

2.22 Climate Change

Climate change refers to long-term changes in temperature, precipitation, wind patterns, and other elements of the earth's climate system. An ever-increasing body of scientific research attributes these climatological changes to greenhouse gas (GHG) emissions, particularly those generated from the production and use of fossil fuels.

While climate change has been a concern for several decades, the establishment of the Intergovernmental Panel on Climate Change (IPCC) by the United Nations and World Meteorological Organization in 1988, has led to increased efforts devoted to GHG emissions reduction and climate change research and policy. These efforts are primarily concerned with the emissions of GHGs generated by human activity including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), tetrafluoromethane, hexafluoroethane, sulfur hexafluoride (SF₆), HFC-23 (fluoroform), HFC-134a (s, s, s, 2-tetrafluoroethane), and HFC-152a (difluoroethane).

In the U.S., the main source of GHG emissions is electricity generation, followed by transportation. In California, however, transportation sources (including passenger cars, light duty trucks, other trucks, buses, and motorcycles) make up the largest source (second to electricity generation) of GHG emitting sources. The dominant GHG emitted is CO₂, mostly from fossil fuel combustion.

There are typically two terms used when discussing the impacts of climate change. “Greenhouse Gas Mitigation” is a term for reducing GHG emissions in order to reduce or “mitigate” the impacts of climate change. “Adaptation,” refers to the effort of planning for and adapting to impacts resulting from climate change (such as adjusting transportation design standards to withstand more intense storms and higher sea levels).¹

There are four primary strategies for reducing GHG emissions from transportation sources: (1) improving the transportation system and operational efficiencies, (2) reducing growth of vehicle miles traveled (VMT), (3) transitioning to lower GHG emitting fuels, and (4) improving vehicle technologies. To be most effective all four strategies should be pursued collectively. The following Regulatory Setting section

¹ http://climatechange.transportation.org/ghg_mitigation/.

outlines state and federal efforts to comprehensively reduce GHG emissions from transportation sources.

2.22.1 Regulatory Setting

2.22.1.1 State

With the passage of several pieces of legislation including State Senate and Assembly Bills and Executive Orders, California launched an innovative and pro-active approach to dealing with GHG emissions and climate change.

- **Assembly Bill (AB) 1493, Pavley. Vehicular Emissions: Greenhouse Gases, 2002:** Requires the California Air Resources Board (ARB) to develop and implement regulations to reduce automobile and light truck GHG emissions. These stricter emissions standards were designed to apply to automobiles and light trucks beginning with the 2009-model year. In June 2009, the U.S. Environmental Protection Agency (U.S. EPA) Administrator granted a Clean Air Act waiver of preemption to California. This waiver allowed California to implement its own GHG emission standards for motor vehicles beginning with model year 2009. California agencies will be working with federal agencies to conduct joint rulemaking to reduce GHG emissions for passenger cars model years 2017-2025.
- **Executive Order (EO) S-3-05 (signed on June 1, 2005, by former Governor Arnold Schwarzenegger):** The goal of this EO is to reduce California's GHG emissions to: 1) year 2000 levels by 2010, 2) year 1990 levels by the 2020, and 3) 80 percent below the year 1990 levels by the year 2050. In 2006, this goal was further reinforced with the passage of Assembly Bill 32.
- **AB 32, the Global Warming Solutions Act of 2006, Núñez and Pavley:** AB 32 sets the same overall GHG emissions reduction goals as outlined in EO S-3-05, while further mandating that ARB create a scoping plan, (which includes market mechanisms) and implement rules to achieve "real, quantifiable, cost-effective reductions of greenhouse gases."
- **EO S-20-06 (signed on October 18, 2006 by former Governor Arnold Schwarzenegger):** Further directs state agencies to begin implementing AB 32, including the recommendations made by the California's Climate Action Team.
- **EO S-01-07 (signed on January 18, 2007 by former Governor Arnold Schwarzenegger):** Set forth the low carbon fuel standard for California. Under this EO, the carbon intensity of California's transportation fuels is to be reduced by at least ten percent by the year 2020.

- **Senate Bill 97 Chapter 185, 2007:** Required the Governor's Office of Planning and Research (OPR) to develop recommended amendments to the California Environmental Quality Act (CEQA) Guidelines for addressing GHG emissions. The amendments became effective on March 18, 2010.
- **Caltrans Director's Policy 30 (DP-30) Climate Change (approved June 22, 2012):** Is intended to establish a Caltrans policy that will ensure coordinated efforts to incorporate climate change into Caltrans decisions and activities. This policy contributes to the Caltrans' stewardship goal to preserve and enhance California's resources and assets.

2.22.1.2 Federal

Although climate change and GHG reduction is a concern at the federal level; currently there are no regulations or legislation that have been enacted specifically addressing GHG emissions reductions and climate change at the project level. Neither the U.S. EPA nor the Federal Highway Administration (FHWA) has promulgated explicit guidance or methodology to conduct project-level GHG analysis. As stated on FHWA's climate change website (<http://www.fhwa.dot.gov/hep/climate/index.htm>), climate change considerations should be integrated throughout the transportation decision-making process—from planning through project development and delivery. Addressing climate change mitigation and adaptation up front in the planning process will facilitate decision-making and improve efficiency at the program level, and will inform the analysis and stewardship needs of project level decision-making. Climate change considerations can easily be integrated into many planning factors, such as supporting economic vitality and global efficiency, increasing safety and mobility, enhancing the environment, promoting energy conservation, and improving the quality of life.

The four strategies set forth by FHWA to lessen climate change impacts do correlate with efforts that the state has undertaken and is undertaking to deal with transportation and climate change; the strategies include improved transportation system efficiency, cleaner fuels, cleaner vehicles, and a reduction in the growth of vehicle hours travelled.

Climate change and its associated effects are also being addressed through various efforts at the federal level to improve fuel economy and energy efficiency, such as the “National Clean Car Program” and EO 13514 – Federal Leadership in Environmental, Energy and Economic Performance.

Executive Order 13514 is focused on reducing greenhouse gases internally in federal agency missions, programs and operations, but also directs federal agencies to participate in the Interagency Climate Change Adaptation Task Force, which is engaged in developing a national strategy for adaptation to climate change.

On April 2, 2007, in *Massachusetts v. EPA*, 549 U.S. 497 (2007), the Supreme Court found that greenhouse gases are air pollutants covered by the Clean Air Act and that the U.S. EPA has the authority to regulate GHG. The Court held that the U.S. EPA Administrator must determine whether or not emissions of greenhouse gases from new motor vehicles cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision.

On December 7, 2009, the U.S. EPA Administrator signed two distinct findings regarding greenhouse gases under section 202(a) of the Clean Air Act:

- **Endangerment Finding:** The Administrator found that the current and projected concentrations of the six key well-mixed greenhouse gases—carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆)—in the atmosphere threaten the public health and welfare of current and future generations.
- **Cause or Contribute Finding:** The Administrator found that the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle engines contribute to the GHG pollution which threatens public health and welfare.

Although these findings did not themselves impose any requirements on industry or other entities, this action was a prerequisite to finalizing the U.S. EPA's *Proposed Greenhouse Gas Emission Standards for Light-Duty Vehicles*, which was published on September 15, 2009.¹ On May 7, 2010 the final *Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards* was published in the Federal Register.

U.S. EPA and the National Highway Traffic Safety Administration (NHTSA) are taking coordinated steps to enable the production of a new generation of clean vehicles with reduced GHG emissions and improved fuel efficiency from on-road

¹ <http://www.epa.gov/oms/climate/regulations.htm#1-1>.

vehicles and engines. These next steps include developing the first-ever GHG regulations for heavy-duty engines and vehicles, as well as additional light-duty vehicle GHG regulations. These steps were outlined by President Obama in a Presidential Memorandum on May 21, 2010.¹

The final combined U.S. EPA and NHTSA standards that make up the first phase of this national program apply to passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2012 through 2016. The standards require these vehicles to meet an estimated combined average emissions level of 250 grams of CO₂ per mile, (the equivalent to 35.5 miles per gallon [MPG] if the automobile industry were to meet this CO₂ level solely through fuel economy improvements. Together, these standards will cut GHG emissions by an estimated 960 million metric tons and 1.8 billion barrels of oil over the lifetime of the vehicles sold under the program (model years 2012–2016).

On November 16, 2011, U.S. EPA and NHTSA issued their joint proposal to extend this national program of coordinated greenhouse gas and fuel economy standards to model years 2017 through 2025 passenger vehicles.

2.22.2 Environmental Consequences

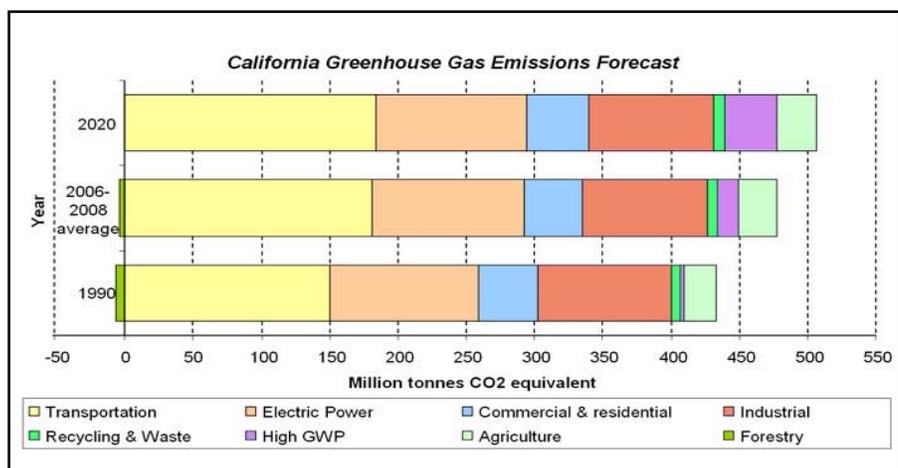
An individual project does not generate enough GHG emissions to significantly influence global climate change. Rather, global climate change is a cumulative impact. This means that a project may contribute to a potential impact through its incremental change in emissions when combined with the contributions of all other sources of GHG.² In assessing cumulative impacts, it must be determined if a project's incremental effect is "cumulatively considerable" (CEQA Guidelines sections 15064(h)(1) and 15130). To make this determination the incremental impacts of the project must be compared with the effects of past, current, and probable future projects. To gather sufficient information on a global scale of all past, current, and

¹ <http://epa.gov/otaq/climate/regulations.htm>.

² This approach is supported by the AEP: *Recommendations by the Association of Environmental Professionals on How to Analyze GHG Emissions and Global Climate Change in CEQA Documents* (March 5, 2007), as well as the South Coast Air Quality Management District (Chapter 6: The CEQA Guide, April 2011) and the US Forest Service (Climate Change Considerations in Project Level NEPA Analysis, July 13, 2009).

future projects in order to make this determination is a difficult, if not impossible, task.

The AB 32 Scoping Plan mandated by AB 32 contains the main strategies California will use to reduce GHG emissions (Figure 2.22-1). As part of its supporting documentation for the Draft Scoping Plan, ARB released the GHG inventory for California (forecast last updated: October 28, 2010). The forecast is an estimate of the emissions expected to occur in the year 2020 if none of the foreseeable measures included in the Scoping Plan were implemented. The base year used for forecasting emissions is the average of statewide emissions in the GHG inventory for 2006, 2007, and 2008.



Source: <http://www.arb.ca.gov/cc/inventory/data/forecast.htm>.

Figure 2.22-1 California Greenhouse Gas Forecast

Caltrans and its parent agency, the Business, Transportation, and Housing Agency, have taken an active role in addressing GHG emission reduction and climate change. Recognizing that 98 percent of California's GHG emissions are from the burning of fossil fuels and 40 percent of all human-made GHG emissions are from transportation, Caltrans has created and is implementing the Climate Action Program at Caltrans that was published in December 2006.¹

¹ Caltrans Climate Action Program is located at the following web address: http://www.dot.ca.gov/hq/tpp/offices/ogm/key_reports_files/State_Wide_Strategy/Caltrans_Climate_Action_Program.pdf.

One of the main strategies in Caltrans's Climate Action Program to reduce GHG emissions is to make California's transportation system more efficient. The highest levels of CO₂ from mobile sources, such as automobiles, occur at stop-and-go speeds (0-25 miles per hour) and speeds over 55 mph; the most severe emissions occur from 0-25 miles per hour (see Figure 2.22-2 below). To the extent that a project relieves congestion by enhancing operations and improving travel times in high congestion travel corridors GHG emissions, particularly CO₂, may be reduced.

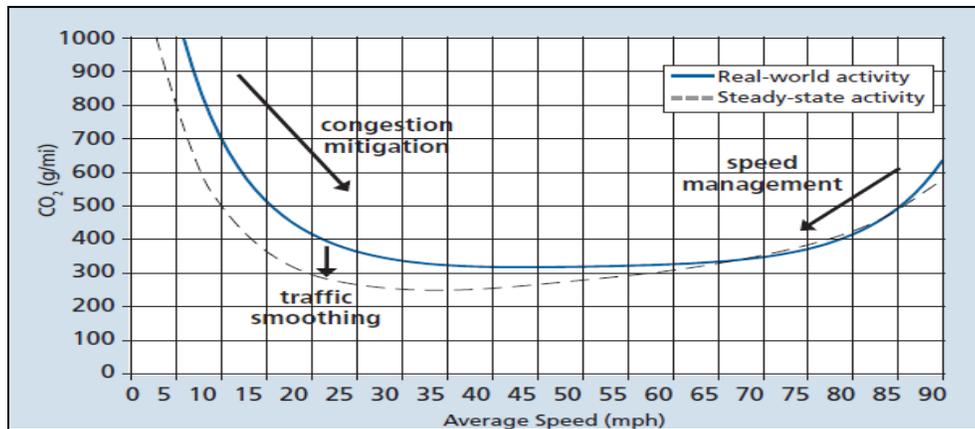


Figure 2.22-2 Possible Effect of Traffic Operation Strategies in Reducing On-Road CO₂ Emission¹

2.22.2.1 Project Analysis

As described in Section 1.1, the proposed project is included within the 2012 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) adopted by the Southern California Association of Governments (SCAG). The RTP/SCS includes a commitment to reducing emissions from transportation sources in compliance with Senate Bill 375, improve public health and meet federal air quality standards. Additional benefits of the RTP/SCS include reductions in GHG emissions within the air basin. A reduction of 9 percent by 2020 and 16 percent by 2035 is expected. This air quality benefit is made possible largely by more sustainable planning, integrating transportation and land use decisions to allow southern Californians the ability to live closer to where they work and play, and to high-quality transit service. As the proposed project is included in the 2012 RTP/SCS it is part of

¹ Traffic Congestion and Greenhouse Gases: Matthew Barth and Kanok Boriboonsomsin (TR News 268 May-June 2010), <http://onlinepubs.trb.org/onlinepubs/trnews/trnews268.pdf>.

the overall transportation network that has been considered in achieving the expected GHG reductions.

The purpose of the I-5 Widening Project, as outlined in Section 1.2.1, is to improve both existing and forecast mainline congestion on I-5 from SR-73 to El Toro Road and improve interchange operations on an interim basis. The vehicle hours traveled (VHT)/vehicle miles traveled (VMT) analysis provided in Section 2.13, Air Quality (subsection 2.13.3.4) of this IS/EA, shows that VHT associated with the Build Alternatives would increase from the No Build Alternative by 0.05 percent for Alternative 2 and 0.13 percent for Alternative 3. VMT would increase at a higher rate than VHT, which indicates that although traffic volumes increase slightly, congestion and travel time would decrease with implementation of the Build Alternatives.

As discussed previously in Chapter 1 (Section 1.7), alternatives to widening this segment of I-5 were considered during the early planning studies.

The TSM Alternative consisted of strategies to maximize efficiency of the existing facility by providing options such as ridesharing, parking, and traffic signal optimization. Although TSM measures would not solely satisfy the purpose and need of the project, TSM measures have been incorporated into the Build Alternatives for this project as summarized below:

- Ramp Metering
- Auxiliary Lanes
- Turning Lanes
- Traffic Signal Coordination
- Bicycle and Pedestrian Improvements

The TDM Alternative focused on regional strategies for reducing the number of vehicle trips and vehicle miles traveled, as well as increasing vehicle occupancy. It facilitates higher vehicle occupancy or reduces traffic congestion by expanding the traveler's transportation choice in terms of travel method, travel time, travel route, travel costs, and the quality and convenience of the travel experience. Although TDM measures would not solely satisfy the purpose and need of the project, implementation of the I-5 Widening Project Build Alternatives will add up to two additional general-purpose lanes, reestablish existing auxiliary lanes and construction of auxiliary lanes, and extend a second HOV lane in each direction on I-5 from Alicia Parkway to El Toro Road. The widening of the general-purpose lanes and the reestablishments of existing and construction of new auxiliary lanes will reduce

traffic congestion on the I-5 mainline, increase capacity and operations within the Study Area, and improve merging/diverging from freeway ramps and improve weaving operations. The HOV lane extension will provide travel time savings, operating cost savings, and increased travel reliability. Either of the Build Alternatives, if selected, is expected to further increase the occupancy rate on I-5 and thus decrease the traffic demand.

No Build Alternative – Alternative 1

Alternative 1, the No Build Alternative, proposes no improvements to Interstate 5 (I-5), maintaining the existing four general-purpose lanes and are high-occupancy vehicle (HOV) lanes throughout the majority of the project limits. As a result, no modifications to I-5 would occur, and there would be no permanent project impacts related to global climate change (GCC).

Build Alternatives - Alternative 2 (Preferred Alternative) and Alternative 3

Table 2.22-1 depicts the Vehicle Hours Traveled (VHT) for the project Study Area during existing conditions and the Horizon Year. Based on the data provided in the *Traffic Operations Analysis Report*, total daily VHT would be 137,540 during the Horizon Year 2045 No Build scenario (Alternative 1), 137,602 during the Build Alternative 2 scenario, and 137,719 during the Build Alternative 3 scenario.

Table 2.22-1 Vehicle Hours Traveled Summary

Period	Existing (2011)	2045 Horizon Year		
		Alternative 1 (No Build)	Alternative 2 (Preferred Alternative)	Alternative 3
Vehicle Hours Traveled:				
Peak	60,177	72,435	72,524	72,608
Non-Peak	51,053	65,105	65,079	65,111
Total	111,231	137,540	137,602	137,719
Percent Increase from No Build	--	--	0.05%	0.13%

Source: Air Quality Assessment (November 2012).

As indicated in Table 2.22-1, both Build Alternative 2 and Build Alternative 3 would result in a minor increase (less than 0.2 percent) in VHT when compared to No Build conditions in the Horizon Year.

The emission factors from EMFAC are in grams per mile of vehicle travel. Multiplying these emission factors by the number of VMT in the Study Area provides

an estimate of the total emissions from vehicles traveling through the Study Area. For the purposes of the following GHG analysis, VMT for Horizon Year 2045 No Build and Horizon Year 2045 Build Alternative 2 and 3 scenarios were based on the traffic volumes and VMT data from the project Traffic Operations Analysis Report. As indicated in Table 2.22-2, daily VMT for Build Alternatives 2 and 3 would vary slightly from No Build conditions due to the proposed improvements and variations in lane configurations. Vehicle emissions vary by speed, and emissions are higher on a grams-per-mile basis for slower speeds. For some pollutants, including GHGs, emissions increase with speeds greater than 50 mph. Therefore, GHG emissions were modeled based on the freeway data presented in the Traffic Operations Analysis Report as well as supplemental data prepared by a project traffic consultant (July 2012).

Table 2.22-2 Daily Vehicle Miles Traveled

Period	Existing (2011)	2045 Horizon Year		
		Alternative 1 (No Build)	Alternative 2 (Preferred Alternative)	Alternative 3
Vehicle Miles Traveled:				
Peak	2,863,774	3,455,208	3,475,741	3,483,654
Non-Peak	2,602,729	3,358,350	3,364,697	3,368,335
Total	5,466,502	6,813,557	6,840,437	6,851,989
Percent Increase from No Build	--	--	0.39%	0.56%

Source: Air Quality Assessment (November 2012).

Table 2.22-3 depicts the estimated future emissions from vehicles traveling within the project limits. Refer to the Air Quality Technical Report, Appendix C (Emissions Modeling Calculations) for the emissions factors used to calculate the proposed project's GHG emissions. As shown in Table 2.22-3, the existing VMT in the Study Area generate 6,399 tons per day of CO₂. CO₂ emissions would increase during the Horizon Year scenarios due to VMT growth. Table 2.22-3 also indicates that emissions under the Build Alternatives would represent a less than 1 percent increase compared to No Build conditions due to the slight increase in VMT. When considering further emissions improvements under AB 1493 (Low Carbon Fuel Standard), Build Alternatives 2 and 3 would have a smaller increase in CO₂ emissions.

Table 2.22-3 Daily Greenhouse Gas Emissions

Scenario	CO ₂ ^{1,2}	CO ₂ (Pavley I + LCFS) ^{1,2}
	tons/day	tons/day
Existing (2011)	6,399	6,376
Horizon Year (2045):		
No Build (Alternative 1)	7,813	6,918
Build Alternative 2 (Preferred Alternative)	7,843	6,946
Difference from Existing (Percent Change)	1,444 (22.6%)	569 (8.9%)
Difference from No Build (Percent Change)	31 (0.39%)	27 (0.39%)
Build Alternative 3	7,857	6,957
Difference from Existing (Percent Change)	1,457 (22.8%)	581 (9.1%)
Difference from No Build (Percent Change)	44 (0.56%)	39 (0.56%)

¹ Emissions calculated using EMFAC2011.

² Based on the Air Quality Assessment (November 2012)

CO₂ = carbon dioxide

LCFS = Low Carbon Fuel Standard

These CO₂ emissions numbers are only useful for a comparison between alternatives. The numbers are not necessarily an accurate reflection of what the true CO₂ emissions will be because CO₂ emissions depend on other factors that are not part of the model, such as the fuel mix (EMFAC model emission rates are only for direct engine-out CO₂ emissions, not full fuel cycle; fuel cycle emission rates can vary dramatically depending on the amount of additives like ethanol and the source of the fuel components), rate of acceleration, and the aerodynamics and efficiency of the vehicles.

Limitations and Uncertainties with Modeling

EMFAC

Although EMFAC can calculate CO₂ emissions from mobile sources, the model does have limitations when it comes to accurately reflecting CO₂ emissions. According to the National Cooperative Highway Research Program report, *Development of a Comprehensive Modal Emission Model* (April 2008), studies have revealed that brief but rapid accelerations can contribute significantly to a vehicle's carbon monoxide and hydrocarbon emissions during a typical urban trip. Current emission-factor models are insensitive to the distribution of such modal events (i.e., cruise, acceleration, deceleration, and idle) in the operation of a vehicle and instead estimate emissions by average trip speed. This limitation creates an uncertainty in the model's results when compared to the estimated emissions of the various alternatives with baseline in an attempt to determine impacts. Although work by EPA and the CARB is underway on modal-emission models, neither agency has yet approved a modal emissions model that can be used to conduct this more accurate modeling. In addition, EMFAC does not include speed corrections for most vehicle classes for CO₂

– for most vehicle classes emission factors are held constant which means that EMFAC is not sensitive to the decreased emissions associated with improved traffic flows for most vehicle classes. Therefore, unless a project involves a large number of heavy-duty vehicles, the difference in modeled CO₂ emissions due to speed change will be slight.

CARB is currently not using EMFAC to create its inventory of GHG emissions. It is unclear why the CARB has made this decision. Their website only states:

REVISION: Both the EMFAC and OFFROAD Models develop CO₂ and CH₄ [methane] emission estimates; however, they are not currently used as the basis for [CARB's] official [greenhouse gas] inventory which is based on fuel usage information. . . However, ARB is working towards reconciling the emission estimates from the fuel usage approach and the models.

Other Variables

With the current science, project-level analysis of GHG emissions is limited. Although a GHG analysis is included for this project, there are numerous key GHG variables that are likely to change dramatically during the design life of the proposed project and would thus dramatically change the projected CO₂ emissions.

First, vehicle fuel economy is increasing. The EPA's annual report, "Light-Duty Automotive Technology and Fuel Economy Trends: 1975 through 2008 (<http://www.epa.gov/oms/fetrends.htm>)," which provides data on the fuel economy and technology characteristics of new light-duty vehicles including cars, minivans, sport utility vehicles, and pickup trucks, confirms that average fuel economy has improved each year beginning in 2005 and is now the highest since 1993. Most of the increase since 2004 is due to higher fuel economy for light trucks, following a long-term trend of slightly declining overall fuel economy that peaked in 1987. These vehicles also have a slightly lower market share, peaking at 52 percent in 2004 with projections at 48 percent in 2008. Table 2.22-4 shows the alternatives for vehicle fuel economy increases studied by the NHTSA in its Final EIS for New Corporate Average Fuel Economy (CAFE) Standards (October 2008).

**Table 2.22-4 Model Year 2015 Required Miles Per Gallon (mpg)
by Alternative**

No Action		25% Below Optimized	Optimized (Preferred)	25% Above Optimized	50% Above Optimized	Total Costs Equal Total Benefits	Technology Exhaustion
Cars	27.5	33.9	35.7	37.5	39.5	43.3	52.6
Trucks	23.5	27.5	28.6	29.8	30.9	33.1	34.7

Source: New Corporate Fuel Economy (CAFÉ) standards, National Highway Traffic Safety Administration (October 2008).

Second, near zero carbon vehicles will come into the market during the design life of this project. According to a March 2008 report released by University of California Davis (UC Davis), Institute of Transportation Studies:

“Large advancements have occurred in fuel cell vehicle and hydrogen infrastructure technology over the past 15 years. Fuel cell technology has progressed substantially resulting in power density, efficiency, range, cost, and durability all improving each year. In another sign of progress, automotive developers are now demonstrating over 100 fuel cell vehicles (FCVs) in California – several in the hands of the general public – with configurations designed to be attractive to buyers. Cold-weather operation and vehicle range challenges are close to being solved, although vehicle cost and durability improvements are required before a commercial vehicle can be successful without incentives. The pace of development is on track to approach pre-commercialization within the next decade.”

“A number of the U.S. DOE 2010 milestones for FCV development and commercialization are expected to be met by 2010. Accounting for a five to six year production development cycle, the scenarios developed by the U.S. DOE suggest that 10,000s of vehicles per year from 2015 to 2017 would be possible in a federal demonstration program, assuming large cost share grants by the government and industry are available to reduce the cost of production vehicles.”¹

¹ Cunningham, Joshua, Sig Cronich, Michael A. Nicholas. March 2008. Why Hydrogen and Fuel Cells are Needed to Support California Climate Policy, UC Davis, Institute of Transportation Studies, pp. 9–10.

Third, and as previously stated, California has recently adopted a low-carbon transportation fuel standard. The CARB is scheduled to come out with draft regulations for low carbon fuels in late 2008 with implementation of the standard to begin in 2010.

Fourth, driver behavior has been changing as the U.S. economy and oil prices have changed. In its January 2008 report, “Effects of Gasoline Prices on Driving Behavior and Vehicle Market” (<http://www.cbo.gov/ftpdocs/88xx/doc8893/01-14-GasolinePrices.pdf>), the Congressional Budget Office found the following results based on data collected from California: (1) freeway motorists have adjusted to higher gas prices by making fewer trips and driving more slowly; (2) the market share of sports utility vehicles is declining; and (3) the average prices for larger, less-fuel-efficient models have declined over the past 5 years as average prices for the most-fuel-efficient automobiles have risen, showing an increase in demand for the more fuel efficient vehicles.

Limitations and Uncertainties with Impact Assessment

Taken from p. 3-70 of the NHTSA Final Environmental Impact Statement (EIS) for New CAFE Standards (October 2008), Figure 2.22-3 illustrates how the range of uncertainties in assessing GHG impacts grows with each step of the analysis:

“Cascade of uncertainties typical in impact assessments showing the “uncertainty explosion” as these ranges are multiplied to encompass a comprehensive range of future consequences, including physical, economic, social, and political impacts and policy responses.”

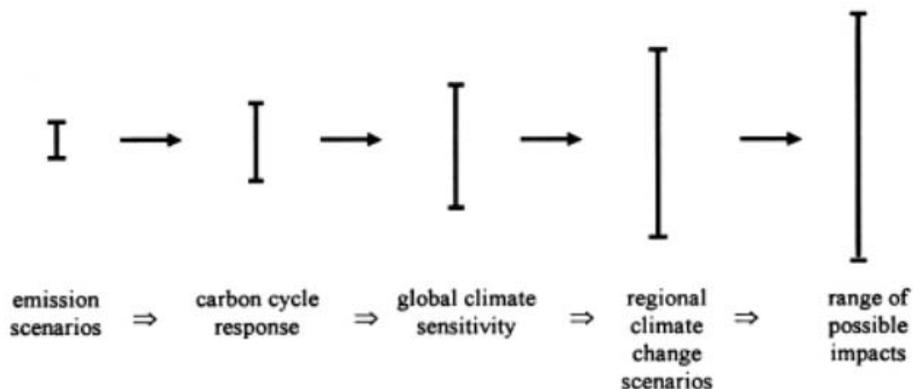


Figure 2.22-3 Cascade of Uncertainties

Much of the uncertainty in assessing an individual project's impact on climate change surrounds the global nature of the climate change. Even assuming that the target of meeting the 1990 levels of emissions is met, there is no regulatory or other framework in place that would allow for a ready assessment of what any modeled increase in CO₂ emissions would mean for climate change given the overall California GHG emissions inventory of approximately 430 million tons of CO₂ equivalent. This uncertainty only increases when viewed globally. The IPCC has created multiple scenarios to project potential future global GHG emissions as well as to evaluate potential changes in global temperature, other climate changes, and their effect on human and natural systems. These scenarios vary in terms of the type of economic development, the amount of overall growth, and the steps taken to reduce GHG emissions. Nonmitigation IPCC scenarios project an increase in global GHG emissions by 9.7, up to 36.7 billion metric tons of CO₂ from 2000 to 2030, which represents an increase of between 25 and 90 percent.¹

The assessment is further complicated by the fact that changes in GHG emissions can be difficult to attribute to a particular project because the projects often cause shifts in the locale for some type of GHG emissions, rather than causing "new" GHG emissions. It is difficult to assess the extent to which any project-level increase in CO₂ emissions represents a net global increase, reduction, or no change. There are no models approved by regulatory agencies that operate at the global or even statewide scale.

The complexities and uncertainties associated with project-level impact analysis are further borne out in the recently released Final EIS completed by the National Highway Traffic Safety Administration (NHTSA) CAFE Standards, October 2008. As the text quoted below shows, even when dealing with GHG emission scenarios on a national scale for the entire passenger car and light truck fleet, the numerical differences among alternatives is very small and well within the error sensitivity of the model.

"In analyzing across the CAFE 30 alternatives, the mean change in the global mean surface temperature, as a ratio of the increase in warming between the

¹ Intergovernmental Panel on Climate Change (IPCC). February 2007. Climate Change 2007: The Physical Science Basis: Summary for Policy Makers. <http://www.ipcc.ch/SPM2feb07.pdf>.

B1 (low) to A1B (medium) scenarios, ranges from 0.5 percent to 1.1 percent. The resulting change in sea level rise (compared to the No Action Alternative) ranges, across the alternatives, from 0.04 centimeter to 0.07 centimeter. In summary, the impacts of the model year 2011-2015 CAFE alternatives on global mean surface temperature, sea level rise, and precipitation are relatively small in the context of the expected changes associated with the emission trajectories. This is due primarily to the global and multi-sectoral nature of the climate problem. Emissions of CO₂, the primary gas driving the climate effects, from the United States automobile and light truck fleet represented about 2.5 percent of total global emissions of all greenhouse gases in the year 2000 (EPA, 2008; CAIT, 2008). While a significant source, this is a still small percentage of global emissions, and the relative contribution of CO₂ emissions from the United States light vehicle fleet is expected to decline in the future, due primarily to rapid growth of emissions from developing economies (which are due in part to growth in global transportation sector emissions).” [NHTSA Draft EIS for New CAFE Standards, June 2008, pp.3-77 to 3-78]

Construction Emissions

Greenhouse gas emissions for transportation projects can be divided into those produced during construction and those produced during operations. Construction GHG emissions include emissions produced as a result of material processing, emissions produced by onsite construction equipment, and emissions arising from traffic delays due to construction. These emissions will be produced at different levels throughout the construction phase; their frequency and occurrence can be reduced through innovations in plans and specifications and by implementing better traffic management during construction phases.

In addition, with innovations such as longer pavement lives, improved traffic management plans, and changes in materials, the GHG emissions produced during construction can be mitigated to some degree by longer intervals between maintenance and rehabilitation events. As modeled with the Roadway Construction Emissions Model¹ (RCEM, Version 7.1.2, September 2012), construction activities would generate a total of 6,605 tons of CO₂ (refer to Appendix C of the Air Quality

¹ A spreadsheet tool developed for the Sacramento Metropolitan Air Quality Management District (SMAQMD) (Jones & Stokes and Rimpo and Associates).

Assessment). These emissions would be produced at different levels throughout the construction phase, and their frequency and occurrence can be reduced through innovations in plans and specifications and by implementing better traffic management during construction phases. The proposed project would comply with any state, federal, and/or local rules and regulations developed as a result of implementing control and mitigation measures proposed as part of their respective State Implementation Plans (SIPs).

CEQA Conclusion

As discussed above, both the future with project and future no build show increases in CO₂ emissions over the existing levels; the future build CO₂ emissions are higher than the future no build emissions. In addition, as discussed above, there are also limitations with EMFAC and with assessing what a given CO₂ emissions increase means for climate change. Therefore, it is Caltrans determination that in the absence of further regulatory or scientific information related to GHG emissions and CEQA significance, it is too speculative to make a determination regarding significance of the project's direct impact and its contribution on the cumulative scale to climate change. However, Caltrans is firmly committed to implementing measures to help reduce the potential effects of the project. These measures are outlined in the following section.

Greenhouse Gas Reduction Strategies

AB 32 Compliance

Caltrans continues to be actively involved on the Governor's Climate Action Team as ARB works to implement Executive Orders S-3-05 and S-01-07 and help achieve the targets set forth in AB 32. Many of the strategies Caltrans is using to help meet the targets in AB 32 come from the California Strategic Growth Plan, which is updated each year. Former Governor Arnold Schwarzenegger's Strategic Growth Plan calls for a \$222 billion infrastructure improvement program to fortify the state's transportation system, education, housing, and waterways, including \$100.7 billion in transportation funding during the next decade. The Strategic Growth Plan targets a significant decrease in traffic congestion below today's level and a corresponding reduction in GHG emissions. The Strategic Growth Plan proposes to do this while accommodating growth in population and the economy. A suite of investment options has been created that combined together are expected to reduce congestion. The Strategic Growth Plan relies on a complete systems approach to attain CO₂ reduction goals: system monitoring and evaluation, maintenance and preservation, smart land

use and demand management, and operational improvements as depicted in Figure 2.22-4: Mobility Pyramid.



Figure 2.22-4 Mobility Pyramid

Caltrans is supporting efforts to reduce vehicle miles traveled by planning and implementing smart land use strategies: job/housing proximity, developing transit-oriented communities, and high density housing along transit corridors. Caltrans works closely with local jurisdictions on planning activities but does not have local land use planning authority. Caltrans assists efforts to improve the energy efficiency of the transportation sector by increasing vehicle fuel economy in new cars, light and heavy-duty trucks; Caltrans is doing this by supporting on-going research efforts at universities, by supporting legislative efforts to increase fuel economy, and by its participation on the Climate Action Team. It is important to note, however, that the control of the fuel economy standards is held by U.S. EPA and ARB.

Table 2.22-5 summarizes Caltrans and statewide efforts that Caltrans is implementing in order to reduce GHG emissions. More detailed information about each strategy is included in the *Climate Action Program* at Caltrans (December 2006).

To the extent that it is applicable or feasible for the project and through coordination with the project development team, the following measures will also be included in the project to reduce the GHG emissions and potential climate change impacts from the project:

Table 2.22-5 Climate Change/CO₂ Reduction Strategies

Strategy	Program	Partnership		Method/Process	Estimated CO ₂ Savings (MMT)	
		Lead	Agency		2010	2020
Smart Land Use	Intergovernmental Review (IGR)	Caltrans	Local governments	Review and seek to mitigate development proposals	Not Estimated	Not Estimated
	Planning Grants	Caltrans	Local and regional agencies & other stakeholders	Competitive selection process	Not Estimated	Not Estimated
	Regional Plans and Blueprint Planning	Regional Agencies	Caltrans	Regional plans and application process	0.975	7.8
Operational Improvements & Intelligent Transportation System (ITS) Deployment	Strategic Growth Plan	Caltrans	Regions	State ITS; Congestion Management Plan	0.07	2.17
Mainstream Energy & GHG into Plans and Projects	Office of Policy Analysis & Research; Division of Environmental Analysis	Interdepartmental effort		Policy establishment, guidelines, technical assistance	Not Estimated	Not Estimated
Educational & Information Program	Office of Policy Analysis & Research	Interdepartmental, Cal/EPA, ARB, CEC		Analytical report, data collection, publication, workshops, outreach	Not Estimated	Not Estimated
Fleet Greening & Fuel Diversification	Division of Equipment	Department of General Services		Fleet Replacement B20 B100	0.0045	0.0065 0.045 0.0225
Non-vehicular Conservation Measures	Energy Conservation Program	Green Action Team		Energy Conservation Opportunities	0.117	.34
Portland Cement	Office of Rigid Pavement	Cement and Construction Industries		2.5 % limestone cement mix	1.2	4.2
				25% fly ash cement mix > 50% fly ash/slag mix	0.36	3.6
Goods Movement	Office of Goods Movement	Cal/EPA, ARB, BT&H, MPOs		Goods Movement Action Plan	Not Estimated	Not Estimated
Total					2.72	18.18

ARB = California Air Resources Board
 BT&H = Business, Transportation and Housing Agency
 Cal/EPA = California Environmental Protection Agency
 CO₂ = carbon dioxide
 CEC = California Energy Commission
 GHG = greenhouse gas(es)
 MMT = million metric tons
 MPOs = Metropolitan Planning Organizations

- Landscaping reduces surface warming, and through photosynthesis, decreases CO₂. Landscaping would be provided where necessary within the corridor to provide aesthetic treatment, replacement planting, or mitigation planting for the project. The landscape planting would help offset any project CO₂ emissions.
- The project would incorporate the use of energy-efficient lighting, such as light-emitting diode (LED) traffic signals, to the extent feasible. LED bulbs—or balls, in the stoplight vernacular—cost \$60 to \$70 apiece, but last 5–6 years, compared

to the 1-year average lifespan of the incandescent bulbs previously used. The LED balls themselves consume 10 percent of the electricity of traditional lights, which will also help reduce the project's CO₂ emissions.

According to Caltrans Standard Specification Provisions, idling time for lane closure during construction is restricted to 10 minutes in each direction. In addition, the contractor must comply with Title 13, California Code of Regulations (CCR) Section 2449(d)(3), adopted by the ARB on June 15, 2008. This regulation restricts idling of construction vehicles to no longer than five consecutive minutes. Compliance with this regulation reduces harmful emissions from diesel-powered construction vehicles.

Adaptation Strategies

“Adaptation strategies” refer to how Caltrans and others can plan for the effects of climate change on the state's transportation infrastructure and strengthen or protect the facilities from damage. Climate change is expected to produce increased variability in precipitation, rising temperatures, rising sea levels, variability in storm surges and intensity, and the frequency and intensity of wildfires. These changes may affect the transportation infrastructure in various ways, such as damage to roadbeds from longer periods of intense heat; increasing storm damage from flooding and erosion; and inundation from rising sea levels. These effects will vary by location and may, in the most extreme cases, require that a facility be relocated or redesigned. There may also be economic and strategic ramifications as a result of these types of impacts to the transportation infrastructure.

At the federal level, the Climate Change Adaptation Task Force, co-chaired by the White House Council on Environmental Quality (CEQ), the Office of Science and Technology Policy (OSTP), and the National Oceanic and Atmospheric Administration (NOAA), released its interagency report on October 14, 2010 outlining recommendations to President Obama for how Federal Agency policies and programs can better prepare the U.S. to respond to the impacts of climate change. The Progress Report of the Interagency Climate Change Adaptation Task Force recommends that the federal government implement actions to expand and strengthen the nation's capacity to better understand, prepare for, and respond to climate change.

Climate change adaption must also involve the natural environment as well. Efforts are underway on a statewide-level to develop strategies to cope with impacts to habitat and biodiversity through planning and conservation. The results of these

efforts will help California agencies plan and implement mitigation strategies for programs and projects.

On November 14, 2008, former Governor Arnold Schwarzenegger signed EO S-13-08 which directed a number of state agencies to address California's vulnerability to sea level rise caused by climate change. This EO set in motion several agencies and actions to address the concern of sea level rise.

The California Natural Resources Agency (Resources Agency) was directed to coordinate with local, regional, state and federal public and private entities to develop the California Climate Adaptation Strategy (Dec 2009),¹ which summarizes the best known science on climate change impacts to California, assesses California's vulnerability to the identified impacts, and then outlines solutions that can be implemented within and across state agencies to promote resiliency.

The strategy outline is in direct response to EO S-13-08 that specifically asked the Resources Agency to identify how state agencies can respond to rising temperatures, changing precipitation patterns, sea level rise, and extreme natural events. Numerous other state agencies were involved in the creation of the Adaptation Strategy document, including the California Environmental Protection Agency; Business, Transportation and Housing; Health and Human Services; and the Department of Agriculture. The document is broken down into strategies for different sectors that include: Public Health; Biodiversity and Habitat; Ocean and Coastal Resources; Water Management; Agriculture; Forestry; and Transportation and Energy Infrastructure. As data continues to be developed and collected, the state's adaptation strategy will be updated to reflect current findings.

The Resources Agency was also directed to request the National Academy of Science to prepare a Sea Level Rise Assessment Report by December 2010² to advise how California should plan for future sea level rise. The report is to include:

¹ <http://www.energy.ca.gov/2009publications/CNRA-1000-2009-027/CNRA-1000-2009-027-F.PDF>.

² Pre-publication copies of the report, *Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*, were made available from the National Academies Press on June 22, 2012. For more information, please see http://www.nap.edu/catalog.php?record_id=13389.

- Relative sea level rise projections for California, Oregon and Washington taking into account coastal erosion rates, tidal impacts, El Niño and La Niña events, storm surge and land subsidence rates.
- The range of uncertainty in selected sea level rise projections.
- A synthesis of existing information on projected sea level rise impacts to state infrastructure (such as roads, public facilities and beaches), natural areas, and coastal and marine ecosystems.
- A discussion of future research needs regarding sea level rise.

Prior to the release of the final Sea Level Rise Assessment Report, all state agencies that are planning to construct projects in areas vulnerable to future sea level rise were directed to consider a range of sea level rise scenarios for the years 2050 and 2100 in order to assess project vulnerability and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise. Sea level rise estimates should also be used in conjunction with information regarding local uplift and subsidence, coastal erosion rates, predicted higher high water levels, storm surge and storm wave data.

Interim guidance has been released by The Coastal Ocean Climate Action Team (CO-CAT) as well as Caltrans as a method to initiate action and discussion of potential risks to the states infrastructure due to projected sea level rise.

All projects that have filed a Notice of Preparation as of the date of EO S-13-08, and/or are programmed for construction funding from 2008 to 2013, or are routine maintenance projects may, but are not required to, consider these planning guidelines. The proposed project is outside the coastal zone and direct impacts to transportation facilities due to projected sea level rise are not expected.

Interim guidance has been released by The Coastal Ocean Climate Action Team (CO-CAT) as well as Caltrans as a method to initiate action and discussion of potential risks to the states infrastructure due to projected sea level rise. As the proposed project is outside the coastal zone at an elevation between 300 and 500 feet above sea level, direct impacts to transportation facilities due to projected sea level rise are not expected.

EO S-13-08 also directed the Business, Transportation, and Housing Agency to prepare a report to assess vulnerability of transportation systems to sea level rise affecting safety, maintenance and operational improvements of the system, and economy of the state. Caltrans continues to work on assessing the transportation system vulnerability to climate change, including the effect of sea level rise.

Currently, Caltrans is working to assess which transportation facilities are at greatest risk from climate change effects. However, without statewide planning scenarios for relative sea level rise and other climate change effects, Caltrans has not been able to determine what change, if any, may be made to its design standards for its transportation facilities. Once statewide planning scenarios become available, Caltrans will be able review its current design standards to determine what changes, if any, may be warranted in order to protect the transportation system from sea level rise.

Climate change adaptation for transportation infrastructure involves long-term planning and risk management to address vulnerabilities in the transportation system from increased precipitation and flooding; the increased frequency and intensity of storms and wildfires; rising temperatures; and rising sea levels. Caltrans is an active participant in the efforts being conducted in response to EO S-13-08 and is mobilizing to be able to respond to the National Academy of Science Sea Level Rise Assessment Report.

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