

***Technical Methodology to Estimate Greenhouse Gas
Emissions for the 2020 RTP/SCS from the
Butte County Association of Governments***



***Submitted July 24th, 2020
(revised April 2021)***

INTRODUCTION

Purpose

As required by the Sustainable Communities and Climate Protection Act of 2008, and in accordance with Government Code 65080(b)(2)(J)(i), BCAG has prepared this document describing the technical methodology it has used in estimating greenhouse gas emissions from its 2020 Regional Transportation Plan (RTP) and (SCS) Sustainable Communities Strategy. This is intended to be a working document as BCAG, in coordination with the California Air Resources Board (ARB), navigates the development and final acceptance of the 2020 RTP/SCS quantification of greenhouse gas emissions.

Applicable Targets

In 2011, ARB set GHG targets for the BCAG region from passenger vehicles as a 1% increase from 2005 emissions levels by 2020 and a 1% increase from 2005 emissions levels by 2035. BCAG's 2012 RTP/SCS achieved a 2% reduction in per capita GHG emissions for the years 2020 and 2035. Subsequently, BCAG's 2016 RTP/SCS achieved a 6% reduction in per capita GHG emissions for the year 2020 and 7% reduction for 2035.

In 2018, ARB updated the BCAG targets as a 6% decrease from 2005 emissions levels by 2020 and 7% decrease from 2005 emissions levels by 2035. These targets apply to the BCAG region for passenger vehicle emissions, and not to individual cities or sub-regions. The metric used for reporting will be GHG emissions per capita.

Analysis Years

The following table includes the proposed analysis years for BCAG's 2020 RTP/SCS.

Year	Purpose
2005*	Base Year for SB 375 GHG emission reduction Target Setting
2018	Base Year for BCAG 2020 RTP/SCS
2020	SB 375 GHG Emission Reduction Target
2035	SB 375 GHG Emission Reduction Target
2040	BCAG 2020 RTP/SCS Horizon Year

*Note – 2005 baseline information carried over from 2012 and 2016 RTP/SCS

Schedule

Early Outreach (2018)

Prior to development of the 2020 RTP/SCS, BCAG conducted early outreach in mid-2018 with the BCAG Board of Directors, BCAGs various committee's and an early round of public workshops to inform the public regarding the plan and projects and to

solicit early input. Coordination with local agencies also began in 2018 with a review of local development and data. Consultants were obtained to assist with updates of the regional travel and land use models.

Data Development, Modeling, Preliminary Analysis, and Continued Outreach (2019)

In 2019, BCAG worked with its planning and transportation committees to prepare provisional regional growth forecasts, review transportation project priorities, identify the regional road network, update the public participation plan, and prepare an SCS Progress Report to assist in guiding the development of the 2020 RTP/SCS. Development of the land use and travel models resumed, following a 4-month pause due to the Camp Fire, as strategies for completing the plan were re-evaluated. A second public workshop was conducted in November to review the project to-date and the scoping of the environmental analysis.

Preliminary Draft RTP/SCS (Spring & Summer 2020)

Going into 2020, BCAG staff and project consultants prepared the model outputs and analysis for the preliminary draft land use and transportation scenarios. The first draft of the technical methodology for estimating greenhouse gas emissions was also prepared and presented to ARB. Upon submittal of the technical methodology, BCAG initiated the official public process and conducted a third round of workshops in September for the purpose of receiving public input on the land use and transportation scenarios and reviewing any additional or revised policies included with the plan. Due to the in-person meeting limitations associated with Covid-19, the workshop was held virtually.

Draft RTP/SCS (Fall 2020)

Upon completion of receiving public input, a complete Draft RTP/SCS and EIR were developed and released in October 2020. The public comment period was opened for the required 55-day period and a fourth-round workshop was held virtually in November 2020. A public hearing was also held at the October 2020 BCAG Board of Director's meeting.

Final RTP/SCS Adoption (December 2020)

On December 10th, 2020, the BCAG Board of Director's approved the Final 2020 RTP/SCS following a final public hearing.

Regional and Local Planning Context

- Camp Fire – On November 8, 2018, the Camp Fire burned through the incorporated Town of Paradise (population 26,572) and the unincorporated communities of Magalia, Concow, Butte Creek Canyon and Pulga in Butte County. The Camp Fire is the largest and most devastating fire in California's history and the most destructive in the nation in the past 100 years. This has resulted in a significant challenge for the region in terms of housing, jobs, and transportation. BCAG is in the process of preparing a Post-Camp Fire Regional Population & Transportation Study that will analyze regional population, housing, employment, and traffic data for pre (2018), post (2019/20), and future (2030)

Camp Fire time periods. In addition, an update of the region's short and mid-term transit plan will be completed with the collected data. However, the work products related to this effort will not be completed in time to include in the 2020 RTP/SCS, rather, the information will be used in preparing the 2024 RTP/SCS.

- SCS Progress Report – To better inform the development of the 2020 RTP/SCS, BCAG prepared an [SCS Progress Report](#)¹ which looked at several indicators for objectives included in the 2016 RTP/SCS, the progress made to date, and related trends. The report included several recommendations for consideration in developing the 2020 RTP/SCS, including adjusting the ratio of single-family to multi-family housing.
- Local General Plans – No significant updates to local general plans have occurred since the adoption of the 2016 RTP/SCS. However, one large scale project (500+ housing units) has been approved in Chico, with another significantly larger project (2,000+ housing units) currently being prepared for consideration.
- Projected Revenue – Many of the regions revenues are addressing a backlog of safety and operational needs. A significant amount of safety related funds has been programmed along the SR 70 corridor which are intended to address head-on collisions and fatalities. Caltrans will continue to be a major partner in addressing operations and maintenance of the state highway system in Butte County. Bicycle and pedestrian projects are anticipated to increase, as the area looks to utilize regional funds to leverage grant funding opportunities and has a history of success with the state Active Transportation Program. Capacity increasing projects are not projected to significantly increase in the outer years of the RTP. Funds which typically contribute to capacity increasing types of projects are expected to continue to decline as the main revenue source (gas tax) is not keeping pace with increases in VMT. BCAG anticipates pursuing increased mass-transit investments including commuter transit and rail investments. This would be consistent with Governor Newsom's executive order to reduce greenhouse gas emissions.

CARB Recommendations

After completing the technical review of BCAG's 2016 RTP/SCS, CARB developed two recommendations for BCAG's consideration in developing the 2020 RTP/SCS.

1. *Recommendation* - Account for GHG reductions from Long-Range Transit and Non-Motorized Plan. *Action* - Transit and bike/ped have been incorporated into the latest update of the travel demand model. Improvements related to transit,

¹ *Sustainable Communities Strategy Progress Report*, Butte County Association of Governments, September 2020 - <http://www.bcag.org/documents/planning/RTP%20SCS/2020%20RTP%20SCS/BCAG%20SCS%20Progress%20Report%20-%20Final.pdf>

bike and pedestrian have been modeled and accounted for in the GHG reductions.

2. *Recommendation* - Align Per Capita GHG Reductions with VMT. *Action* – Aligned 2020 RTP/SCS VMT and GHG reductions for years 2035 and 2040. In the past, 2040 VMT and GHG were greater than year 2035. Although slight, year 2040 VMT and GHG per capita are lower than year 2035. Attachment A includes a table of VMT and GHG comparisons from the 2016 RTP/SCS and the 2020 RTP/SCS.

OVERVIEW OF EXISTING CONDITIONS

Prior to the Camp Fire, housing and job growth were strong with an improvement in the national economy. Following the fire, many neighboring communities, especially Chico, have seen significant increases in traffic, housing shortages, and related impacts associated with the redistribution of the burn area population (25,000+ people). Surrounding communities have taken steps to expedite housing development and development has continued to be strong in the Chico area. The Town of Paradise has prepared a vision plan and is in the early stages of implementation, however, there are still significant challenges to overcome in the rebuilding process.

In terms of transportation, The Butte County region has continued to see decreases in transit ridership, as has most of the nation, and overall traffic volumes have been on the rise since the 2016 RTP was completed.

REGIONAL GROWTH FORECASTS

In September 2019, BCAG prepared the [Provisional Long-Term Regional Growth Forecasts \(2018-2040\)](#)². The forecasts were prepared as the Camp Fire related impacts are still being assessed, therefore, they are noted as provisional. It is anticipated the forecasts will be revised upon completion of the Camp Fire Study in 2021.

Forecasts	2016 RTP (Year 2040)	2020 RTP (Year 2040)
Population	319,342	265,964
Household Population*	311,643	259,524
Households	129,006	107,169
Persons Per Household	2.48	2.48
Jobs	108,198	92,118
Jobs to Housing Unit Ratio	0.78	0.80

*Note: For the purpose of modeling and meeting SB 375 targets, BCAG will be excluding group quarters from the population, as requested by ARB. CA Dept. of Finance estimates were utilized in determining the group quarters population for each analysis year.

² *Provisional Long-Term Regional Growth Forecasts 2018-2040*, Butte County Association of Governments, September 2019, <http://www.bcag.org/documents/planning/RTP%20SCS/2020%20RTP%20SCS/Appendices/Appendix%206-2%20Final.pdf>

In comparison to the regional forecast prepared by BCAG in 2014, the 2018 forecast presents a significantly slower growth trend. Compound annual growth rates (CAGR) for the 2018 forecasts (2018-2040) are 0.68%-0.70% for population and housing, compared to the 1.37%-1.4% CAGR prepared in 2014 (2014-2040). The ratio of jobs to housing units has increased from 0.78 to 0.80 based on the historical average (1999-2018).

The new forecasts represent an update of the 2014-2040 forecasts developed during the 2014/15 fiscal year and include a revised methodology which considers the latest California Department of Finance (DOF) population projections and estimates, California Employment Development Department (EDD) job estimates, past housing production by the local jurisdictions, and preliminary housing unit loss and population redistribution estimates resulting from the Camp Fire.

As requested by ARB, BCAG has removed group quarters from the overall regional population totals and developed a household population estimate for calculating the CO2 per capita metric. Household population estimates were prepared for all future analysis years by applying the base year (2018) group quarters rate from the Department of Finance. Year 2005 rates were also pulled from existing Department of Finance data.

QUANTIFYING STRATEGIES

For the 2020 RTP/SCS, BCAG has moved forward with the same basic strategies included in the previous SCS which focus on land use, housing, and alternative modes of transportation (transit, bike, and walk).

As part of the regional travel demand model update for the 2020 RTP/SCS, BCAG worked with consultants to develop an assessment of strategies related to vehicle miles traveled (VMT) and greenhouse gas (GHG) emission reductions, including transportation demand management (TDM), transportation system management (TSM), and intelligent transportation system (ITS). The purpose of this work was to compile a list of strategies that are applicable in Butte County and evaluate their effectiveness. This information can then be used to determine potentially feasible VMT mitigation measures for individual projects (project level) and provide information for future regional and local policy implementation (regional/local level).

These additional strategies have not been quantified as part of the 2020 RTP/SCS, rather they will be utilized in BCAG's upcoming development of SB 743 guidelines for implementation in Butte County. However, the parking management strategy was included in one of the environmental impact report alternatives.

The table below contains the strategies and quantification methods which have been included in the 2020 RTP/SCS at the regional level. All strategies utilize the travel demand model for quantification and no off-model strategies are present.

2020 RTP/SCS Strategy	Quantification Method
Land Use/Location (Increase Diversity, Density, and Transit Accessibility)	Travel Demand Model
Bike and Pedestrian Network Improvements	Travel Demand Model
Transit Service Increases	Travel Demand Model
Parking Management (<i>not included in final SCS</i>)	Travel Demand Model

Interregional Travel

For the purpose of preparing the GHG emissions analysis for 2020 RTP/SCS, BCAG will subtract all emissions from through trips (X-X trips). In addition, the portion of VMT from trips that either begin or end within the region but travel to/from neighboring regions (X-I, I-X trips) will be included for all portions of the trip within the BCAG region, this is consistent with the method used in preparing BCAG's recommendation to ARB for targets which were approved in 2010 and those applied to the 2012 RTP/SCS, as well as the method used for the 2016 RTP/SCS and updated targets approved by ARB in 2018.

The percentage of VMT by through trip type (X-X) will be calculated for the 2020 and 2035 target years.

Interregional trip distributions and purpose determinations will utilize data from the California household travel survey, Location-based Services (LBS), and the California statewide travel model. Additional information regarding interregional travel is available in the [BCAG 2020 RTP Travel Demand Model – Model Development Report](#)³.

EMFAC

BCAG has utilized ARB's 2014 emissions factor model (EMFAC), as it did with the 2016 RTP/SCS. EMFAC has been used to calculate the carbon dioxide (CO₂) emissions output based on the provided VMT and speed bin classification from the travel model. BCAG utilized the annual option for CO₂ output as suggested by the 2010 Regional Targets Advisory Committee report.

Once all vehicle trips were processed in EMFAC, BCAG extracted the total VMT and CO₂ emissions for LDA, LDT1, LDT2, and MDV vehicle types. This ensures that only passenger vehicle (cars and light trucks) types were included in the emissions analysis.

In addition, BCAG has applied the prescribed adjustment included in *Methodology to Calculate CO₂ Adjustment to EMFAC Output for SB 375*, provided by ARB, as modified by BCAG for the 2016 RTP/SCS (Attachment B).

³ BCAG 2020 RTP Travel Demand Model – Model Development Report, Fehr & Peers, September 2020.
<http://www.bcag.org/documents/planning/RTP%20SCS/2020%20RTP%20SCS/Appendices/Appendix%206-6b%20Final.pdf>

LAND USE AND TRAVEL DEMAND MODELING

As with the 2016 SCS, BCAG utilized a land use allocation model and a travel demand forecasting model in preparing the 2020 RTP/SCS.

Land Use Allocation Model

The BCAG Land Use Allocation Model was developed in 2010 by a team of project consultants from the University of California Davis – Information Center for the Environment (ICE), California State University, Chico – Geographical Information Center (GIC), and Fehr & Peers. The model utilizes the UPlan software platform, which has been implemented broadly across the state for various Blueprint planning efforts. UPlan is a rule-based model which allocates future residential and employment growth while considering the region’s existing land use plans, growth forecasts, and development attractions (e.g. transportation and infrastructure) and discouragements (e.g. resource areas, farmland, and floodplains).

The model was initially funded by grants from the California Strategic Growth Council (SGC) for the development of the 2012 RTP/SCS.

In preparing the 2020 RTP/SCS, the land use allocation model base year was updated to 2018, to coincide with the latest validated travel model and existing land use datasets. Land use allocations were then developed for the years 2020, 2035 and 2040. The forecasted allocation years of 2020, 2035, and 2040 are based on revisions of the adopted 2016 RTP/SCS allocations with adjustments made for the revised regional growth forecasts, the latest available data from the Camp Fire, school enrollment, the latest project information and general plan changes from local jurisdictions, recommendations included in the SCS Progress Report, and public input.

The [Butte County Association of Governments – Land Use Allocation Model](#)⁴ includes a copy of the full model documentation.

Travel Demand Model

The updated BCAG Regional Travel Demand Model is a traditional four-step model and is used to forecast travel activity based on inputs of the forecasted allocation of housing and non-residential land uses from the land use allocation model and forecasts of the regional transportation network. Inputs have been prepared for the model base year (2018), the GHG target years of 2020 and 2035, and the 2020 RTP horizon year of 2040.

The model underwent updates and modifications for the 2020 RTP/SCS. Revisions to the model include the following:

⁴ *Butte County Association of Governments – Land Use Allocation Model - Technical Methodology for Preparing 2020 Regional Transportation Plan / Sustainable Communities Strategy Land Use Allocations*, Butte County Association of Governments, September 2020, <http://www.bcag.org/documents/planning/RTP%20SCS/2020%20RTP%20SCS/Appendices/Appendix%206-6a%20Final.pdf>

New Features

- Trip Generation: Replaced total vehicle trips generated with person trips and commercial truck trips
- Trip Distribution: Implemented employee salary and household income relationship for home-work trips
- Interregional Travel: Improved control over scenario evaluation of interregional inputs by implementing job salary and interregional parameters at a Traffic Analysis Zone (TAZ) scale rather than based on land use and trip purpose model wide.
- Through Travel: Values for trips traveling through the region were updated and separated by passengers and trucks.
- Multimodal Network: Enhanced network to include modes allowed to use the facility, distinguishing between drive-alone, shared ride, bike/pedestrian, transit, and commercial trucks.
- Travel Cost: Added auto operating cost based on all fuel types, travel cost per mile, and parking cost to Trip Distribution and Mode Choice
- Trip Distribution: Included cost and modes allowed on transportation facilities in trip distribution.
- Mode Choice: Implemented mode choice utility equation based on demographics, distance, cost, and built environment.

Updated Features

- Land Use Inputs: Updated base year 2014 data to represent base year 2018. Updated future forecasts to account for the Camp Fire and revised housing, student, and job totals.
- Transportation Projects: The transportation project list was updated to reflect the currently planned and programmed projects.
- Auto Operating Cost: Auto operating cost was updated to include energy sources other than petroleum-based fuels

As requested by ARB, the updated model accounts for induced demand, including both the short- and long-term effects. The travel model documentation includes a complete discussion along with sensitivity tests. However, following discussions with ARB staff it was determined that the full effects of long-term induced demand were not fully captured in the travel model. To account for these effects, BCAG has prepared an off-model adjustment and included as Attachment C.

A copy of the travel demand model documentation has been included in the link below. This document includes detailed information regarding the updates, processes, and features of the model.

- [BCAG 2020 RTP Travel Demand Model- Model Development Report](#)

EXOGENOUS VARIABLES

Included in the table below are a listing of independent (exogenous) variables to be utilized in the model for scenario analysis.

Category	Variable Specification	Assumption (Year 2035)	Source
Demographics	Population, employment, and housing	Household Population = 251,863 Employment = 92,118 Households = 107,169	BCAG Provisional Long-Term Regional Growth Forecasts 2018-2040
Auto operating costs	Fuel and non-fuel related costs (maintenance, repair, and tire wear)	18.9 cents/mile	California Air Resources Board spreadsheet tool, 2020
Vehicle fleet efficiency	EMFAC 2014 model	36.01 MPG	EMFAC 2014
Household income	Distribution	Baseline (2018)	BCAG Regional Travel Demand Model
Commercial vehicle activity	Share of commercial vehicle VMT	2.31% of regional VMT	BCAG Regional Travel Demand Model
Interregional travel	Share of external interregional VMT	9.06% of regional IX-XI VMT 3.74% of regional XX VMT	BCAG Regional Travel Demand Model

As described earlier in the document, population, employment and housing information was developed as part of [BCAG's Provisional Long-Term Regional Growth Forecasts \(2018-2040\)](#). At the request of ARB staff, group quarters populations have been removed for modeling purposes and are based on California Department of Finance (DOF) estimates for the year 2018 and carried forward at the same percentage for all subsequent analysis years.

Assumptions and data sources associated with auto operating costs, household income, commercial vehicle activity, and interregional travel are detailed in the [travel model documentation](#). Vehicle fleet efficiency for the region is presented as the EMFAC 2014 default.

PRIOR RTP/SCS ANALYSIS

BCAG analyzed the 2016 RTP/SCS land use and transportation networks as an additional alternative for the environmental impact report. As such, the exogenous variables listed above have been utilized as part of that analysis, except for the demographic category. It should be noted, BCAG is not subject to the incremental progress analysis included in ARB's latest (November 2019) evaluation guidelines, based on CARB staff recommendations outlined in the *Updated Final Staff Report: Proposed Update to the SB 375 Greenhouse Gas Emission Reduction Targets*.

OFF-MODEL STRATEGIES

Upon completion of the selected strategies and travel demand model, no off-model strategy calculations were required for quantifying the 2020 RTP/SCS.

UPDATES TO THIS DOCUMENT

As previously stated, this is intended to be a working document as BCAG and CARB coordinate on the technical aspects of quantifying the 2020 RTP/SCS. Included as Attachment D are the comments and responses provided by CARB and BCAG as the document is revised and updated.

ATTACHMENT A

Year	2012 RTP				2016 RTP					2020 RTP			
	2005	2010 (Base)	2020	2035	2005	2014 (Base)	2020	2035	2040	2018 (Base)	2020	2035	2040
Population													
Household Population ¹	208,322	215,273	249,731	322,722	208,322	216,956	234,678	299,206	311,643	227,896	228,694	258,113	265,964
Housing	85,478	96,623	111,813	143,948	85,478	97,379	105,125	133,266	138,716	222,378	223,157	251,863	259,524
Jobs (Non-Farm)	73,400	71,501	87,214	112,279	73,400	74,100	81,998	103,948	108,198	99,353	86,929	111,339	115,235
VMT (w/o X-X) ²	4,573,188	4,689,869	5,533,199	7,125,432	4,573,188	4,626,746	4,979,356	6,227,645	6,506,652	4,705,417	4,343,919	5,181,813	5,332,327
VMT per Capita	21.95	21.79	22.16	22.08	21.95	21.33	21.22	20.81	20.88	21.16	19.47	20.57	20.55
% Change from 2005 (2012 RTP)		-0.76%	0.93%	0.58%		-2.86%	-3.35%	-5.19%	-4.89%	-3.61%	-11.33%	-6.28%	-6.40%
EMFAC 2011													
SB 375 CO2 per Capita (lbs/day) ³	18.45		18.08	18.09									
% Change from 2005 (2012 RTP)			-1.98%	-1.91%									
EMFAC 2014													
SB 375 CO2 per Capita (lbs/day) ³			17.38	17.21		17.04	16.64	16.25	16.31	16.63	15.21	16.08	16.07
% Change from 2005 (2012 RTP)			-5.79%	-6.71%		-7.63%	-9.77%	-11.92%	-11.55%	-10%	-17.53%	-12.82%	-12.87%
EMFAC 2011 / EMFAC 2014 ⁴ ARB Adjustment Factor			3.81%	4.81%			3.81%	4.81%			3.81%	4.81%	
Induced Travel Demand Off-Model Adjustment ⁵			-	-			-	-			-	0.03%	
BCAG GHG Per Capita Reduction			-1.98%	-1.91%			-5.96%	-7.11%			-13.72%	-7.98%	
* Regional Target (CARB)			1%	1%			1%	1%			-6%	-7%	

4/5/2021

¹ Excludes group quarters population. The 2012 and 2016 RTPs populations have been normalized to exclude group quarters using CA Dept of Finance estimates.

² VMT has been normalized for the 2012 and 2016 RTPs by applying the per capita VMT to household populations.

³ CO2 per Capita (lbs/day) has been normalized from the 2012 and 2016 RTPs by applying the per capita CO2 to household populations.

⁴ See Attachment B

⁵ See Attachment C

* Targets are expressed as a percent change in per capita passenger vehicle greenhouse gas emissions relative to 2005

ATTACHMENT B

BCAG Modification of ARB EMFAC Methodology to Calculate CO2 Adjustment to EMFAC Output for SB 375 Target Demonstrations

In 2015, ARB developed a methodology to assist metropolitan planning organizations (MPOs), such as BCAG, in adjusting the calculation of percent reduction in per capita CO2 emissions used to meet established targets when using EMFAC2011 or EMFAC2014 for their second round RTP/SCS. ARB's methodology is intended to allow for the direct comparison of reductions achieved in the first rounds of RTP/SCSs to those attained in the second and third rounds while holding each MPO to the same level of stringency in achieving the target.

A key assumption of the ARB methodology is that the 2005 baseline travel estimates developed with the first round RTP/SCS travel demand model will be identical to those produced with the updated models used to estimate travel with the second/third round RTP/SCS. However, in the case of BCAG's second round updated travel model, changes to land use data and the trip generation sub-model caused the model to generate greater estimates of per capita travel for the base year and the 2005 back-cast years in comparison to the first round RTP/SCS model. The changes in base year per capita VMT then effect the forecast years since future land uses are added to the base to develop the forecasts.

To address this change in the first and second round 2005 baseline outputs, BCAG modified the ARB methodology to incorporate an adjustment which compensates for this change in preparing the 2018 RTP/SCS. This modification is in line with the intent of the ARB methodology which seeks to neutralize the changes between the various versions of EMFAC while allowing for an "apples to apples" comparison of the first, second, and third round of RTP/SCSs. The modification was approved, along with the 2018 RTP/SCS, by ARB in 2019 as part of the SCS review.

Upon consultation with ARB in preparing the 2020 RTP/SCS, BCAG has not developed a specific "backcast" (2005), and instead will be utilizing the information from the past RTP/SCS. As such, and in accordance with the ARB's Final Sustainable Communities Strategy Program and Evaluation Guidelines (November 2019), BCAG has applied the same methodology and adjustment factors (Year 2020 = 3.81% and Year 2035 = 4.81%). It should be noted that due to the shift in removing group quarters from the population used in calculating the Per Capita CO2 (SB 375 metric) reductions, BCAG, in consultation with ARB, has normalized the population, VMT, and GHG data for the 2012 and 2020 RTPs prior to applying the adjustment.

The following table demonstrates the application of the BCAG Modified Adjustment Factor for EMFAC 2007 to EMFAC 2014, as approved for ARB for the 2012 RTP/SCS, with normalized data from the 2020 RTP/SCS.

ATTACHMENT B

Table 1. BCAG Modified Adjustment Factor for EMFAC 2007 to EMFAC 2014		
Determine Year 2005 Adjustment Factor	Enter 2012 SCS Total VMT for Year 2005 ->	4,090,094
	Enter 2016/2020 SCS Total VMT for Year 2005 ->	4,573,188
	Adjustment Factor (2020 SCS VMT / 2012 SCS VMT)	1.118113178
2012 SCS (EMFAC 2007)	Year 2005 CO2 Per Capita (lbs.day) ->	16.50
	Year 2020 CO2 Per Capita (lbs.day) ->	16.17
	Year 2035 CO2 Per Capita (lbs.day) ->	16.18
Apply Adjustment Factor to 2012 SCS (EMFAC 2007)	Adjusted Year 2005 CO2 Per Capita (lbs.day) ->	18.45
	Adjusted Year 2020 CO2 Per Capita (lbs.day) ->	18.08
	Adjusted Year 2035 CO2 Per Capita (lbs.day) ->	18.09
Calculate Reductions in CO2 Per Capita	Year 2020 CO2 Per Capita Percent Reductions ->	-1.98%
	Year 2035 CO2 Per Capita Percent Reductions ->	-1.91%
2012 SCS (EMFAC 2014)	Year 2020 CO2 Per Capita (lbs.day) ->	15.54
	Year 2035 CO2 Per Capita (lbs.day) ->	15.39
Apply Adjustment Factor to 2012 SCS (EMFAC 2014)	Adjusted Year 2020 CO2 Per Capita (lbs.day) ->	17.38
	Adjusted Year 2035 CO2 Per Capita (lbs.day) ->	17.21
Calculate Reductions in CO2 Per Capita	Year 2020 CO2 Per Capita Percent Reductions ->	-5.80%
	Year 2035 CO2 Per Capita Percent Reductions ->	-6.72%
Determine EMFAC 2014 Adjustment %	Year 2020 EMFAC 2014 Adjustment ->	3.81%
	Year 2035 EMFAC 2014 Adjustment ->	4.81%
2020 SCS (EMFAC 2014)	Year 2020 CO2 Per Capita (lbs.day) ->	15.21
	Year 2035 CO2 Per Capita (lbs.day) ->	16.08
Calculate Reductions in CO2 Per Capita	Year 2020 CO2 Per Capita Percent Reductions ->	-17.53%
	Year 2035 CO2 Per Capita Percent Reductions ->	-12.82%
Apply EMFAC Adjustment	Adjusted Year 2020 EMFAC 2014 ->	-13.72%
	Adjusted Year 2035 EMFAC 2014 ->	-8.01%

ATTACHMENT C

Induced Travel Demand Off-Model Adjustment

The BCAG RTP/SCS model does not include a feedback process to account for the potential long-term land use growth effects that may occur due to induced vehicle travel. According to The Fundamental Law of Road Congestion: Evidence from US Cities, Gilles Duranton and Matthew A. Turner, American Economic Review 101, October 2011, 5 to 21 percent of the 1.03 long-term VMT elasticity is attributable to land use growth effects such as population migration. Applying this portion of the elasticity to the RTP/SCS VMT forecasts, an additional 1,730 to 7,260 weekday VMT could be attributable to the RTP/SCS roadway capacity expansion projects. When assessing this range, reviewers should consider the reasonableness of new population growth being attracted to Butte County due to isolated improvements in accessibility.

The table below includes the calculations associated with the off-model adjustment to per capita VMT, CO₂, and the % reductions from year 2005, for the 2035 and 2040 analysis years. Since this is VMT from new population growth it would be additive to both overall VMT and VMT (w/o XX trips) for passenger vehicles. All the VMT will either be II, IX, or XI trips generated by the additional population.

As the BCAG region is a suburban/rural area, it is reasonable to use the lower end of the range (1,730) given the lack of congestion and the isolated economy of Butte County.

Long-Term Induced Travel Demand Off-Model Adjustment

Year	VMT (thousands) - All Vehicles	Per Capita VMT - All Vehicles	VMT - Passenger Vehicles	Per Capita VMT - Passenger Vehicles	Passenger Vehicles Weekday CO ₂ (tons)	Passenger Vehicles Per Capita CO ₂ (lbs/day)	% CO ₂ Per Capita from 2005 ²
2035 Rate ¹		0.0040		0.0040		0.0079	
2040 Rate ¹		0.0039		0.0039		0.0077	
2035	1.73	0.01	1.73	0.01	0.68	0.01	+0.03%
2040	1.73	0.01	1.73	0.01	0.68	0.01	+0.03%

[1] Rate of per capita VMT and CO₂ for passenger and all vehicles calculated based on EMFAC 2014 runs for the years 2035 and 2040.

[2] Percentage applied to overall reduction from the year 2005 from the 2020 RTP/SCS modeled reductions.

ATTACHMENT D

Summary of CARB Staff's Preliminary Review of Butte CAG's July 24, 2020 Technical Methodology for the 2020 SCS

CARB staff prepared this memo to summarize its preliminary review of BCAG's technical methodology (TM) provided on July 24, 2020. The following clarifying questions and comments are intended to help BCAG provide the clarifying detail and supporting documentation necessary for CARB staff to fully evaluate the TM, and recommend its approval.

Clarifying Questions and Comments

1. Evolving Process and Forthcoming Information: CARB staff understands that BCAG anticipates the TM and key assumptions to evolve concurrently with the 2020 RTP/SCS development process. Please indicate:
 - a. Areas of the TM that BCAG anticipates will substantially change (e.g. changes in demographics, land use model inputs and outputs, travel demand model inputs and outputs, or other assumptions, factors, and variables), and
 - b. Provide supporting documentation that helps CARB staff to understand why certain changes were made.

While some essential documentation is in development, CARB staff appreciates the clarity of available information and supporting appendices. We look forward to reviewing BCAG's responses and further information, once available, from the list below.

- c. Planned improvements based on CARB's prior recommendations (TM, at pg. 5)
 - d. Appendix D, Land Use Modeling details
 - e. Appendix E, Transportation Demand Modeling details
 - f. Appendix F, Off-model Strategies
2. Updated Baselines: CARB staff understands that BCAG will update the 2020 RTP/SCS baseline to 2018. Please confirm that BCAG does not anticipate any changes to the 2005 baseline for the purposes of CARB's evaluation of the 2020 SCS.
3. Updates to the Travel Model: CARB staff understands that BCAG made several updates to the travel demand model. (TM, summarized at pg. 9.) CARB staff requests additional information on how BCAG planned to enhance the travel demand model, and specifically, descriptions on how those enhancements were implemented will be helpful. In particular, please provide additional information on modeling improvements for "roadway and parking pricing" and the "enhanced demand management capabilities."
4. EMFAC Adjustments: CARB staff understands that BCAG used EMFAC 2014 for the 2016 RTP/SCS and intends to use EMFAC 2014 for the 2020 RTP/SCS. BCAG proposed to apply an adjustment factor to EMFAC outputs for the 2020 RTP/SCS. (See, TM Attachment C, at pg. 37.) No EMFAC adjustment is needed if the same version of EMFAC will be used. (*CARB 2019 [SCS] Program and Evaluation Guidelines*, Appendix D, at. 26: EMFAC adjustment applicable when first RTP/SCS was developed using EMFAC2007 or EMFAC2011.)¹

¹ Available at: <https://ww2.arb.ca.gov/sites/default/files/2019-11/Final%20SCS%20Program%20and%20Evaluation%20Guidelines%20Appendices.pdf>

5. Induced Demand: CARB staff understands that BCAG accounts for induced demand in the travel demand model and supporting documentation will be included in Attachment E, once completed. (TM, at pg. 10.) Please include how BCAG will address short- and long-term effects of induced demand. (*CARB 2019 [SCS] Program and Evaluation Guidelines, Appendix A, at pg. 7.*)
6. Quantification Methodology: BCAG lists a summary of strategies and proposes to develop methods to quantify VMT and/or GHG emission reductions by either using the transportation demand model or off-model calculations. (See, TM, at pgs. 7 and 10.) CARB staff understands that the method to quantify GHG emission reductions from Electric Vehicle Infrastructure, TSM, and ITS strategies are also in development. Please clarify if these strategies, as summarized, are under consideration as off-model strategies.
7. Support Off-Model Strategies: BCAG lists off-model strategies that will be quantified for achieving VMT and GHG emission reductions. (TM, at pg. 10.) Please provide supporting documentation (i.e., methodology, existing status of the strategy/program, assumptions, data sources, and known or reasonably identifiable funding sources) to support VMT and/or GHG emission reduction estimates that further supports the magnitude of claimed VMT and/or GHG emission reductions per off-model strategy. (*CARB 2019 [SCS] Program and Evaluation Guidelines, Appendix A, at pg. 9 for further discussion on the specificity of detail needed for CARB to evaluate off-model strategies.*)
8. Exogenous Variables: CARB staff understands that BCAG identified exogenous variables. (TM, summarized at pg. 10.) Please provide brief descriptions of how BCAG derived these exogenous variables, related assumptions, and citation to data sources.
9. Transit and Rail Strategies: BCAG lists "transit service increases" and "rail service increase/expansion" and states VMT/GHG emissions reductions may be calculated outside of the travel demand model. (TM, at pg. 10.) Please clarify whether BCAG intends to quantify these strategies, and if so, provide supporting documentation (i.e., methodology, existing status of the strategy/program, assumptions, and data sources) that describes how BCAG intends to quantify VMT and/or GHG emission reductions.
10. Group Quarters: CARB staff understands that BCAG included group quarters in the regional population forecast, consistent with its approach to develop the 2016 RTP/SCS. The calculation for household VMT and per capita VMT should represent light-duty vehicle within an MPO's boundary generated by residents and households within the MPO for normal commuting purposes. Thus, group quarter population should be exclude in the calculations for GHG per capita and VMT per capita estimates. (*CARB [SCS] Program and Evaluation Guidelines, Appendix C, at pg. 22.*)

Recommended Clarifications and Documentation for BCAG's 2020 SCS Submittal to CARB

- A. Growth Forecasts: Clarify the calculations BCAG used to estimate jobs-to-housing unit ratios for preparing the regional growth forecasts in the TM. (TM, summary table, at pg. 6.)
- B. Transit Funding and Ridership: CARB staff understands that BCAG anticipates a decline in transit ridership and that the 2020 RTP/SCS dedicates considerably less financial revenue (-13 percent from 2016 RTP/SCS) in the BCAG regional transit system. (See, TM, discussion at pg. 6; 2020 SCS financial summary, Attachment A, at pg. 18.) In part, BCAG states that the reduced revenue reflects the completion of the new Transit Operations and Maintenance Facility and bus replacements from FYs 16/17 and 17/18. Please provide supporting documentation that helps CARB staff to understand how the 2020 RTP/SCS continues BCAG's investments to support, maintain, enhance, or extend transit services in the Butte region.

ATTACHMENT D

BCAG's Response to CARB Staff's Preliminary Review of Butte CAG's July 24, 2020 Technical Methodology for the 2020 SCS (April 2021)

Listed below are responses to CARB's preliminary review. The listed responses correspond with the numbered comments/questions submitted by CARB.

1. Evolving Process and Forthcoming Information:
 - a. The current TM includes all changes from the original submitted in July 2020 and is reflective of the latest available information.
 - b. Supporting documentation has been included throughout the documentation as well as the referenced appendices.
 - c. Included on Pages 3-4 under "CARB Recommendations"
 - d. [Technical Methodology for Preparing 2020 Regional Transportation Plan / Sustainable Communities Strategy Land Use Allocations](#) has been included as a footnote with a link to the document.
 - e. The [BCAG 2020 RTP Travel Demand - Model Development Report](#) has been included as a footnote with a link to the document.
 - f. BCAG did not utilize off-model strategies for the 2020 SCS. The referenced appendix has been removed from the TM.
2. Updated Baseline: Correct the 2020 SCS utilizes a year 2018 baseline. The 2005 baseline has been carried over from previous RTPs and no new 2005 baseline was prepared for 2020 SCS.
3. Updates to the Travel Model: Summarized on page 7 and detailed in [Technical Methodology for Preparing 2020 Regional Transportation Plan / Sustainable Communities Strategy Land Use Allocations](#).
4. EMFAC Adjustments: In consultation with CARB, BCAG will be utilizing the same EMFAC adjustment used for the 2016 SCS (2020 = 3.81% and 2035 = 4.81%). See Attachment B.
5. Induced Demand: BCAG has addressed both short and long-term effects of induced demand in modeling the 2020 SCS. [Technical Methodology for Preparing 2020 Regional Transportation Plan / Sustainable Communities Strategy Land Use Allocations](#) contains a discussion of the testing completed for each. In addition, Attachment C contains an off-model adjustment associated with the long-term VMT.
6. Quantification Methodology: A summary of the quantification of strategies is included on page 5. Please note, none of the strategies quantified include Electric Vehicle Infrastructure, TSM, or ITS.
7. Support Off-Model Strategies: No off-model strategies were utilized for the 2020 SCS.
8. Exogenous Variables: A summary of the exogenous variables has been included on page 8. The related assumptions and citations to data sources are included in the summary or referenced attachments.
9. Transit and Rails Strategies: All transit related strategies have been quantified with the travel demand model. No rail strategies have been included or quantified for the purpose of meeting SB 375 related targets.
10. Group Quarters: At the request of ARB, BCAG has excluded group quarters populations in the calculations for GHG per capita and VMT per capita estimates. In consultation with ARB, BCAG has normalized past SCSs, for quantification purposes, using CA Department of Finance group quarters figures for the backcast (2005) and associated base years (2010, 2014, and 2018).

ATTACHMENT D

Group quarter estimates for all forecast years are based on carrying the percentage forward of each base year. For example, the 2020 SCS utilizes the percentage of group quarters present in 2018 (base year) for all future years (2020, 2035, and 2040). VMT and associated GHG's have been normalized for past SCSs utilizing the per capita VMT and per capita GHG for each plan multiplied by the updated household population.

- A. Growth Forecasts: The methodology for estimating the jobs-to-housing ratio is described in BCAGs [Provisional Long-Term Regional Growth Forecasts 2018-2040](#). This is the same methodology utilized in all past SCSs.
- B. Transit Funding and Ridership: The information cited in the ARB comment is based on the [Sustainable Communities Strategy Progress Report](#) which compares BCAG's 2019 FTIP (short-term plan) to the estimates included in the 2016 RTP. Correct, base year (2018) transit ridership is down from the highs seen earlier in the decade as is the case across the entire nation. The 2020 SCS estimates \$266 million (19.2%) in transit funds over the 20-year planning period compared to the \$278 million (21.7%) estimated for the 2016 SCS over a 24-year period. This is reflective of decreased overall ridership associated with lower planned population totals as well as impacts from the Camp Fire. Currently, BCAG is revising the long-term transit plan as part of the [Post-Camp Fire Study](#).