APPENDIX M – SENATE BILL 375 TECHNICAL METHODOLOGY

Stanislaus Council of Governments
2022 Regional Transportation Plan/Sustainable Communities Strategy

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1.0 Introduction

SB 375 requires that Metropolitan Planning Organizations (MPO) submit to the Air Resources Board a description of the technological methodology that it intends to apply in the Sustainable Community Strategy (SCS), or an Alternate Planning Strategy (APS) if applicable. This document describes the approach that the Stanislaus Council of Governments (StanCOG) followed for estimating greenhouse gas emissions for its 2022 Regional Transportation Plan (RTP) and Sustainable Communities Strategy (SCS) update. As part of this effort several major activities were completed, including:

- An update to the regional travel demand model
- Discussions with CARB staff on methodological approach
- Scenario development and analysis
- Public and stakeholder meetings

Every 8 years, the California Air Resources Board (CARB) updates the Greenhouse Gas (GHG) emissions reduction targets for each MPO for 2020 and 2035 as compared to 2005 levels. StanCOG's 2022 RTP/SCS GHG emission reduction targets, as provided by CARB, are summarized in **Table 1** below.

Table 1 – StanCOG GHG Emissions Reduction Targets

MPO	2020 Target	2035 Target
StanCOG	-12%	-16%

The technical methodology described in this document satisfies the requirements of SB 375 and is consistent with the original Regional Targets Advisory Committee (RTAC) target setting process, as well as the CARB target revision process initiated in 2016. For the 2022 RTP/SCS, the Stanislaus Council of Governments (StanCOG) modeled 2005 as the base analysis year, 2019 as the base year for the 2022 RTP/SCS, and 2020 and 2035 as the target analysis year for the purposes of SB 375. **Table 2** summarizes the analysis years for compliance with SB 375.

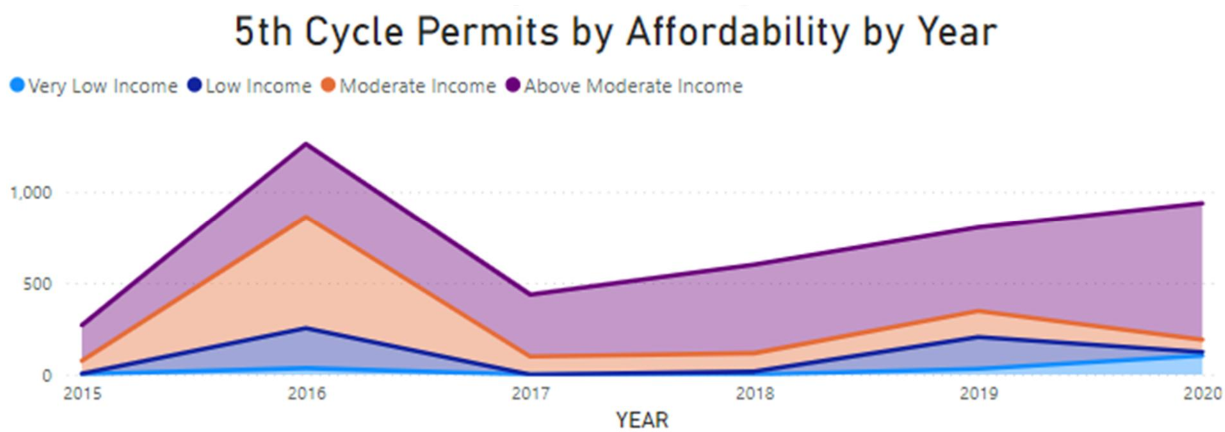
Table 2 – StanCOG's 2022 RTP/SCS Analysis Years

Analysis Year	Purpose
2005	Base Year for SB 375 GHG Emission Reduction Target Setting
2019	Base Year for 2022 RTP/SCS
2020	SB 375 GHG Emission Reduction Target
2035	SB 375 GHG Emission Reduction Target
2046	Horizon Year for 2022 RTP/SCS

2.0 Overview of Existing Conditions

Since the adoption of the 2018 RTP/SCS, the region has experienced continued job and housing growth driven by economic expansion throughout California and escalating home prices in surrounding regions. Modesto, the region's largest jurisdiction, adopted a new General Plan in 2019 and is working proactively to reduce barriers to housing production through an SB2-funded housing plan. In addition, all of the region's jurisdictions have continued to make progress toward their Cycle 5 regional housing needs allocation (RHNA) targets as shown in **Figure 1** the regional increase in annual residential permits summarized below.

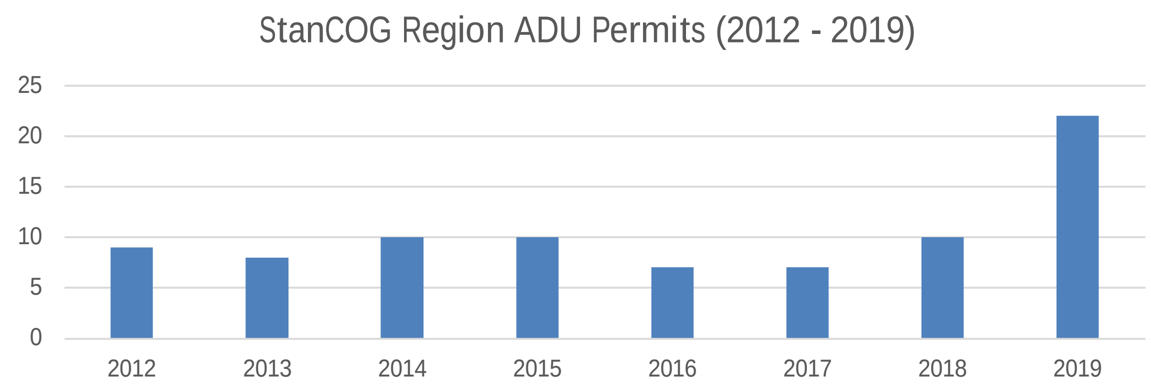
*Figure 1: StanCOG Cycle **5** (2015 - 2020) Residential Permits / Source: HCD*



In terms of transportation, progress over the last four years was the result of state funding for equity and sustainability planning such as StanCOG's Non-Motorized Transportation Plan (2021). The region is also preparing for several the expansion of Altamont Corridor Express (ACE) rail service that will eventually connect several Stanislaus County jurisdictions to the Bay Area.

Aside from progress made at the local level to implement General Plans and invest in transportation infrastructure, new state statutes have also influenced development patterns across the region. These include policies to reduce vehicle miles traveled (VMT) (SB 743) and policies aimed at encouraging auxiliary dwelling units (ADUs) (AB 68, AB 881, AB 670) which have likely influenced increased ADU production in the region as shown in **Figure 2**.

Figure 2: StanCOG Region ADU Permits (2012 - 2019) / Source: HCD



3.0 Population and Employment Growth Forecasts

The University of the Pacific Center for Business & Policy Research developed population, housing and employment forecasts for the Stanislaus region for use in StanCOG's 2022 RTP/SCS Update[1]. The economic and demographic forecasts were prepared using the REMI model (Regional Economic Models, Inc.), an econometric regional forecasting model. One of the strongest features of the REMI model is its integrated dynamic feedback between economic and demographic variables. The REMI model uses historical data from several government sources to estimate economic and demographic forecast predictions at national and regional levels. The model first makes projections at the national level, because the national forecast is an input used for the regional forecasts. The UOP's REMI model forecasts were generated at the County level, the smallest geography available for the REMI model. The County level forecast was then broken down to local areas using growth trends from available local data, with adjustments for consideration of local market factors and plans, based on UOP's local knowledge and consultation with local officials.

For the purposes of completing modeling to support the RTP/SCS, the Bureau of Economic Analysis (BEA) employment-based estimates provided by UOP were refined by StanCOG to limit them to the definition of employment used by the Bureau of Labor Statistics (BLS). A BLS employment forecast includes payroll/employee jobs covered by unemployment insurance, whereas a BEA employment forecasts adds self-employment (including 1099, gig workers, etc.). Given that the BEA definition includes employment that would not be appropriate for use in the StanCOG travel demand model (by default the TDM would generate commute and other trips for all employment types even those, that in the case of some BEA employment types, would not generate trips), the BLS numbers are more appropriate to use as the basis of the analysis contained herein.

[1] *Stanislaus County Demographic and Employment Forecast*. University of the Pacific Center for Business & Policy Research. June 7, 2021.

Like many areas in California, Stanislaus County has experienced a slowing of population growth in recent years. Population growth in the past decade peaked in 2016 and by 2019, Stanislaus County population growth is estimated to be back at the levels seen during the Great Recession. The Census Bureau's 2019 population estimate was lower than the baseline REMI forecast due to a lower level of net migration and slightly lower births. Thus, the amount of migration into Stanislaus County in the REMI model was reduced by 1,900 individuals in 2019 and the 2019 birth rate was lowered by 0.05% so that the REMI forecast growth for 2019 would more closely matched Census estimates.

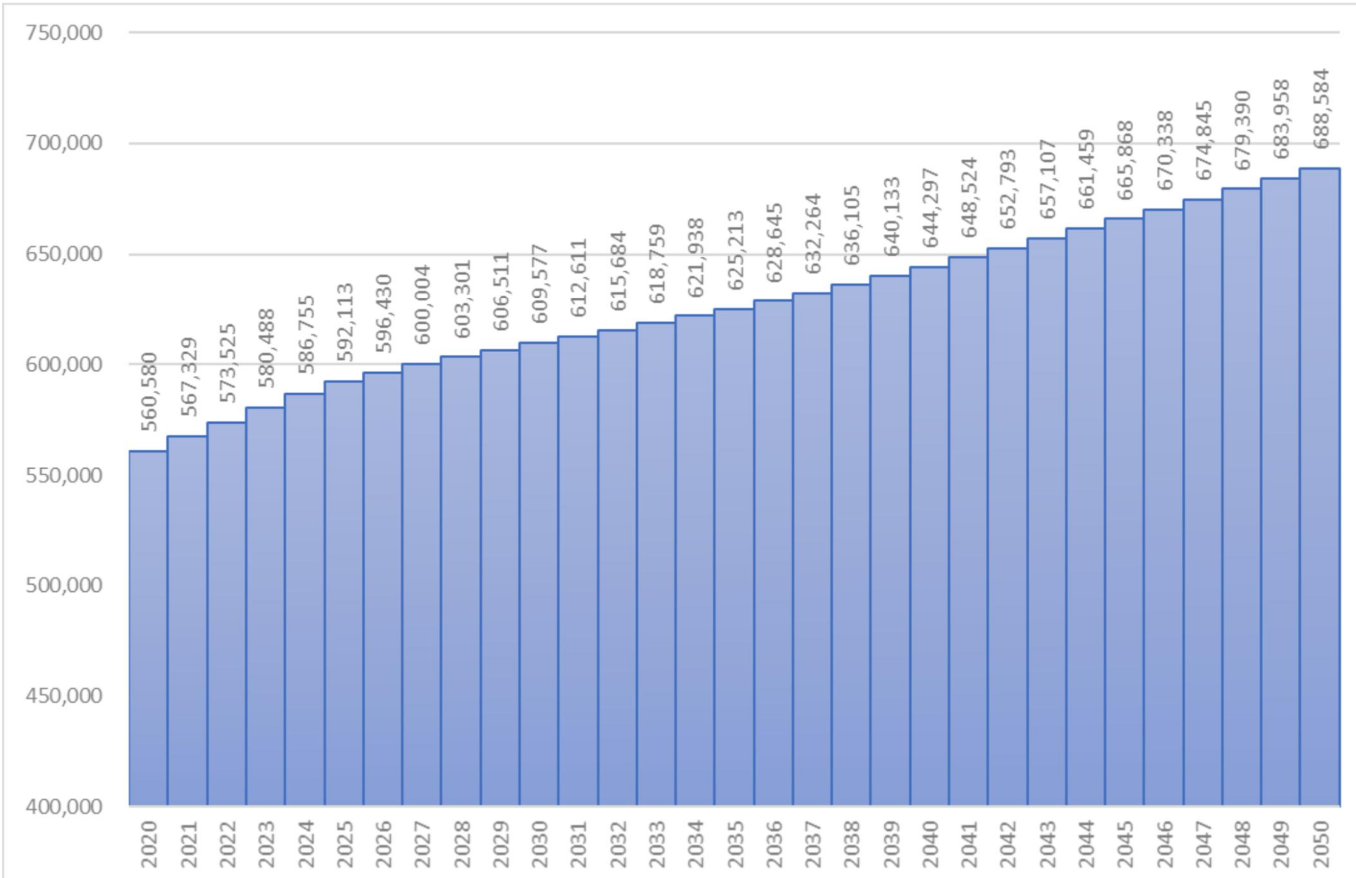
A summary of demographic forecasts for Stanislaus County is provided below in **Table** 3. Note that it includes several years that were interpolated to meet the analysis requirements of the RTP/SCS. A more detailed breakdown of the population forecast and the household forecast are provided in **Figure 3** and **Figure 4**, respectively. Note that as described previously that the employment forecast provided in **Table 3** has been refined to reflect only the BLS definition of employment.

*Table **3** – Summary of StanCOG Demographic Forecasts*

StanCOG	2005	2020	2035	2040	2046*
Total Population	503,191	560,580	625,213	644,296	670,411
Total Households	171,960	183,229	208,137	215,916	224,290
Total Employment	178,368	201,680	234,246	240,669	249,452

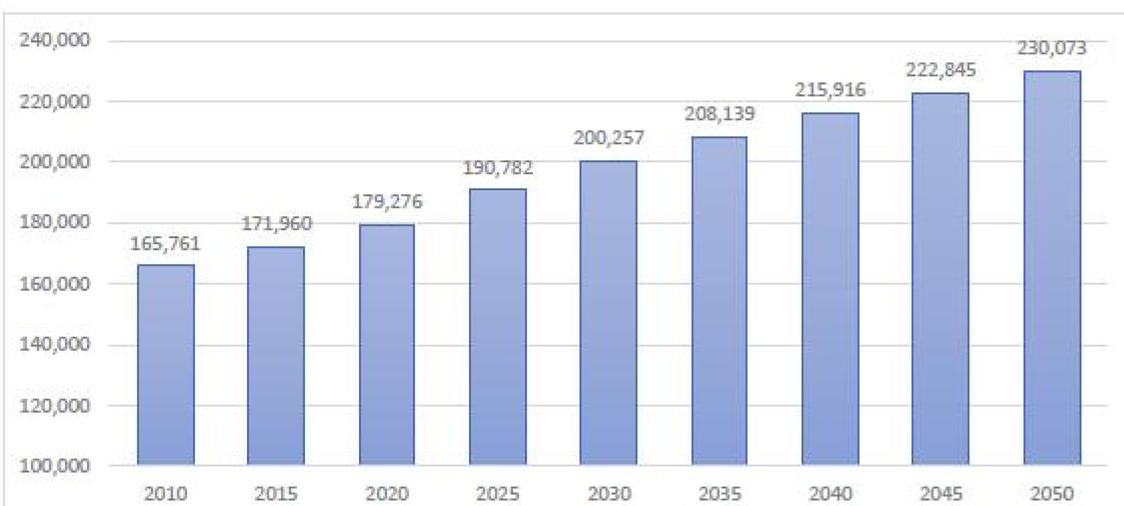
Source: 2021 Stanislaus County Demographic and Employment Forecast (University of Pacific), June 7, 2021
*Interpolated to meet the analysis requirements of the RTP/SCS

Figure 3 - Population Forecast for Stanislaus County



Source: 2021 Stanislaus County Demographic and Employment Forecast (University of Pacific), June 7, 2021

Figure 4 - Household Forecast for Stanislaus County



Source: 2021 Stanislaus County Demographic and Employment Forecast (University of Pacific), June 7, 2021

For the purposes of estimating travel within the StanCOG region, Envision Tomorrow is being used to transform the population and employment estimates into scenarios that can be analyzed using StanCOG's travel demand model. Envision Tomorrow is an open-access scenario planning package that allows users to analyze how their community's current growth pattern and future decisions impacting growth will impact a range of measures beyond just those resulting from travel demand analysis. The analysis tools within Envision Tomorrow allow users to analyze aspects of their current community using commonly accessible GIS data, such as tax assessor parcel data and Census data. The scenario painting tool allows users to "paint" alternative future development scenarios on the landscape and compare scenario outcomes in real time. A description of the draft scenarios under development using the Envision Tomorrow software are described in the next section.

4.0 2022 RTP/SCS Scenario Descriptions

In addition to relying on the population and employment forecasts presented in the prior section, StanCOG's scenario development process relied heavily on community engagement. StanCOG's comprehensive community engagement process was designed to solicit input from stakeholders and community members on priorities for the region's long-term transportation future. The overall community engagement process is continuous, coordinated, and comprehensive, with public engagement throughout the RTP/SCS planning process.

During development of the 2022 RTP/SCS, community members were primarily engaged online due to COVID restrictions. One of the benefits of this approach, irrespective of COVID requirements, is the ability for the public to be engaged throughout the County without having to travel to public workshops and community forums. Online meetings were held on days of the week in order to have the broadest section of the public engaged. In addition, all public meetings include the availability of Spanish translation services to encourage participation from transportation disadvantaged communities. Through this process, the foundational elements of the 2022 RTP/SCS – policies, projects, investment strategies, and land-use assumptions were considered, identified/developed identified and evaluated according to the preferences and priorities for Stanislaus County citizens and stakeholders. Public opinion on the scenarios was solicited using online survey via the project website, public comments and live workshop polling. Other major elements of the community outreach efforts included:

- Regular meetings with StanCOG 's Valley Vision Stanislaus Steering Committee which includes representation from all of the cities and unincorporated county
- Presentations to City Councils, County Board of Supervisors, StanCOG's Bike Ped, Citizens, and other Advisory Committees.
- Three (3) rounds of public workshops that included 2 different meeting times with available Spanish interpretation
- Two (2) rounds of Community Based Organizations (CBO) and Stakeholder/Business representative focus groups with available Spanish interpretation

- A project dedicated website (valleyvision2046.com) that allowed members of the community access information on the RTP/SCS, provide input on the RPT/SCS, to register to receive regular emails so that they are aware of upcoming events, and to view prior event recordings.

In terms of the scenarios, four emerging trends received special attention during their development:

- Climate change - floods, droughts, and their impact to agriculture land and productivity
- Lifestyle changes - working, shopping, schooling from home is changing travel patterns and housing needs
- Transportation technology - Autonomous vehicles (Avs), electrification, and micro mobility is resulting in the need to rethink not only transportation investments, but also land use patterns
- Demographic trends - aging population and in-migration of Latinx populations will require housing options for seniors and multigenerational families

Four distinct RTP/SCS draft scenarios were developed for analysis and consideration (additional scenarios may be introduced). These scenarios include:

- Scenario A: "Stay the Course" – Under this scenario, the region chooses to move forward with the investments and policies in the 2018 RTP/SCS. Primarily this results in the County's growth being focused in new growth areas. This scenario is also valuable and necessary for the purposes of evaluating plan over plan performance as required by CARB.
- Scenario B: "City Retrofit" – Under this scenario, growth is prioritized on underutilized land along the region's aging commercial corridors and downtowns. This scenario, responds to the potential that some land may no longer be needed as a result of increasing numbers of workers working from home.
- Scenario C – "Complete Communities" – Under this scenario, new growth areas are reimagined to include a broader range of housing types and mix of uses. Growth is focused in new growth areas, but at higher densities and with greater mixes of uses. Some additional infill in neighborhoods would occur as well.
- Scenario D – "Neighborhood Infill" – Under this scenario, established neighborhoods transform over time to accommodate a diverse range of housing types. Growth is focused in neighborhood infill areas, and to a lesser extent along corridors. This scenario includes consideration for more robust effects resulting from Senate Bill (SB) 9 and SB 10. SB 9 enables homeowners to more easily subdivide their current residential lot and SB 10 allows local governments to zone any parcel for up to 10 residential units if located within a transit priority area enabling them to be exempted from the California Environmental Quality Act (CEQA).

5.0 Quantification Approaches

StanCOG's integrated modeling and forecasting system serves as a conduit between local jurisdictions and StanCOG by:

- Integrating locally vetted data and plans into StanCOG models for the analysis of regional plan performance; and
- Providing directional and order-of-magnitude impacts of local land use and policy decisions that assist in the development of regional plans and associated scenario analyses.

Table 4 details the quantification approaches that were undertaken in support of reporting required SB 375 GHG results.

*Table **4** – StanCOG 2022 RTP/SCS Strategy Quantification Approaches*

RTP/SCS Strategy	Quantification Approach
Targeted infill/increase density	Travel Demand Model
Bus Service	Travel Demand Model
Bicycle Projects	Off-Model
BRT Modesto	Off-Model
ACE Forward (passenger rail service extension)	Off-Model
Telecommuting	Off-Model
Rule 9410 (Transportation Demand Measures)	Off-Model
Electric Vehicle Incentive Strategy	Off-Model
Electric Vehicle Infrastructure Charging Incentive Program	Off-Model
Transportation System Management/ Intelligent Transportation Systems	Off-Model
Van Pool Program (Calvans)	Off-Model
VMT Mitigation Banking	Travel Demand Model/ Off-Model

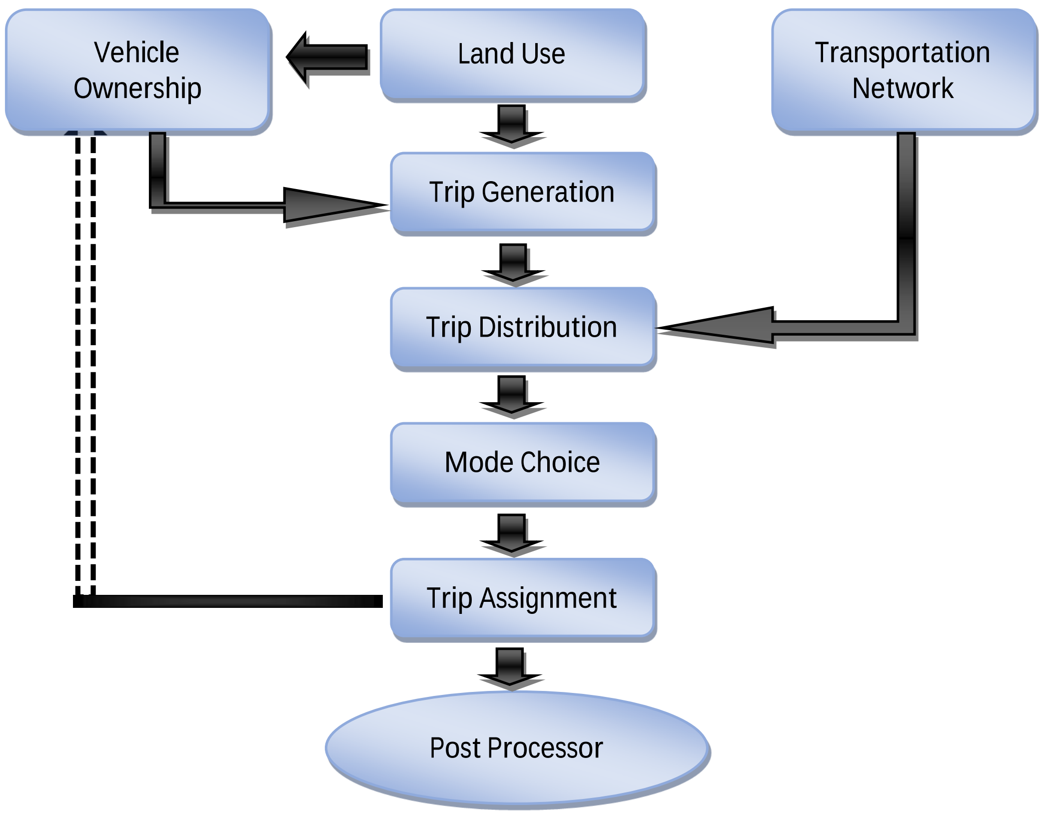
The quantification approaches identified above utilized the following tools for the purposes of informing the estimation of GHG emissions for the 2022 RTP/SCS:

- **Population/Employment Forecasting Model** – REMI Policy Insight Model (Section 3.0)
- **Land Use Planning Tool** – Envision Tomorrow Scenario Planning/Land Use Model (Section 3.0)
- **Transportation Model** – StanCOG Travel Demand Model (Section 6.0)
- **Induced Demand Estimation Model** - California Induced Travel Calculator (Section 6.0)
- **Active Transportation Evaluation** – Geographical Information System (GIS) analysis relying on NCHRP 552 methodologies (Section 9.0)
- **Transportation Demand Measures** - TRIMMS software (Section 9.0)
- **Air Quality Model** – EMFAC 2014 Emissions Factor Model

6.0 Land Use/Travel Demand Modeling

StanCOG develops and applies state-of-the-art models, integrated into a comprehensive modeling and forecasting framework to develop growth projections, travel forecasts, and emissions estimates to support the Region's various planning programs. StanCOG has developed a sub-area version of the MIP2 travel demand model for the 2022 RTP/SCS. This sub-area version reduced the 3-County MIP2 travel demand model to a 1-County model covering only the Stanislaus County area for the purposes of improving model performance and validation. The 1-county StanCOG model was updated with sociodemographic detail (as described under section 3) and current roadway network refinements reflecting planned projects to support the development of the 2022 RTP/SCS. **Figure** 5 below is the StanCOG Modeling Framework.

*Figure **5** - StanCOG Modeling and Forecasting Framework*



Model Sensitivity Discussion

The Model does not require a sensitivity analysis as it is a sub area version model of the prior model and retains the prior models' assumptions and modeling methodologies. Model output has been evaluated to confirm that model performance is consistent.

Induced Demand Overview

Given the rural nature of Stanislaus County, the induced vehicle travel effects of roadway expansion projects are anticipated to be substantially dampened. Although the StanCOG Model does not explicitly evaluate induced travel from the perspective of destination change from new land uses, increasing auto dependency, or newly generated induced trips previously suppressed by congestion, these effects may be negligible at the regional level compared to the overall amount of travel. However, in order to address specific CARB requirements, an induced demand analysis consistent with stated CARB requirements was undertaken. Given the many limitations of this analysis, the additional VMT identified during the course of this analysis should be considered a worst-case scenario and is included strictly for the purpose of demonstrating SB 375 target compliance under those conditions. Note that based on these considerations, that the analysis of induced demand described in the next section, was limited to SB 375 analysis requirements within the RTP/SCS and SB 743 analysis requirements within the accompanying Environmental Impact Report.

Short-term induced travel is caused by the immediate change in speeds and travel when a new roadway capacity expansion project is open to traffic (i.e., a Build compared to a No Build scenario). The research shows a short-term elasticity of 0.1 to 0.60 for induced VMT. Long-term induced vehicle travel effects consider the influence on land use and growth patterns over time.

Induced Demand Methodology

In order to account for induced demand (both the short-term and long-term effects) in a manner consistent with stated CARB requirements, it was determined that the vehicle miles traveled (VMT) data obtained from the travel demand model would need to be augmented using the California Induced Travel Calculator[2]. This calculator allows a user to estimate the total (both short-term and long-term) induced demand VMT annually added as the result of the new construction of general-purpose lane miles, high-occupancy vehicle (HOV) lane miles, or high-occupancy toll (HOT) lane miles. In particular, induced demand analysis is required by CARB for SB 375 analysis for Federal Highway Administration functional classifications of Interstate (class 1), other freeway and expressways (class 2), and other principal arterials (class 3). For the purposes of analysis, it is assumed that the travel demand model accounts for the short-term effects of induced demand.

Note that the calculator has some limitations to accurately predicting long-term induced demand. This includes the fact that a majority of the data used in the research studies ranges from the 1980s to the early 2000s and this time period may not be reflective of current VMT trends. In addition, the elasticities used in the calculator are not sensitive to land use context, geographic constraints (e.g., water or topography barriers), or the amount of existing congestion. Without sensitivity to project context, the calculator results may over- or under-estimate induced VMT effects. Finally, in uncongested suburban and rural areas, the VMT forecasts from the calculator may be unreasonably high and would not be compatible with observed trip rates and trip lengths within Stanislaus County. Without congestion, vehicle trip rates and lengths are not influenced or suppressed in these areas meaning no new trips would occur with the additional capacity. This lack of sensitivity to land use and congestion context means that adding lane miles in an area with no congestion will have the same proportional

[2] https://travelcalculator.ncst.ucdavis.edu

effect as adding lane miles in an urban area with multiple hours of congestion, an unreasonable outcome.

To determine the elasticity associated with the short-term induced demand required undertaking an analysis that accounted for the induced VMT produced by the travel demand model. This would then allow the short-term induced VMT to be deducted from the total induced VMT calculated by the calculator, so that only the portion of induced demand not accounted for by the travel demand model (the long-term induced demand) would be added to a given scenario's total VMT for the purposes of GHG analysis.

In order to determine the elasticity associated with the short-term induced demand for the travel demand model, a sensitivity analysis was undertaken. Using the base year scenario for the travel demand model, three different segments of SR-99 within Stanislaus County were widened by one lane, one segment per model run for a total of three model runs. For each of these model runs the total lane miles and vehicle miles traveled (VMT) were calculated by taking the difference total lane miles and total VMT between each of the three sensitivity runs and the unmodified base year. A weighted average added VMT was calculated based on the added lane miles and a simple average of lane miles was also calculated. The elasticity of the travel demand model with respect to induced demand was calculated by dividing the proportion of added VMT to the total VMT by the proportion of added lane miles to the total lane miles. This resulted in a short-term elasticity of 0.22 for the travel demand model related to induced demand.

The greater the elasticity, the greater the increase in VMT from a given increase in roadway capacity. An elasticity of 1.0 indicates that a given percent increase in lane miles will cause the same percent increase in VMT. In general, studies show that a 10-percent increase in roadway capacity is likely to increase network-wide VMT by 6 to 10 percent (an elasticity of 0.6 to 1.0) in the long run (5 to 10 years), with greater elasticities for expansions of major highways (e.g. interstates) than for capacity increases on other roadways. Based on the accompanying documentation ti , for total induced demand, an elasticity of 1.0 is used for lane additions to interstate highways, while an elasticity of 0.75 is used for lane additions to class 2 or 3 facilities (expressways and major arterials).

Subsequently, for the purposes of SB 375 and SB 743 analysis, each future capacity enhancing project identified as a class 1, 2, or 3 facility was evaluated to determine the additional VMT that should be added to a scenario total to represent the induced demand that is not accounted for by the travel demand model. Based on the research cited as the basis of the calculator, it is understood that long-term effects occur between 5 and 10 years after the opening date[3]. For the purposes of analysis, it was assumed on average that a project would realize its full long-term induced demand effects at 7.5 years (the midpoint between 5 and 10 years). As such each project had its long-term induced demand effect prorated if its opening date was less than 7.5 years from 2035. The resultant long-term induced demand for each project was then summed together and added to the VMT total for each scenario.

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[3] https://travelcalculator.ncst.ucdavis.edu/about.html

7.0 List of Variables and Assumptions for Use in the RTP/SCS

Table 5 lists the major variables and assumptions that influence the outcome of travel demand modeling completed in support of evaluating the RTP/SCS.

Table 5 – List of Exogenous Variables for use in the 2022 RTP/SCS

Category of Variable (as applicable)	Variable Specification in Model	Example Assumption in 2035
Demographics	Population, Households & Employment	Population: 625,213 Households: 208,137 Employment: 234,246
Auto Operating Cost	Fuel and non-fuel related costs	Cents/mile: 0.248
Vehicle Fleet Efficiency	EMFAC 14 model	Average fuel economy: 21.7
Household Income	Census Tract distribution	Median income: $48,817
Household Demographics	Household size, workers, age	HH Size: 3.00 Workers: 1.13
MPO Travel Demand Model Version		StanCOG MIP2 Subarea Version of Trip-based Model

The auto operating cost is based on a weighted average of auto operating costs for gasoline powered vehicles, diesel powered vehicles, electric powered vehicles and plug-in hybrid electric vehicles. The operating cost for each type of vehicle is developed using costs for fuel, fuel efficiency of the vehicles, and non-fuel-related operating costs. The weighted average operating cost is calculated by taking the operating cost for each type of vehicle and weighted the average based on the total VMT produced within the StanCOG region for each vehicle type.

Auto operating costs were updated for the 2022 RTP/SCS consistent with CARB's SCS Program and Evaluation Guidelines. The final Auto Operating Costs (AOC)/calculation, for which CARB provided concurrence on the Methodology, is being employed.

8.0 Per Capita GHG Emisssions from Prior RTP/SCS

StanCOG has tested the previous RTP/SCS Preferred Scenario using the updated exogenous variables for the 2022 RTP/SCS for plan over plan comparison. StanCOG used this approach for the 2018 RTP/SCS and included the results in the data table submitted to CARB for RTP/SCS evaluation.

9.0 Off-Model Strategies

Similar to other traditional four-step travel demand models, the Stanislaus County travel demand model is not sensitive to the impacts of all transportation policy and program strategies. In these instances, StanCOG will rely on "off-model" adjustments using methodologies commonly used in literature, previously approved or cited by CARB, and consistent with the other MPOs. Specifically, the following off-model adjustments were performed for quantification of GHG reduction benefits:

Active transportation projects (Tier I Bike Improvements)

The total number of new cyclists in 2035 resulting from the 2022 RTP/SCS active transportation improvements is estimated to be 18,507 persons (including commuters and recreational cyclists). The total daily reduction in vehicle miles traveled is anticipated to be 91,865 miles.

Methodology

The number of new cyclists was estimated using the National Cooperative Highway Research Program (NCHRP) 552 methodology provided in the *Guidelines for Analysis of Investment in Bicycle Facilities.* The NCHRP 552 report provides national level research that suggest commute mode share can be used to extrapolate a more general mode share for bicycles using a best fit formula. In subsequent validation, the report suggests that the results of this analysis are typically within the 95% confidence interval, and when they are not, they provide a conservative estimate.

NCHRP 552 provides methodology and assumptions to measure and forecast the demand for bicycling based on population and employment data. The total number of new cyclists anticipated is based on the 2022 RTP/SCS future land use (Scenario D) population and employment data. Given that population is not a model parameter, future year population by TAZ was estimated by multiplying future households by TAZ with a household occupancy factor. The latter was based on the baseline (2015) countywide household and population estimates developed by UOP.

Using the Stanislaus County travel demand model zone structure and associated 2035 land us data used for the 2022 RTP/SCS, the amount of population and employment within a half mile, mile and mile and a half of the proposed bicycle facilities included in the 2022 RTP/SCS Capital Improvement Program (CIP) project list was determined. Only those improvements reported in sufficient detail, including location and improvement limits, could be analyzed. Other inputs, such as bicycle mode share of commute trips (0.4%), and adult population percentage of the total population (80%), based on NCHRP recommended values. Similarly, several projects include pedestrian improvements that would likely increase walking activity, which is not captured by this analysis.

Applying the NCHRP 552 methodology to the pedestrian/bicycle improvements yields 1,069 new commute cyclists and 10,414 new non-commute cyclists. The total reduction in vehicle miles traveled was estimated based on an 8-mile average roundtrip commute distance, assuming adult cyclist trips replace vehicle trips. The NCHRP 552 analysis generates three demand response estimates: low, moderate, and high. In this case, the high estimate was chosen for the following reasons:

1. This assessment does not capture the full extent of active transportation investments, as many bicycle improvement descriptions lacked the requisite detail to include in the analysis.
2. Stanislaus County is conducive to cycling due to the flat terrain and moderate weather.
3. Many of the active transportation improvements included new Class I and Class II facilities, which typically encourage bicycle use.

Modesto BRT

The 2022 RTP/SCS includes a proposed new BRT service between West Modesto and the Vintage Faire Mall. The proposed service was assumed to run with 15-minute headways during peak periods with a total of 48 round trips each day with a stop each ½ mile.

Ridership was estimated by determining the number of people that both live and work within the study area and the average transit commute mode share in Modesto. The study assumed a 1% capture for those that could use the service for part of their commute, and 5% capture for those that could use it for their entire commute. The result was 689 daily commuters. APTA research has shown that commute trips account for just under half of all transit ridership, so another 689 daily trips were added for non-commute purposes.

The Bus Rapid Transit Practitioners Guide has published elasticities for ridership increases that accompany many BRT system attributes. For this project, it was assumed to include branded stops/stations (15% increase), branded vehicles (15% increase), system branding (10% increase), and the 15-minute peak headway (20% increase). These led to a future daily ridership estimate of 2,203 trips per day.

If it is assumed that the average one-way trip is half the length of the route, 2,203 daily trips would account for 30,845 less auto VMT per day.

ACE Forward

The StanCOG 2022 RTP/SCS includes an extension of the Altamont Commuter Express (ACE) through Stanislaus and Merced Counties with stops in Modesto, Ceres, and Turlock. The service would then continue to the city of Merced. ACE service would include one train per day in each direction between Stanislaus County and San Jose, and three trains per day between Stanislaus County and Sacramento. For the purposes of this analysis, it was assumed that all four trains would operate with seven-passenger cars capable of transporting up to 70 people apiece. This could displace as many as 1,960 single occupant vehicles each day. The three Sacramento-bound trains would offer a transfer at Lathrop for those traveling to Alameda County or San Jose.

The Longitudinal Employment and Housing Dynamic (LEHD) was used to quantify the number of people whose commute patterns would most likely be able to take advantage of the ACE services. Commuters living within four miles of the proposed stations in Modesto, Ceres, Turlock, Livingston, and Merced who work within one mile of the existing ACE stations in San Joaquin, Alameda, and Contra Costa Counties, and the proposed station in Sacramento were considered as the likely rider pool.

Table 6 identifies the number of commuters for each station location and the number of daily vehicle miles that could be saved by each rider using that station.

*Table **6** – ACE Station Potential Commute Riders*

Station	Commuters to Other ACE Stations	Percent	Average Stanislaus County Commute Distance (mi)
Modesto	1,394	52.5	8
Ceres	439	16.5	12
Turlock	448	16.9	20
Livingston	63	2.4	25
Merced	310	11.7	25

This group of commuters represent approximately 69,410 single occupant vehicle miles on Stanislaus County roadways each day and a much larger number of miles on Merced, San Joaquin, Alameda, Santa Clara, and Sacramento County roadways. At full capacity, the ACE services would be able to replace nearly 74% of those vehicle miles.

For the purposes of this analysis, it was assumed that 90% of the available capacity would be used on the single train between Merced and San Jose by the time the train departs the station in Modesto, carrying 441 passengers. Assuming those passengers are collected at a ratio similar to their commuting populations as shown in **Table 1**, 11,533 vehicle miles would be saved each day. The Sacramento trains were assumed to be at 50% of their capacity upon departure from Modesto carrying 245 passengers each, or 735 passengers total, saving 19,222 vehicle miles each day for a total of 30,755 vehicle miles with all four trains.

Vanpool program expansion (introduction of CalVans Program in Stanislaus County)

An off-model analysis was performed to quantify the benefits of the projected number of in-service vans and historic demand response in other areas of the state where CalVans provides service relative to an assumed passenger market capture and travel distance within Stanislaus County. This will be completed using the following steps:

1) Calculate the number of full vans implemented by the strategy.
2) Calculate the number of private automobile trips reduced annually based on the occupancy of vanpool vans. It is assumed one private automobile equals one vanpool passenger.
3) Calculate the adjusted automobile miles traveled per trip. The formula takes into account the variability in driving behaviors of potential vanpool participants prior to the launch of the project, including the number of drivers that would drive to a vanpool location and the number of vanpool riders that drive alone.

4) Calculate total adjusted automobile VMT reduced by multiplying the number of trips produced by the average trip length.
5) Obtain displaced private automobile trip CO_2 emission rates from the current version of EMFAC.
6) Calculate the CO_2 emissions of private automobile trips reduced by vanpool service trips.

As a result of implementing this strategy, and as shown in **Table 10**, the region's VMT and GHG would be reduced by 0.05%, accounting for 1.95 tons of daily GHG emissions.

Rule 9410 Employer Trip Reduction (which includes various strategies facilitated by DIBS)

An off-model analysis was performed to quantify the benefits of Rule 9410 Employer Trip Reduction based on a dual assessment using TRIMMS software. StanCOG's RTP/SCS will document these analyses and VMT reduction results as a separate document in the technical appendices of the 2022 RTP/SCS. The purpose of Rule 9410 is to reduce vehicle miles traveled (VMT) from private vehicles used by employees to commute to and from their worksites to reduce emissions of oxides of nitrogen (NOx), volatile organic compounds (VOC) and particulate matter (PM). The trip reduction and administrative requirements of this rule apply to each employer in the San Joaquin Valley Air Basin with at least 100 Eligible Employees at a worksite for at least 16 consecutive weeks during the employer's previous fiscal year, that is located either:

1) Within an incorporated city with a population of at least 10,000, as determined by the Demographic Research Unit of the Department of Finance, or
2) Within an incorporated city with a population of less than 10,000, as determined by the Demographic Research Unit of the Department of Finance, and more than 50 percent of their employees work at least 2,040 hours per year, or
3) Within the unincorporated area of a county, and more than 50 percent of their employees work at least 2,040 hours per year.

The analysis required the collection of the number of Tier 1 worksites (worksites with 100-249 employees) and Tier 2 worksites (worksites with 250+ employees), the total base year employment (obtained from the travel demand model or elsewhere), the base year home-based work (HBW) trip length, the analysis year total employment (obtained from the travel demand model), and the analysis year HBW trip length.

As shown in **Table 10**, as a result of implementing this strategy including associated reductions related to telecommuting, the region's VMT and GHG would be reduced by 2.84%, accounting for 108.54 tons of daily GHG emissions.

Electric Vehicle Incentive Strategy

An off-model analysis was performed to quantify the benefits of implementing a strategy to incentivize residents to switch from internal combustion engine (ICE) vehicles to electric or zero emission vehicles (ZEV). StanCOG's RTP/SCS will document these analyses and the associated

Greenhouse Gas (GHG) emission reductions that result as a separate document in the technical appendices of the 2022 RTP/SCS. The GHG emission reduction calculations were completed using the following steps:

1) Identify the total funding (Total Program Funds) allocated for the subsidy/rebate program established by StanCOG.
2) Identify the individual ZEV subsidy/rebate amount for the subsidy/rebate program established by StanCOG.
3) Estimate the number of new ZEV's (Total Program ZEV) that could be purchased through the subsidy/rebate program established by StanCOG.
4) Identify the average trip length of vehicle trips to be replaced by a ZEV. One option includes using the daily usage for a vehicle (miles per day per vehicle) from EMFAC.
5) Calculate the average total eVMT from all trip purposes (ZEV VMT) associated with new ZEVs purchased through the incentive program
6) Obtain the average regional GHG emission factors for new non-ZEVs replaced by new ZEVs purchased through the incentive program from the most recent version of EMFAC.
7) In addition to StanCOG's incentive program, if other rebate or incentive programs are utilized for the Electric Vehicle Incentive strategy (e.g., CVRP), calculate StanCOG's fraction of overall EV incentives provided.
8) Calculate GHG emission reductions from new non-ZEVs replaced by new ZEVs purchased through the incentive program. For this strategy a battery electric vehicle is required to be purchased, thus the ZEV EF can be assumed to be 0 g/mi.

As a result of implementing this strategy, and as shown in **Table 10**, the region's VMT and GHG would be reduced by 0.19%, accounting for 7.34 tons of daily GHG emissions.

Electric Vehicle Infrastructure Charging Incentive Program

An off-model analysis was performed to quantify the benefits of providing additional electric vehicle charging infrastructure. StanCOG's RTP/SCS will document these analyses and Greenhouse Gas (GHG) emission reductions that result as a separate document in the technical appendices of the 2022 RTP/SCS. The GHG emission reduction calculations were completed using one of two of the following methods:

1) Estimate CO2 emission reductions from PHEV eVMT based on estimated average VMT shift per PHEV from gasoline to electricity (cVMT to eVMT) as a result of increased workplace and public charges.
    a. Part 1: Estimate EV population associated with the strategy.
    b. Part 2: Estimate eVMT associated with the strategy.
    c. Part 3: Estimate CO_2 emissions associated with the strategy.
2) Estimate the GHG reductions based on electricity consumptions of EV Chargers associated with this strategy.
    a. Estimate the CO_2 reductions per unit amount of electricity consumption (i.e., convert cVMT to eVMT) in the StanCOG region.

b. Estimate the electricity consumption per charger by changer type. Supporting documentation for the charger efficiency parameters will be provided.
c. Identify the number of workplace EV chargers by charging type installed in the StanCOG region as part of the strategy.
d. Estimate the average number of EVs per charger installed by charger type.
e. Determine the total regional electricity consumption from EVs associated with the installation of EV charging infrastructure.
f. Determine the total regional GHG emission reductions due to the installation of EV charging infrastructures.

As a result of implementing this strategy, and as shown in **Table 10**, the region's VMT and GHG would be reduced by 0.16%, accounting for 5.96 tons of daily GHG emissions.

Transportation System Management (TSM)/Intelligent Transportation Systems (ITS) Strategy

An off-model analysis was performed to quantify the benefits of implementing a Transportation System Management (TSM)/Intelligent Transportation Systems (ITS) strategy within the StanCOG region. StanCOG's RTP/SCS will document these analyses and the associated VMT and GHG emission reductions that result as a separate document in the technical appendices of the 2022 RTP/SCS. The VMT and GHG emission reduction calculations were completed using the following steps:

1) Identify the amount of funding for a particular TSM strategy
2) Identify the unit cost of installation and/or maintenance of the specific TSM-related system
3) Calculate the approximate number of TSM-related system(s) the given funding would allow.
4) Gather the average hourly travel speed and VMT (VMT) of the affected roadway network.
5) Based on the proposed number of and type of TSM-related systems, estimate the impact of the proposed TSM strategy to travel speed from empirical literature.
6) Estimate the CO_2 emission factors for travel speeds with and without the effects of the TSM strategy using the latest EMFAC model.
7) Estimate the effects of the TSM strategy on CO_2 emissions.

As a result of implementing this strategy, and as shown in **Table 10**, the region's VMT and GHG would be reduced by 0.69%, accounting for 26.17 tons of daily GHG emissions.

Vehicle Miles Traveled (VMT) Mitigation Bank/Exchange Program

An off-model analysis was completed to determine the reduction that a planned regional VMT Mitigation Bank/Exchange program could reduce vehicle miles traveled and GHG emissions by in 2035. The focus of this analysis is to quantity the VMT that would need to be mitigated to reach a threshold of 15% below the regional average for new residential (VMT/capita) and employment-based (VMT/employee) development under the preferred scenario. This value was used to establish a reasonable regional VMT and GHG percent reduction that can be attributed to the VMT Bank/Exchange's implementation. For the purposes of establishing a conservative value, the following was assumed:

- Only new development that is anticipated to be occur by 2035 was considered in the SB 375 analysis.
- It was assumed that participation in the VMT Bank/Exchange would be capped at 20%, irrespective of the amount of VMT that may be required to mitigate a future development. This was done to maintain a conservative estimate as to the limits of feasible mitigation based on the assumption that it may not be financially feasible to fully mitigate all development projects requiring mitigation.
- Employment-based VMT analysis was limited to an evaluation of employee commute trips only

The anticipated VMT reduction that will result from the implementation of a VMT Mitigation Bank/Exchange is summarized in **Table 8**. As shown, for the total reduction estimated for this strategy is 148,288 VMT. For the purposes of analysis, it is assumed that the resultant VMT reduction as compared to the total daily regional VMT would be the same for GHG emissions.

*Table **8** – Estimate of VMT Reduction*

VMT Reduction Summary - 2035	VMT Quantity
Residential	
2035 New Households	25,762
2035 New Households over Threshold	11,406
2035 New Households under Threshold	14,356
2035 Total VMT over Threshold	256,001
2035 Estimated VMT to be Mitigated (30% Max)	95,994
Employment	
2035 New Employees	42,370
2035 New Employment over Threshold	22,318
2035 New Employment under Threshold	20,052
2035 Total Commute VMT over Threshold	277,152
2035 Estimated Commute VMT to be Mitigated (30% Max)	109,000
Total	
2035 Estimated VMT to be Mitigated (30% Max)	204,994

10.0 Analysis and Results

The following four scenario themes were developed for StanCOG's 2022 RTP/SCS based on input from the Valley Vision Stanislaus Steering Committee (VVS), general public, and other stakeholders:

- *Scenario A, Stay the Course* - The region chooses to move forward with the investments and policies in the 2018 RTP/SCS.
- *Scenario B: City Retrofit* - Growth is prioritized on underutilized land along the region's aging commercial corridors and downtowns.
- *Scenario C: Complete Communities* - New growth areas are reimagined to include a broader range of housing types and mix of uses.
- *Scenario D: Neighborhood Infill* - Established neighborhoods transform over time to accommodate a diverse range of housing types.

During the course of the 2022 RTP/SCS development, StanCOG refined these scenarios based on input received and their ability to meet federal ambient air quality requirements and state greenhouse gas reduction targets. StanCOG also refined these scenarios in consideration of the additional Vehicle Miles Traveled (VMT) estimated to result from capacity enhancing projects due to induced travel demand. Specifically, the analyses undertaken addressed all prior requirements along with the following new SCS requirements:

- **Increased Greenhouse Gas (GHG) Reduction Targets**. During the last RTP cycle, the GHG targets set by the California Air Resource Board (CARB) required StanCOG to reduce GHG per capita between 2005 and 2035 by 10 percent. For the 2022 RTP/SCS update, CARB has revised the targets for the Stanislaus Region to a 16 percent per capita reduction.
- **Induced Travel Demand Evaluation**. Induced travel demand is the phenomenon whereby there is an increase in travel arising from an improvement in travel conditions. A project that reduces travel time, uncertainty, risks, or expenditures can lead to changes in traveler behavior that can increase the overall amount of travel. For this 2022 update of the RTP/SCS, CARB is now requiring that all MPOs estimate the additional VMT that will result from capacity enhancing projects due to induced travel demand.

Scenario Refinement and Analysis

The refinement of the scenarios included a particular focus on reducing VMT by using residential VMT per capita based Bureau of Transportation Statistics (BTS) estimates from the national household travel survey to further concentrate development in areas of below-average VMT. Note that care was taken during the redistribution of growth to maintain consistency with the original development themes identified for each scenario.

The refined scenarios were first modeled, roughly, at the Traffic Analysis Zone (TAZ) level to see if the effect of these refinements would have a positive impact on reducing VMT, which is the primary input for determining Greenhouse Gas outcomes. As the initial results demonstrated material reductions, they were then modeled at the parcel level using Envision Tomorrow (the land use model that serves as the basis for inputs into the Travel Demand Model). Subsequently, the results from Envision Tomorrow were input into the Travel Demand Model, and those results were entered into EMFAC 2014 (the air quality model) to determine their resultant Greenhouse Gas (GHG) emissions estimates.

The finalized Envision Tomorrow files were analyzed to yield land use-based performance measures for each scenario. The results of the performance metric analysis are presented in Exhibit 1. As shown in Exhibit 1 the scenarios (B, C, and D) improve on nearly every metric as compared to Scenario A, which is representative of anticipated conditions from the prior 2018 RTP/SCS preferred scenario. As shown, it is also noted that among the scenarios, Scenario B, is the least impactful scenario in terms of land use impacts to prime farmland and energy usage. Scenario B, is also anticipated to result in the greatest diversity of residential housing types and the most beneficial distribution of new housing into existing low VMT areas. Meanwhile Scenario A has the highest allocation to High Resource Areas. Finally, Scenario B is identified as having the greatest infill potential for Center/Corridor areas and Scenario D allocates the most to existing neighborhood infill areas.

Although, Scenario B was identified as being the environmentally preferred option for the purposes of CEQA, based on input and discussion received over the course of the study, it was determined that Scenario D would best serve the needs of the community while at the same time supporting the Goals and Objectives of the RTP/SCS while meeting federal ambient air quality requirements and state greenhouse gas reduction targets.

Induced Demand Evaluation

Based on a consultation with CARB staff on January 28th, 2022 and further discussions with other Metropolitan Planning Organizations/Regional Transportation Planning Agencies (MPOs/RTPAs) in the Valley, StanCOG determined that a hybrid method that utilizes data from the travel demand model and the National Center of Sustainable Transportation (NCST) Induced Demand Calculator would serve as the basis for evaluating the effect of induced demand on the 2022 RTP/SCS. This approach relies on the travel demand model to provide information on short-term induced demand effects, which are then deducted from the total induced demand estimate from the NCST Induced Demand Calculator. The resultant induced demand VMT estimate reflects only the long-term additional VMT that was then added to the total VMT for each scenario.

The results of this analysis are presented in **Table 9**. As shown in **Table 9**, the 2035 long-term induced demand resulting from planned transportation improvements is estimated to be 234,325 daily VMT.

Table 9 – 2035 SB 375 Induced Demand Analysis

Roadway Classification	2035 Total Lane Miles	2035 Lane Mile Increase	2035 Induced VMT (Long-Term Only)
Freeway (1)	337.5	25.18	100,425
Expressway & Major Arterial (2 & 3)	3,167.0	101.71	133,900
Total	*3,504.5*	*126.89*	*234,325*

Off-Model Strategies

As described, the StanCOG travel demand model was used to evaluate the land use and transportation project scenarios for the RTP/SCS Update. The model provided VMT estimates and other performance metrics for each scenario. Despite significant improvements to the policy sensitivity and multi-modal utility of travel demand models, the effects of implementing some programs in support of some of the SCSs developed must still be handled by post-processing techniques/operations (Off-Model). Specifically, the model has limitations in its ability to calculate the benefits of transportation improvements/programs such as bike and pedestrian projects, rideshare programs, electrical vehicle market incentives, Transportation Demand Management and Transportation Systems Management (TDM/TSM) projects, such as ridesharing programs and Intelligent Transportation Systems (ITS), respectively.

By applying off-model strategies, the benefits of GHG reducing programs included in the plan, which cannot be estimated by the Travel Demand Model, were be accounted for in determining whether the 2022 SCS, when implemented, would meet the regional greenhouse gas emission reduction targets for both 2020 and 2035 as show in **Table 10**.

Table 10 – StanCOG 2022 RTP/SCS Strategy Quantification Approaches

RTP/SCS Strategy	Quantification Approach	2005	2020		2035	
		GHG (tons)	GHG (tons)	GHG Change (%)	GHG (tons)	GHG Change (%)
Population	UoP Forecast	503,191	560,580		625,213	
VMT	Travel Demand Model	9,129,097	9,159,585		10,057,773	
Long-Term Induced Demand	Travel Demand Model/ Off-Model				234,325	
Total VMT		9,129,097	9,159,585		10,292,098	
Intial GHG Results		GHG (tons)	GHG (tons)	GHG Change (%)	GHG (tons)	GHG Change (%)
GHG Scenario Results	EMFAC	3,531.00	3,413.00		3,732.00	
Long-Term Induced Demand	Off-Model				84.97	2.28%
Total GHG with Induced Demand		3,531.00	3,413.00		3,816.97	
Off Model Reductions						
Bicycle Projects	Off-Model				-34.12	-0.89%
Modesto BRT	Off-Model				-11.44	-0.30%
ACE Forward (passenger rail service extension)	Off-Model				-11.41	-0.30%
Telecommuting	Off-Model		-27.16	-0.80%	-30.37	-0.80%
Rule 9410 (Transportation Demand Measures)	Off-Model		-67.67	-1.98%	-78.17	-2.05%
Electric Vehicle (EV) Incentive	Off-Model				-7.34	-0.19%
Electric Vehicle Infrastructure Charging Incentive Programs	Off-Model				-5.96	-0.16%
Transportation System Management/ Intelligent Transportation Systems	Off-Model				-26.17	-0.69%
Van Pool Program (Calvans)	Off-Model		-2.00	-0.06%	-1.95	-0.05%
VMT Mitigation Banking/Exchange	Travel Demand Model/ Off-Model				-74.33	-1.99%
Results						
Total Off Model Reductions (CO2 Tons)			-96.83		-281.26	
Total CO2 Emissions Per Weekday			3,316.17		3,535.71	
EMFAC Adjustment				-2.47%		-3.24%
GHG/Capita Change from 2005				-13.22%		-16.17%
GHG/Capita Target				-10.00%		-16.00%