff's review a complete submittal of the 2018 SCS and all necessary supporting information on January 29, 2021. KCAG's 2018 SCS estimates a 10.8 percent and 11.8 percent decrease in GHG per capita emissions from light-duty passenger vehicles by 2020 and 2035,[2] 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.[3] This report reflects CARB staff's technical evaluation of KCAG'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 Guidelines),[4] CARB accepts KCAG's determination that its 2018 SCS plan would meet the targets of a 5 percent reduction in per capita GHG emissions from light-duty passenger vehicles by 2020 and a 10 percent reduction by 2035, compared to 2005 levels, when fully implemented.

---

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

[2] A typo in Figure 12-3 of the RTP/SCS refers to a 2030 target instead of 2035.

[3] CARB. Board Resolution 10-31 (September 23, 2010).

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

KCAG's 2018 SCS contains new GHG reduction strategies[5] compared to KCAG's 2014 SCS,[6] which CARB reviewed and accepted in October 2015 as meeting the GHG emissions reduction targets. The 2018 SCS includes quantification of strategies that were included in the 2014 SCS but were not previously quantified toward achievement of the SB 375 targets. Therefore, this evaluation incorporates the analysis from CARB's review of the 2014 SCS[7] and adds analysis of changes with the potential to affect land use, transportation, and GHG emissions KCAG has included in the 2018 SCS.

CARB staff reviewed KCAG'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.[8] CARB staff also reviewed land use and transportation strategies included within the SCS to understand what, if any, of the 2018 SCS strategy commitments changed from KCAG's 2014 commitments. In addition, CARB staff reviewed KCAG's reported regional land use and transportation performance indicators to confirm that the indicators were trending in a direction that is consistent with forecasted GHG emission and/or vehicle miles traveled (VMT) reduction trends, as expressed in the empirical literature.

Based on these evaluations, CARB staff accepts KCAG's determination that its 2018 SCS would meet the targets when fully implemented. CARB staff's analysis and assessment of changes to KCAG's 2018 SCS and GHG quantification are documented in the "Changes from the Region's Previous SCS" section of this evaluation report.

CARB staff have identified issues with KCAG's 2018 SCS submittal that KCAG 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*[9] published by CARB in November 2019 (2019 Evaluation Guidelines). Specifically, KCAG's third-round SCS submittal will require data on several key performance indicators that further support GHG emissions reduction calculations, and the third-round SCS will require information about specific actions, milestones,

---

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

[6] KCAG. 2014 Regional Transportation Plan/Sustainable Communities Strategy.

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

[8] 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.

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

and enabling project investments that will support full implementation of its SCS policies and programs. These items are necessary given CARB's recent assessment of on-the-ground progress since regions began developing SCSs.[10] This assessment found that California was not on track to meet the GHG reductions expected under SB 375. As a result, the KCAG region may not realize the GHG reductions forecasted 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 emissions reduction commitments and support the statewide effort to successfully mitigate the worst projected impacts of climate change. CARB staff's concerns and suggested remedies are documented in the "Recommendations" section of this evaluation.

Changes from the Region's Previous SCS

The following sections summarize changes from the previous SCS made to underlying 2018 SCS assumptions and strategies, quantification tools and methods, and resulting SCS performance indicator metrics, and CARB staff's assessment of the specified actions.

CARB staff examined KCAG'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 staff's 2011 SCS Evaluation Guidelines.

Land Use and Transportation Strategies

KCAG's 2018 SCS maintains a set of land use and transportation strategies that are similar to those adopted in its previous SCS, with updates to add a new employer trip reduction strategy. The 2018 SCS also newly quantifies five programs that were discussed within the 2014 SCS but were not quantified as strategies for GHG reduction as described in Appendix A. The 2018 SCS also incorporates updates to the region's expected future growth. CARB staff assessed KCAG's updates to its 2018 SCS strategies, as well as assumptions about changes to the region's demographic characteristics, land use, transportation investments, and infrastructure, and found them all to be reasonable. Table 1 summarizes these changes and provides CARB staff's assessment based on consistency with best available information and practice.

[10] 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 Changes to Demographic, Land Use, and Transportation Investment and System Assumptions in KCAG's 2018 SCS Compared to the 2014 SCS

Action	CARB Staff's Assessment	Finding
Updated Regional Growth Forecast	Reasonable	KCAG updated population, housing, and employment growth estimates for its 2018 SCS. Compared to 2014 SCS projections, the 2018 SCS uses a 2035 population forecast that is 8 percent lower, a total number of households forecast that is 2.5 percent higher (with associated changes in average household size), and an employment forecast that is 1.7 percent lower. Per the 2011 Evaluation Guidelines, CARB staff reviewed these revisions and found them to be consistent with the 2014 California Department of Finance (DOF) forecasts, which were the latest available forecasts at the time of plan development.
Updated Land Use Scenario	Reasonable	KCAG updated the SCS land use assumptions. Per the 2011 Evaluation Guidelines, CARB staff reviewed KCAG'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 the latest local planning assumptions in consultation with its members. Compared to the 2014 SCS, the 2018 SCS land use scenario corrects the proportion of existing (base year) multifamily housing units and the forecasted plan year multifamily housing units from approximately 40 percent of total housing units to approximately 20 percent of total housing units, better matching the 2015 figures in the Kings County *2016 – 2024 Housing Element*.

Action	CARB Staff's Assessment	Finding
Updated Revenue Projections and Transportation Investments	Reasonable	The 2018 SCS updates both transportation revenue projections and investments. Per the 2011 Evaluation Guidelines, CARB staff reviewed overall changes to KCAG's SCS planned transportation project investments and found them generally consistent with changes in projected resources. Compared to the 2014 SCS, total revenues and investments increase from approximately $542 million to $724 million, approximately 34 percent. The increase in funding is attributable to multiple changes projected for the revenue forecast period, including funding provided by the Road Repair and Accountability Act of 2017 (SB 1); and federal Section 5307 funding from the Federal Transit Administration (FTA) for transit capital and operating assistance and transportation-related planning. Transportation investments by mode remain proportionally similar to the 2014 SCS. Road expansion investments are unchanged at 18 percent of total projected spending, whereas the proportion of total investments in transit and active transportation projects increased slightly between plans from approximately 17 to 19 percent.

Action	CARB Staff's Assessment	Finding
New Strategies: Active Transportation Program, ITS Improvements, Agricultural Vanpool Program, Rule 9410 Employer Trip Reduction Program, Electric Vehicle (EV) Incentive Program, and Electric Vehicle Charger Installations	Reasonable	KCAG's 2018 SCS includes six newly quantified strategies for GHG reduction. As noted above, five of the newly quantified strategies were programs that were included in the 2014 SCS but not previously quantified for GHG reduction. The newly quantified strategies include investments in infrastructure to encourage active transportation (bicycling and walking), Intelligent Transportation System (ITS) improvements, agricultural vanpools, Rule 9410 Employer Trip Reduction Program, and encouraging use of electric vehicles (EV) through purchase subsidies and by coordinating and funding charger installation. CARB staff reviewed KCAG's suite of newly quantified strategies and found them to be creditable toward its SB 375 targets.

Model Calculations

While KCAG used the same travel demand and land use modeling tools to evaluate its 2018 SCS as it used to evaluate its 2014 SCS, it made updates and changes that affected its calculation of GHG emissions resulting from its SCS. These included updates to its modeling base year to better capture current conditions, updated auto operating cost assumptions, updated transit coverage and traffic counts, as well as adjusting GHG reductions for six additional strategies. Table 2 summarizes these changes along with CARB staff's assessment and findings based on consistency with best available information and modeling practice.

Table 2. Key Changes in KCAG's 2018 SCS Modeling Compared to the 2014 SCS

Modeling Component	CARB Staff's Assessment	Finding
Travel Demand Model	Reasonable	While KCAG used the same travel demand model for the 2018 SCS as it used for the 2014 SCS, it made several updates to its modeling, including a new 2015 modeling base year, updated auto operating cost assumptions, updated indicators of transit coverage, and updated traffic counts on a range of facility types. Per the 2011 Evaluation Guidelines, CARB staff reviewed KCAG's technical methodology and found that KCAG changes were reasonable because they improved the model's ability to represent current conditions, which are then reflected in travel forecasts used for GHG emissions quantification.
Adjustments for GHG Reductions from Multiple Strategies	Reasonable	As shown in Table 1, KCAG developed and applied new quantitative methodologies outside its travel demand model to estimate GHG reductions associated with multiple strategies in its 2018 SCS. These strategies include: the Active Transportation Program, ITS Improvements, the Agricultural Vanpool Program, the Rule 9410 Employer Trip Reduction Program, the Electric Vehicle (EV) Incentive Program, and Electric Vehicle Charger Installations. KCAG estimates these programs will reduce per capita GHG emissions by 4.2 percent in 2035. CARB staff reviewed and found KCAG's methodologies and calculations sufficient, but note that in future SCSs KCAG will need to identify specific funding commitments and local policies that will support these strategies to receive credit for the GHG benefits being claimed. See the "Recommendations" section for additional discussion.

Modeling Component	CARB Staff's Assessment	Finding
Adjustment to EMFAC Outputs	Reasonable	KCAG used EMFAC 2014 to estimate GHG emissions. CARB staff reviewed KCAG's emissions calculations and found that the calculations appropriately followed the procedure demonstrated in CARB's memo titled *Methodology to Calculate CO2 Adjustment to EMFAC Output for SB 375 Target Demonstrations.*

Regional Land Use and Transportation Performance Indicators

To better understand whether KCAG's key modeled land use and transportation performance indicators trend in a direction consistent with forecasted GHG emissions and/or VMT reduction trends, CARB staff re-analyzed several of these indicators against relationships expressed in the empirical literature. Depending on what regional data were available, CARB staff 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 KCAG's 2018 SCS land use performance indicators, and Table 4 shows a summary of KCAG's 2018 SCS transportation performance indicators. Data for this analysis came from KCAG's 2018 SCS data table provided in Appendix B: Data Table.

Table 3. Summary of Land Use Performance Indicators

Performance Indicator	CARB Staff's Assessment	Finding
Residential Density	Consistent with Reducing VMT/GHG	KCAG's 2018 SCS forecasts an increase from 3.43 to 3.54 housing units per developed acre, or a 3 percent increase in residential density by 2035 compared to 2015. Per the 2011 Evaluation Guidelines, CARB staff found 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.

Performance Indicator	CARB Staff's Assessment	Finding
Multi-Family Housing Growth Rate	Consistent with Reducing VMT/GHG	KCAG's SCS projects multi-family housing will make up a greater proportion of new growth compared to the proportion in 2015 existing conditions. Between 2015 and 2035, 21.4 percent of new development will be multi-family dwelling units. This rate is higher than the region's 2015 multi-family dwelling unit rate of 19.5 percent. Per the 2011 Evaluation Guidelines, CARB finds this trend supportive and consistent with the relationship shown in the empirical literature that encouraging multi-family units can increase accessibility to destinations and helps reduce VMT and GHG emissions.
Jobs and Housing near Transit	Consistent with Reducing VMT/GHG	KCAG's 2018 SCS forecasts an increase in jobs and housing units near transit. Compared to the 2015 model base year, the 2018 SCS shows an increase in the number of housing units within a quarter mile of transit stations or stops by 5.3 percent in 2020 and by 21.7 percent in 2035. Similarly, the plan shows an increase in jobs within a quarter mile of transit stations or stops by 11.6 percent in 2020 and by 35.5 percent in 2035. Per the 2011 Evaluation Guidelines, CARB staff found this trend supportive and consistent with the relationship shown in the empirical literature that increasing the proportion of new development near transit increases accessibility to destinations and helps to reduce VMT and GHG emissions.

Table 4. Summary of Transportation Performance Indicators

Performance Indicator	CARB Staff's Assessment	Finding
Per Capita Passenger VMT	Consistent with reducing VMT/GHG	KCAG's travel demand model shows that per capita VMT decreased from 10.6 miles in the 2005 base year to 10.5 miles in 2020 (i.e., -1.0 percent), and then rebounded to 10.7 miles in 2035 (i.e., +1.3 percent). However, VMT values estimated by the transportation demand model do not account for reductions in VMT that are forecasted for strategies that KCAG quantified off-model, which are predicted to reduce per capita VMT by approximately 4 percent in 2035. Accounting for the additional VMT reductions from these off-modeled strategies, KCAG's per capita VMT in 2035 will be lower than its 2005 level. Per the 2011 Evaluation Guidelines, CARB staff found this trend to be generally 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. See the "Recommendations" section for more detail on how to improve VMT/GHG emissions estimates of land use and transportation strategies in its plan.

Performance Indicator	CARB Staff's Assessment	Finding
Transit Mode Share	Consistent with reducing VMT/GHG	KCAG's 2018 SCS forecasts that transit mode share will increase from 2 percent in 2015 to 9.6 percent in 2020 and 9.4 percent in 2035. Per the 2011 Evaluation Guidelines, CARB staff found this increasing trend supportive and consistent with the relationship shown in the empirical literature that increasing the transit mode share helps reduce VMT and GHG emissions. However, CARB staff noticed that the scale of increase (i.e., from 2 percent in 2015 to 9.6 percent in 2020) is so substantial that it may not be fully supported by the transit projects described in KCAG's SCS. See the "Recommendations" section for more detail on how to improve VMT/GHG emissions estimates of land use and transportation strategies in its plan.

Recommendations

In reviewing KCAG's 2018 SCS submittal, CARB staff identified what new information KCAG will need to provide to CARB staff for its upcoming third-round SCS development and documentation process based on the 2019 Evaluation Guidelines[11] published in November 2019. Based on these guidelines, the following sections provide information on some additional information needed in KCAG's third-round SCS evaluation submittal beyond what was shared with CARB for the second-round SCS. For a complete understanding of what is needed for the third-round SCS evaluation submittal, please refer to the 2019 Evaluation Guidelines.

Trend Analysis

CARB staff currently uses land use and transportation system performance indicator trends to assess whether an SCS supports the forecasted GHG emissions reductions. This assessment will continue to be a part of CARB's third-round SCS evaluations. While KCAG's submittal included some performance indicators that were directionally

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

supportive of certain strategies and estimated GHG reductions, data provided to evaluate the performance of key strategies in the SCS were limited.

Given that KCAG's third SCS must address a new, more ambitious 2035 reduction target, KCAG will need to quantify and report changes from its next SCS plan base year to the SCS target years for the eight performance metrics identified below. CARB staff 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.[12] The metrics not provided by KCAG 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.

2. **Mode split:** The percentage of average daily trips by travel mode, including single-occupant vehicle, high-occupancy vehicle or carpool, transit, ride-hailing (TNC), bicycle 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. (KCAG did not provide this metric.)*

4. ***Transit ridership:*** *The total number of passenger boardings on public transportation per day (one-way linked or unlinked). (KCAG 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. (KCAG did not provide this metric.)*

7. **Household VMT:** The average daily light-duty vehicle VMT per household within the MPO, excluding group quarters and visitors.

8. **GHG per capita:** The average daily CO2 emissions of individuals within the MPO from light-duty vehicles.

---

[12] 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.

Policy and Investment Analysis

For all third-round SCSs, CARB staff will focus on assessing whether SCS strategies for GHG emission reductions are likely to be implemented and are therefore reasonable for inclusion and credit toward target achievement. To assess this, MPOs should provide clear descriptions of each SCS strategy's applicable geographic scope, with specific locations if known; implementation timeframes; and key supporting actions the MPO and its member agencies will undertake to support and track strategy implementation.[13]

Key supporting actions should correspond to each individual strategy, and in general, actions should be measurable. This 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, KCAG's 2018 SCS includes a strategy to promote infill and mixed-use development. For the third-round SCS, KCAG should identify what key supporting actions it is committing to in order to help implement this strategy, as well as information showing that the projected development amounts and locations can be reasonably expected to result based on past development trends (for example, compared to the annual building permit totals in the *2014 Kings County Regional Housing Needs Assessment Plan)*. This could include identifying specific funding or other incentive programs the region will have to reward local jurisdictions that are investing in these SCS preferred growth areas, including any actions KCAG plans to take to improve local connectivity to transit and influence development patterns and density around key transit areas across the region.

Of particular importance in the KCAG third-round SCS will be the response to the construction of the Kings/Tulare California High-Speed Rail Station. As noted in the KCAG 2018 RTP/SCS (beginning on page 6-21), the planned station will lie on agricultural land, east of Hanford. The California High-Speed Rail Authority's *Revised Draft 2020 Business Plan* anticipates passenger service beginning between Merced and Bakersfield.[14] There have been plans to make transit connections to the station, as with the *2018 Cross Valley Corridor Plan*. The station area provides an opportunity for transit-oriented development that is unique in the region and for reduced GHG emissions from interregional travel. Without careful planning, the station also holds the potential to drive sprawling development that raises local per capita VMT and GHG emissions. As appropriate, actions to address the station area land use development

---

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

[14] California High-Speed Rail Authority. Revised Draft 2020 Business Plan (February 9, 2021).

and transit connections could be incorporated on-model or off-model into the GHG reduction strategy.

For most of the off-model strategies in the current SCS, KCAG's submittal does not identify funding commitments or local policies that support implementation of the forecasted plan outcomes. If KCAG quantifies these off-model strategies in future SCSs, it should collect local data and monitor implementation, identify specific funding commitments and local policies that will support strategy implementation, and update assumptions used in the methodology to track with that information.

CARB staff will also be evaluating how transportation investments are distributed throughout the region and whether these investments support or put at risk the GHG reduction benefits of the SCS. To assess this, KCAG should provide the complete list of transportation projects identified in both the second- and third-round RTP/SCSs. Projects should 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 and how plans might be adjusted if the previous SCS is not performing as expected. CARB's *2018 Progress Report: California's Sustainable Communities and Climate Protection Act,* prepared pursuant to SB 150, provides some information in this area based on the latest observed statewide data and trends. For the next SCS, KCAG should compare available observed data and trends to the development pattern and travel assumptions used in the 2018 SCS. If the observed data do not align with the plan assumptions, KCAG 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.

KCAG should clearly document how it is using data to track implementation progress of its SCS, as well as justify any adjustments it makes to the underlying baseline assumptions. In particular, CARB staff encourages KCAG to gather more detailed land use, transit, and active transportation data to help assess the effectiveness of the land use and transit strategies in the 2018 SCS.

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 KCAG explore enhanced methods for analyzing short- and long-term induced travel from roadway expansion projects in future SCS cycles. KCAG 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 KCAG's travel demand model, so per capita GHG emissions may be underestimated. CARB staff has identified available tools to help KCAG 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]

Model Improvements and Improved Strategy Calculation Methods

KCAG did not make any improvements to its MIP 1 travel demand modeling framework for the 2018 SCS, compared to what was used for the 2014 SCS. Due to the limitations in the model's capacity, several strategies cannot be modeled by KCAG's MIP 1 model. As a consequence, KCAG's model projected that its plan could increase per capita VMT in 2035 compared to the 2005 base year, if not for significant off-model reductions in VMT. Additionally, CARB staff noticed that KCAG's 2018 SCS forecasted substantial increases in the transit mode share between the 2015 model base year and the horizon years, which do not look to be supported by the scale of transit projects described in the plan. Although the increasing trend of transit mode share directionally supports KCAG's transit strategy, KCAG's 2018 SCS may have overestimated the level of increase, which could be due to the limited capacity of the MIP 1 model, and warrants improvement in the future. CARB staff recommends that KCAG improve its travel demand model for future SCSs to improve its sensitivity to various land use and transportation strategies in its plan and provide model validation and calibration results.

KCAG should also update calculation methods for its Active Transportation Program, ITS Improvements, Agricultural Vanpool Program, Rule 9410 Employer Trip Reduction Program, EV Incentive Program, and EV Charger Installations off-model strategies to receive credit toward its targets in future SCSs. CARB staff reviewed KCAG's methodologies and estimates of GHG emission reductions from these strategies and found them to be reasonable. However, for the third-round SCS evaluation, the

---

[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.

following additional documentation is needed for each off-model strategy before GHG emissions reduction credit can be received: [18]

- A 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
- Efforts to collect local data and monitor implementation.

Conduct Modeling Sensitivity Analysis

CARB staff 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 KCAG makes significant changes to its travel model in the future that can affect its sensitivity to RTP/SCS strategies, CARB staff recommends KCAG 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: KCAG's Strategy Table

KCAG submitted a summary strategy table to compare the key land use and transportation strategies between the 2014 and 2018 SCSs. This table also illustrates how the individual strategies are accounted for using travel demand model (on-model) or off-model analyses. Items marked "**" were revised by CARB staff to conform to terminology usage in the remainder of this document.

SCS Strategy	On/Off Model	Carryover from Last SCS or New?	Comments
Land Use: Encourage mixed-use, high-density and infill new development in existing communities	On Model	Carryover from last SCS with updates	KCAG model incorporates updated land use information for Hanford and Lemoore.
Mobility improvements: Transit Investment	On Model	Carryover from last SCS with updates	Updated transit coverage.
EV Incentive Program and EV Charger Installations: Encourage the development of infrastructure for and the implementation of alternative fuel vehicles**	Off Model	New Strategies** (discussed in the 2014 SCS but not previously quantified)	KCAG is developing an EV Readiness Plan that will prepare and guide the region in EV infrastructure and adoption. This plan will provide resources for best practices and identifies funding sources for agencies and residents/businesses to adopt EVs. Congestion Mitigation and Air Quality Improvement (CMAQ) Program funds are also available for local agencies to promote adoption of alternative fuel and electric vehicles.

SCS Strategy	On/Off Model	Carryover from Last SCS or New?	Comments
Active Transportation Program: Encourage bicycle and pedestrian facilities**	Off Model	New Strategy** (discussed in the 2014 SCS but not previously quantified)	With the completion of local and regional active transportation plans, prioritized non-motorized projects have been identified and are included in the project list. Some projects have been funded through the CMAQ Program. Local agencies have also applied for and been awarded grants from the competitive statewide Active Transportation Program to support their active transportation plans.
Agricultural Vanpool Program and Rule 9410 Employer Trip Reduction Program: Make mobility improvements**	Off Model	New Strategies** (Agricultural Vanpool Program was discussed in the 2014 SCS but not previously quantified; Rule 9410 Employer Trip Reduction Program was not discussed in the 2014 SCS and is new to the 2018 SCS)	Kings County has a number of major employment centers with 100 or more employees which include state prisons and private businesses (Leprino Foods, Tachi Palace, etc.). These employment centers utilize vanpools services, like CalVans, and are under the Rule 9410 strategy for the local air pollution control district.
ITS Improvements: Encourage the installation of traffic signals and signal synchronization**	Off Model	New Strategy** (discussed in the 2014 SCS but not previously quantified)	CMAQ Program funds assist in funding traffic signalization installation to mitigate traffic congestion and improve air quality.

Appendix B: Data Table

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Total population	144,732	155,122	167,465	167,465	205,206	205,206	223,124	223,124	CA DOF 2014 Projections
Group quarters population	21,178	32,838	35,585	35,562	43,536	43,517	47,418	47,392	MIP1 Model
Total employment (employees)	41,214	46,393	50,100	50,100	61,400	61,400	66,700	66,700	KCAG based on 2014 DOF
Average unemployment rate (%)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total number of households	37,373	42,650	46,000	46,000	56,400	56,400	61,300	61,300	KCAG based on 2014 DOF
Persons per household	3.31	2.87	2.87	2.87	2.87	2.87	2.87	2.87	Calculation
Auto ownership per household	1.75	1.75	1.76	1.76	1.76	1.76	1.75	1.75	MIP1 Model
Median household income	$44,490	$44,700	$44,700	$44,700	$44,700	$44,700	$44,700	$44,700	United States Census (2010)

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Total acres within MPO	891,547	891,547	891,547	891,547	891,547	891,547	891,547	891,547	KCAG
Total resource area acres (CA GC Section 65080.01)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total farmland acres (CA GC Section 65080.01)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total developed acres	N/A	13,011.4	13,927.4	13,928.1	16,755.3	16,758.8	18,086.2	18,091.0	Calculation
Total commercial developed acres	N/A	5,367.0	5,700.4	5,699.9	6,718.5	6,717.8	7,197.3	7,196.5	KCAG
Total residential developed acres	N/A	7,644.4	8,227.0	8,228.2	10,036.8	10,041.0	10,888.9	10,894.5	KCAG
Total housing units	N/A	44,799	48,318	48,318	59,244	59,243	64,390	64,390	KCAG based on 2014 DOF
Housing vacancy rate	N/A	4.80%	4.80%	4.80%	4.80%	4.80%	4.80%	4.80%	DOF vacancy rate for 2015

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Total single-family detached housing units	N/A	33,824	36,588	36,596	45,172	45,202	49,215	49,256	KCAG based on 2014 DOF
Total small-lot single-family detached housing units	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total conventional-lot single-family detached units	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total large-lot single-family detached units	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total single-family attached housing units	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total multi-family housing units	N/A	8,725	9,479	9,472	11,820	11,790	12,923	12,882	KCAG based on 2014 DOF
Total mobile home units & other	N/A	2,251	2,251	2,251	2,251	2,251	2,251	2,251	KCAG based on 2014 DOF

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Total infill housing units	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total mixed-use buildings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total housing units within 1/4 mile of transit stations and stops	N/A	27,949	29,443	29,442	34,026	34,045	36,196	36,210	N/A
Total housing units within 1/2 mile of transit stations and stops	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total employment within 1/4 mile of transit stations and stops	N/A	29,753	33,206	32,046	40,324	39,085	43,670	42,390	N/A
Total employment within 1/2 mile of transit stations and stops	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Freeway general purpose lanes – mixed-flow lane miles	181	181	181	181	181	181	181	181	MIP1 Model
Highway (lane miles)	296	312	312	312	312	312	312	312	MIP1 Model
Expressway (lane miles)	0	0	0	0	0	0	0	0	MIP1 Model
High-Occupancy Vehicle (lane miles)	0	0	0	0	0	0	0	0	MIP1 Model
Arterial (lane miles)	465	478	496	496	527	527	536	536	MIP1 Model
Collector (lane miles)	550	554	555	555	567	567	567	567	MIP1 Model
Local (lane miles)	880	880	880	880	879	879	879	879	MIP1 Model
Freeway-Freeway (lane miles)	0	0	0	0	0	0	0	0	MIP1 Model

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Local, express bus, and neighborhood shuttle operation miles	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bus rapid transit bus operation miles	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Passenger rail operation miles	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Transit total daily vehicle service hours	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bicycle and pedestrian trail/lane miles	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanpool (total riders per weekday)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Home-based work trips	62,992	70,586	76,431	76,422	94,535	94,543	102,966	102,986	MIP1 Model
Home-based shop trips	41,526	48,957	52,860	52,857	65,029	65,035	70,702	70,714	MIP1 Model

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Home-based other trips	107,916	124,681	135,096	135,089	167,278	167,314	182,253	182,285	MIP1 Model
Home-based school trips	46,842	44,937	48,298	48,303	58,867	58,885	63,857	63,873	MIP1 Model
Home-based university trips	11,670	11,875	12,764	12,766	15,546	15,547	16,851	16,853	MIP1 Model
Non-home-based work trips	10,057	17,349	18,833	18,824	24,060	24,063	26,608	26,602	MIP1 Model
Non-home-based other trips	146,079	202,017	218,815	218,799	276,576	276,552	304,567	304,463	MIP1 Model
Average home-based work weekday trip length (miles)	N/A	14.3	13.6	13.6	13.0	13.0	12.6	12.6	MIP1 Model
Average home-based shop weekday trip length (miles)	N/A	4.9	4.9	4.9	4.8	4.8	4.8	4.8	MIP1 Model

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Average home-based other weekday trip length (miles)	N/A	1.6	1.6	1.6	1.6	1.6	1.6	1.6	MIP1 Model
Average home-based school weekday trip length (miles)	N/A	3.5	4.0	4.0	4.5	4.5	4.7	4.7	MIP1 Model
Average home-based university weekday trip length (miles)	N/A	17.2	17.1	17.1	16.8	16.8	16.6	16.5	MIP1 Model
Average non-home-based work weekday trip length (miles)	N/A	2.5	2.6	2.6	2.8	2.8	2.8	2.8	MIP1 Model
Average non-home-based other weekday trip length (miles)	N/A	1.8	1.9	1.9	2.1	2.1	2.1	2.1	MIP1 Model

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Single-occupancy vehicle (peak period % of trips) (4)	N/A	40.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.1%	MIP1 Model
High-occupancy vehicle (peak period % of trips) (4)	N/A	44.3%	41.8%	41.9%	41.9%	42.0%	42.0%	42.0%	MIP1 Model
Transit (peak period % of trips) (4)	N/A	1.9%	9.4%	9.2%	9.2%	9.0%	9.1%	9.1%	MIP1 Model
Non-motorized (peak period % of trips) (4)	N/A	13.6%	9.6%	9.7%	9.6%	9.7%	9.7%	9.8%	MIP1 Model
Single-occupancy vehicle (whole day % of trips) (4)	39.1%	37.4%	36.7%	36.7%	36.7%	36.6%	36.6%	36.5%	MIP1 Model
High-occupancy vehicle (whole day % of trips) (4)	45.7%	46.6%	44.1%	44.2%	44.3%	44.3%	44.3%	44.3%	MIP1 Model

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Transit (whole day % of trips) (4)	2.6%	2.0%	9.6%	9.4%	9.4%	9.2%	9.4%	9.3%	MIP1 Model
Non-motorized (whole day % of trips) (4)	12.6%	14.1%	9.6%	9.8%	9.7%	9.8%	9.7%	9.8%	MIP1 Model
Single-occupancy vehicle average weekday trip length (miles)	7.3	5.7	5.5	5.5	5.4	5.4	5.3	5.3	MIP1 Model
High-occupancy vehicle average weekday trip length (miles)	4.9	4.0	3.9	3.9	4.0	4.0	4.0	4.0	MIP1 Model
Transit average weekday trip length (miles)	4.7	1.6	2.8	2.8	2.9	2.9	2.8	2.8	MIP1 Model
Walk average weekday trip length (miles)	1.1	1.3	1.4	1.4	1.4	1.4	1.4	1.4	MIP1 Model

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Bike average weekday trip length (miles)	2.4	2.4	2.7	2.7	2.8	2.8	2.8	2.8	MIP1 Model
Total VMT per weekday for passenger vehicles (ARB vehicle classes of LDA, LDT1, LDT2 and MDV) (miles) (5)	2,591,758	3,162,627	3,361,448	3,362,681	4,256,307	4,257,571	4,723,170	4,723,672	EMFAC 2014
Total II (internal) VMT per weekday for passenger vehicles (miles) (5)	889,479	1,027,004	1,088,908	1,089,654	1,408,110	1,408,981	1,539,768	1,539,888	EMFAC 2014
Total IX/XI VMT per weekday for passenger vehicles (miles) (5)	644,106	649,512	667,735	668,223	795,502	795,899	884,830	885,213	EMFAC 2014
Total XX VMT per weekday for passenger vehicles (miles) (5)	1,058,173	1,486,111	1,604,804	1,604,804	2,052,695	2,052,691	2,298,571	2,298,571	EMFAC 2014

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Congested peak hour VMT on freeways (lane miles, V/C ratios >0.75) (5)	N/A	167,476 (88)	174,829 (88)	174,830 (88)	315,076 (89)	315,077 (89)	401,356 (111)	401,358 (111)	MIP1 Model
Congested peak VMT on all other roadways (lane miles, V/C ratios >0.75) (5)	N/A	2,420 (3)	5,437 (5)	5,435 (5)	99,445 (63)	99,468 (63)	157,791 (79)	157,842 (79)	MIP1 Model
Total CO2 emissions per weekday for passenger vehicles (ARB vehicle classes LDA, LDT1, LDT2, and MDV) (tons) (5)	1,285	1,539	1,589	1,590	1,966	1,966	2,179	2,179	EMFAC 2014
Total II (internal) CO2 emissions per weekday for passenger vehicles (tons) (5)	441	500	515	515	650	651	710	710	EMFAC 2014

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Total IX / XI trip CO2 emissions per weekday for passenger vehicles (tons) (5)	319	316	316	316	367	368	408	408	EMFAC 2014
Total XX trip CO2 emissions per weekday for passenger vehicles (tons) (5)	524	723	759	759	948	948	1,060	1,060	EMFAC 2014
% change in per capita GHG due to EMFAC 2011 to EMFAC2014 adjustment (%)	N/A	N/A	2.0%	2.0%	2.2%	2.2%	2.2%	2.2%	EMFAC 2011/2014
Total RTP expenditure	$445	N/A	N/A	N/A	N/A	N/A	$697	$375	2005 Data from 2004 RTP
Highway capacity expansion ($ millions)	$136	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Other road capacity expansion ($ millions)	$23	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2018 RTP/SCS
Roadway maintenance ($ millions)	$263	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2018 RTP/SCS
Other road capacity expansion & roadway maintenance ($ millions)	N/A	N/A	N/A	N/A	N/A	N/A	$556	$310	2018 RTP/SCS
BRT projects ($ millions)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Transit capacity expansion & transit operations ($ millions)	$15	N/A	N/A	N/A	N/A	N/A	$119	$61	2018 RTP/SCS
Bike and pedestrian projects ($ millions)	$9	N/A	N/A	N/A	N/A	N/A	$22	$4	2018 RTP/SCS

Modeling Parameters	2005	2015 (base year)	2020 With Project (1)	2020 Without Project (2)	2035 With Project	2035 Without Project	2042 With Project	2042 Without Project	Data Sources (3)
Vehicle operating costs (year 2010 $ per mile)	$0.19	$0.23	$0.23	$0.23	$0.22	$0.22	$0.23	$0.23	VMIP2 Model
Gasoline price (year 2010 $ per gallon)	N/A	$3.52	$3.87	$3.87	$4.91	$4.91	$5.26	$5.26	VMIP2 Model
Average transit fare (year 2010 $)	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	MIP1 Model
Parking cost (year 2010 $)	0	0	0	0	0	0	0	0	KCAG

(1) This scenario includes modeling of all planned and programmed projects in RTP/SCS for respective calendar year.

(2) This scenario reflects the MPO's business as usual scenario, which is what would happen under the MPO's previously adopted RTP for the respective calendar year.

(3) Data for each modeling parameter does not include off-model reductions.

(4) 2005 and 2015 years do not include updated transit coverage and mode share parameters for these years and should not be compared with subsequent years and scenarios.

(5) Does not include impacts of SCS strategies quantified off-model.