Chapter 4 California Environmental Quality Act Evaluation

4.1 Determining Significance under the California Environmental Quality Act

The project is subject to federal and State environmental review requirements because Caltrans and the Los Angeles County Metropolitan Transportation Authority (Metro) propose the use of federal funds from the Federal Highway Administration (FHWA) and/or the project requires an approval from FHWA. Project documentation, therefore, has been prepared in compliance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). Caltrans and Metro are the project proponents and the lead agencies under CEQA. FHWA's responsibility for environmental review, consultation, and any other action required in accordance with NEPA and other applicable federal laws for this project is being, or has been, carried out by Caltrans under its assumption of responsibility pursuant to 23 United States Code (U.S.C.) 327.

One of the primary differences between NEPA and CEQA is the way significance is determined. Under NEPA, significance is used to determine whether an Environmental Impact Statement (EIS), or a lower level of documentation, will be required. NEPA requires that an EIS be prepared when the proposed federal action (project) *as a whole* has the potential to "significantly affect the quality of the human environment." The determination of significance is based on context and intensity. Some impacts determined to be significant under CEQA may not be of sufficient magnitude to be determined significant under NEPA. Under NEPA, once a decision is made regarding the need for an EIS, it is the magnitude of the impact that is evaluated, and no judgment of its individual significance is deemed important for the text. NEPA does not require that a determination of significant impacts be stated in the environmental documents.

CEQA, on the other hand, does require Caltrans to identify each "significant effect on the environment" resulting from the project and ways to mitigate each significant effect. If the project may have a significant effect on any environmental resource, then an Environmental Impact Report (EIR) must be prepared. Each and every significant effect on the environment must be disclosed in the EIR and mitigated if feasible. In addition, the CEQA Guidelines list a number of mandatory findings of significance, which also require the preparation of an EIR. There are no types of actions under NEPA that parallel the findings of mandatory significance of CEQA. This chapter discusses the effects of this project and CEQA significance.

4.2 Discussion of Significance of Impacts

With the absence of timberland (forest land), coastal zones, mineral resources, and wild and scenic rivers in or near the project area, the project would have no impacts

on these resources. No further discussion of these issues is provided in this chapter. In addition, there would be no traffic/transportation impacts except temporary delays during construction. The project would have beneficial effects on circulation. Traffic and transportation is discussed in Section 3.1.6 of this EIS/EIR.

Questions on the CEQA Environmental Checklist (Appendix A) have been addressed based on the discussions in Chapter 3 and below. The discussion below applies to all four build alternatives (including their variations), unless specifically noted otherwise. As previously discussed in Chapter 3, the environmental baseline for this project is 2010 because that is the year the Notice of Preparation (NOP) was filed.

4.2.1 Less than Significant Effects of the Project

All four build alternatives have the potential for environmental impacts on resources in the area, as analyzed in Chapter 3; however, with standard conditions and avoidance and minimization measures incorporated, the following impacts would have a less than significant effect on the environment (refer to Chapter 3 for further information):

Common to All Build Alternatives

- Air Quality
- Geology and Soils
- Hazards and Hazardous Materials
- Public Services, other than parks
- Recreation
- Utilities and Service Systems

Analyses of these topics are provided in Chapter 3.

No Build Alternative

The No Build Alternative would not lead to any physical changes in the existing environment in the following resource areas:

- Aesthetics
- Air Quality
- Agriculture
- Biological Resources
- Cultural Resources
- Geology And Soils
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Population and Housing
- Public Services
- Recreation
- Utilities and Service Systems

4.2.2 Significant Environmental Effects of the Project

Common to All Build Alternatives

Significant adverse impacts before mitigation measures would occur with the build alternatives in the following resource areas:

- Aesthetics
- Biological Resources
- Cultural Resources
- Paleontological Resources
- Hydrology and Water Quality
- Land Use and Planning
- Noise
- Transportation/Traffic

Analyses of these topics are provided in Chapter 3.

4.2.3 Unavoidable Significant Environmental Effects

Measures have been proposed to mitigate potentially significant adverse impacts of the build alternatives; however, the following impacts would remain significant and unavoidable and are summarized below. Detailed impact analyses are presented in Chapter 3.

Common to All Build Alternatives

Agriculture

The proposed project would require acquisition of land for the proposed HDC ROW. It would directly impact farmland by converting approximately 252 acres of Important Farmland to nonagricultural use, which could be a potentially significant impact (see discussion in Section 3.1.3, Farmland/Grazing Land).

The HDC base alignment would pass through approximately 215 acres of designated grazing land in Los Angeles County and 2,100 acres in San Bernardino County. Most of the alignment in San Bernardino County would traverse FMMP-classified “grazing land”. However, due to availability of abundant grazing land, impact from the project’s contribution to the incremental loss of grazing land is not considered significant.

Biological Resources

The proposed project would affect approximately 6,900 acres of natural communities, which would result in a barrier to wildlife movement. In addition, the proposed project would result in impacts to wetland Waters of the U.S., non-wetland Waters of the U.S., wetland Waters of the State, and non-wetland Waters of the States.

Land Use and Planning

Existing land uses directly within the project footprint would be converted to transportation-related use. Over a period of time, adjacent land uses at these locations

may potentially see changes from existing use towards commercial, business, and/or residential-based land uses. In addition, shifts in land use are expected to occur along interchanges located within developed areas.

Many residential, commercial, industrial, agricultural, and nonprofit properties would be affected through partial or full acquisition. All property acquisition and relocations would be handled in accordance with the Uniform Relocation Act of 1970, as amended, which mandates certain relocation services and payments by Caltrans be made available to eligible residents, businesses, and nonprofit organizations displaced by Caltrans projects. Design refinements to avoid or minimize impacts to existing land uses related to temporary construction use and/or permanent acquisition of properties would be incorporated in the final engineering design of the selected build alternative to the extent practicable.

Despite measures required by the Uniform Relocation Act, available mitigation measures would not reduce all community impacts. Impacts would remain significant and unavoidable.

California Environmental Quality Act Noise Analysis

When determining whether a noise impact is significant under CEQA, a comparison is made between the existing noise level (i.e., baseline) and the build alternative noise levels. The CEQA noise analysis is independent of the NEPA analysis, which is centered on NAC. Under CEQA, the assessment looks at the setting of the noise impact and then how large or perceptible any noise increase would be in the given area. The following are key considerations: uniqueness of the setting, sensitive nature of the noise receptor(s), magnitude of the noise increase, number of residences affected, and project noise level.

If a proposed project is determined to have a significant noise impact under CEQA, then the act dictates that mitigation measures must be incorporated into the project unless such measures are not feasible.

It is generally accepted that people are able to begin to detect sound level increases of 3 dB in typical noisy environments, and that a 5-dB increase is perceived as a distinctly noticeable increase. A 10-dB increase is generally perceived as a doubling of loudness. Therefore, a doubling of sound energy, such as doubling the volume of traffic on a highway that would result in a 3-dB increase in sound would generally be perceived as barely detectable.

A two-tier impact criterion for traffic noise significance analysis is used for CEQA. A 5-dB increase from existing noise levels is considered an impact for areas presently exposed to freeway traffic noise; a 12-dB increase is used for areas that presently are not exposed to freeway traffic noise. This allows less noise increase for areas that are along an existing freeway because the areas are already exposed to high traffic noise levels. The reasoning for this two-tier approach is that people already exposed to high levels of noise should be expected to tolerate a small increase in the amount of noise in their community. In contrast, if the existing noise levels are quite low, it is

reasonable to allow a greater change in community noise for the equivalent difference in annoyance. Typically, a 5-dB noise increase in a noisy environment is more annoying and intruding than a similar noise increase in a quieter environment.

Because a decibel, which is used to report noise levels, is a logarithm, the required increase in energy to increase 1 dB is much less when the noise level is 50 dBA versus when it is 70 dBA. An increase of 5 dB from 67 to 72 dB requires approximately 4.5 times more energy than required to increase 52 dB by 12 dB to 64 dBA; therefore, an increase of 12 dB at a lower noise level will not cause more energy exposure than an increase of 5 dB at a higher noise level. The higher the increase for areas that presently have low background noise levels would bring their noise levels about the same as the areas along existing freeways.

A project is considered to have a significant noise impact when it causes an adopted noise standard to be exceeded at a sensitive receptor and when it substantially increases noise exposure.

At noise receiver locations, the existing baseline noise traffic level was compared to the future build traffic noise level for each of the build alternatives. Feasible traffic noise abatement was considered at locations where a significant noise impact was identified. Construction of noise barriers at these locations was considered a practical traffic noise abatement measure. For purposes of CEQA, Caltrans considers the reasonableness and feasibility of noise abatement the same as discussed in Section 3.2.7, Noise.

4.3 Significant Irreversible Environmental Changes

As discussed in Section 3.5, the impacts of the build alternatives would be similar to each other, and construction would require the commitment of natural, physical, human, and fiscal resources. The loss of developed and undeveloped properties and use of the land that would be acquired for the project would be an irreversible and long-term commitment of this resource. Construction would also require use of fossil fuels, water, and construction materials such as concrete cement, aggregate (i.e., sand and gravel), asphalt, steel, paint, fencing, pipes, and other materials that are generally not retrievable once they have been used to build a road and/or rail facility. Labor would be needed to produce construction materials, demolish existing structures and infrastructure, and build the HDC facility; however, as a beneficial impact, the project would provide employment for local labor resources and would not adversely affect the availability of labor resources in the affected communities.

Lastly, construction of the project would require a substantial one-time expenditure of local, State, and federal funds, which are not retrievable; however, commitment of these resources would benefit residents, workers, travelers, businesses, and others throughout the area, region, and State from the improved quality of the transportation system in the High Desert region. Improvements to local and regional mobility and accessibility are expected to outweigh the irreversible and irretrievable commitment of resources.

4.4 Minimization and Mitigation Measures for Significant Impacts under the California Environmental Quality Act

Impacts are avoided or minimized through implementation of standard conditions, minimization measures, and mitigation measures (identified at the end of each topic in Chapter 3). Implementation of standard conditions is assumed prior to making a determination if an impact is significant, because these are regulatory requirements or practices that Caltrans applies to all projects. Other mitigation measures would reduce impacts identified as significant. Mitigation measures listed in Chapter 3 and summarized in Appendix F, Environmental Commitments Record. No mitigation measures are proposed for the No Build Alternative because the project would not be built.

4.5 Climate Change under CEQA

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 (CO_2), methane (CH_4), nitrous oxide (N_2O), tetrafluoromethane, hexafluoroethane, sulfur hexafluoride (SF_6), 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 of GHG-emitting sources. The dominant GHG emitted is CO_2, mostly from fossil fuel combustion.

There are typically two terms used when discussing the impacts of climate change: “Greenhouse Gas Mitigation” and “Adaptation.” “Greenhouse Gas Mitigation” is a term for reducing GHG emissions 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 (e.g., adjusting transportation design standards to withstand more intense storms and higher sea levels).[11]

There are four primary strategies for reducing GHG emissions from transportation sources: (1) improving the transportation system and operational efficiencies, (2) reducing travel activity, (3) transitioning to lower GHG-emitting fuels, and

[11] http://climatechange.transportation.org/ghg_mitigation/

(4) improving vehicle technologies/efficiency. To be most effective, all four strategies should be pursued cooperatively.[12]

Regulatory Setting

State

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

Assembly Bill (AB) 1493, Pavley, Vehicular Emissions: Greenhouse Gases, 2002: This bill 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.

Executive Order (EO) S-3-05 (June 1, 2005): 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 2050. In 2006, this goal was further reinforced with the passage of AB 32.

AB 32, Núñez and Pavley, The Global Warming Solutions Act of 2006: 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 and implement rules to achieve "real, quantifiable, cost-effective reductions of greenhouse gases."

EO S-20-06 (October 18, 2006): This EO establishes the responsibilities and roles of the Secretary of the California Environmental Protection Agency (Cal/EPA) and state agencies with regard to climate change.

EO S-01-07 (January 18, 2007): This order 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 10 percent by 2020.

Senate Bill (SB) 97, Chapter 185, 2007, Greenhouse Gas Emissions: Required the Governor's Office of Planning and Research (OPR) to develop recommended amendments to the CEQA Guidelines for addressing GHG emissions. The amendments became effective on March 18, 2010.

SB 375, Chapter 728, 2008, Sustainable Communities and Climate Protection: This bill requires the ARB to set regional emissions reduction targets from passenger vehicles. The Metropolitan Planning Organization (MPO) for each region must then develop a "Sustainable Communities Strategy" (SCS) that integrates transportation, land use, and housing policies to plan for the achievement of the emissions target for their region.

[12] http://www.fhwa.dot.gov/environment/climate_change/mitigation/

SB 391 Chapter 585, 2009 California Transportation Plan: This bill requires the State's long-range transportation plan to meet California's climate change goals under AB 32.

Federal

Although climate change and GHG reduction are a concern at the federal level, currently no regulations or legislation have been enacted specifically addressing GHG emissions reductions and climate change at the project level. Neither the U.S. Environmental Protection Agency (EPA) nor FHWA has issued explicit guidance or methods to conduct project-level GHG analysis.[13] FHWA supports the approach that 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 assist in 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 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 outlined by FHWA to lessen climate change impacts correlate with efforts that the State is undertaking to deal with transportation and climate change; these strategies include improved transportation system efficiency, cleaner fuels, cleaner vehicles, and a reduction in travel activity.

Climate change and its associated effects are 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*.

EO 13514 (October 5, 2009): This order is focused on reducing GHGs internally in federal agency missions, programs, and operations, but it 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.

EPA's authority to regulate GHG emissions stems from the U.S. Supreme Court decision in *Massachusetts v. EPA* (2007). The Supreme Court ruled that GHGs meet the definition of air pollutants under the existing Clean Air Act and must be regulated if these gases could be reasonably anticipated to endanger public health or welfare. Responding to the Court's ruling, EPA finalized an endangerment finding in December 2009. Based on scientific evidence it found that six GHGs constitute a threat to public health and welfare. Thus, it is the Supreme Court's interpretation of the existing Act and EPA's assessment of the scientific evidence that form the basis

[13] To date, no national standards have been established regarding mobile source GHGs, nor has EPA established any ambient standards, criteria, or thresholds for GHGs resulting from mobile sources.

for EPA's regulatory actions. EPA in conjunction with National Highway Traffic Safety Administration (NHTSA) issued the first of a series of GHG emission standards for new cars and light-duty vehicles in April 2010.[14]

EPA and 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 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.

The final combined standards that made 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 implemented by this program are expected to reduce 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 August 28, 2012, EPA and NHTSA issued a joint Final Rulemaking to extend the National Program for fuel economy standards to model year 2017 through 2025 passenger vehicles. Over the lifetime of the model year 2017-2025 standards, this program is projected to save approximately 4 billion barrels of oil and 2 billion metric tons of GHG emissions.

The complementary EPA and NHTSA standards that make up the Heavy-Duty National Program apply to combination tractors (semi trucks), heavy-duty pickup trucks and vans, and vocational vehicles (including buses and refuse or utility trucks). Together, these standards will cut GHG emissions and domestic oil use significantly. This program responds to President Barack Obama's 2010 request to jointly establish GHG emissions and fuel efficiency standards for the medium- and heavy-duty highway vehicle sector. The agencies estimate that the combined standards will reduce CO_2 emissions by about 270 million metric tons and save about 530 million barrels of oil over the life of model year 2014 to 2018 heavy-duty vehicles.

Project Analysis

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.[15] In assessing cumulative impacts, it must be determined if a project's incremental effect is "cumulatively considerable" (CEQA Guidelines Sections

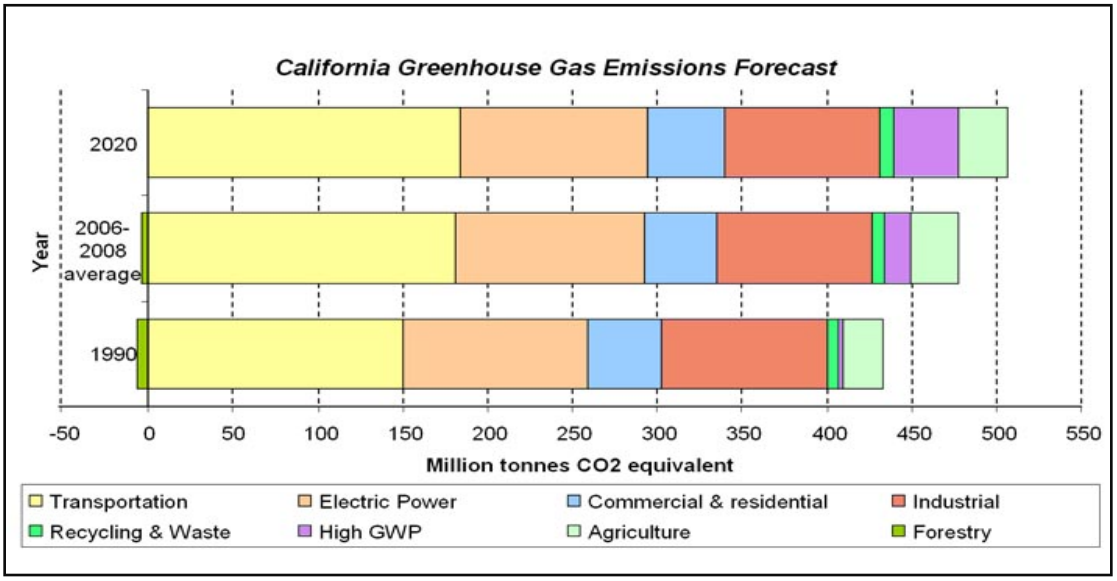
[14] http://www.c2es.org/federal/executive/epa/greenhouse-gas-regulation-faq

[15] 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 CEQADocuments*(March 5, 2007), as well as the South Coast Air Quality Management District (Chapter 6: The CEQA Guide, April 2011) and the U.S. Forest Service (Climate Change Considerations in Project Level NEPA Analysis, July 13, 2009).

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

The AB 32 Scoping Plan mandated by AB 32 includes the main strategies California will use to reduce GHG emissions. 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 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 (see Figure 4-1).

Figure 4-1 California Greenhouse Gas Forecast



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

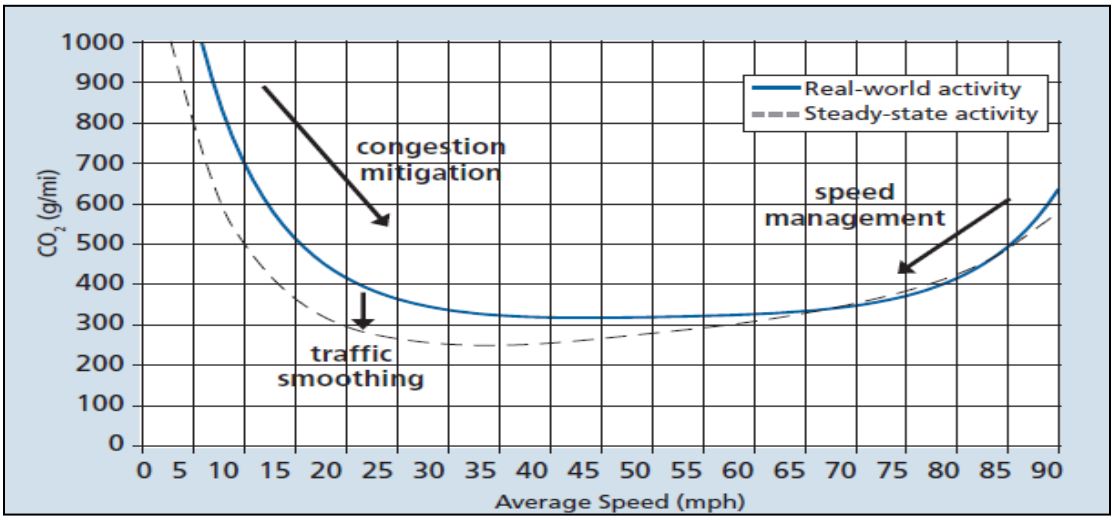
Caltrans and its parent agency, the Transportation Agency, have taken an active role in addressing GHG emission reduction and climate change. Recognizing that 98 percent of California's GHG emissions are from the burning of fossil fuels and 40 percent of all human-made GHG emissions are from transportation, Caltrans has created and is implementing the Climate Action Program at Caltrans that was published in December 2006.[16]

One of the main strategies in Caltrans' Climate Action Program to reduce GHG emissions is to make California's transportation system more efficient. The highest levels of CO_2 from mobile sources, such as automobiles, occur at stop-and-go speeds

[16] 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

(zero to 25 miles per hour [mph]) and speeds over 55 mph; the most severe emissions occur from zero to 25 mph (see Figure 4-2). To the extent that a project relieves congestion by enhancing operations and improving travel times in high congestion travel corridors GHG emissions, particularly CO_2, may be reduced.

Figure 4-2 Possible Effect of Traffic Operation Strategies in Reducing On-Road CO_2 Emission



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

Quantitative Analysis

The HDC Project is included in SCAG's 2012-2035 Regional Transportation Plan/ Sustainable Communities Strategy (RTP/SCS). Since 2000, SCAG has worked actively with the people and institutions of southern California to create a dynamic regional growth vision based on the following principles: *mobility*, *economy*, *and sustainability*. Charged by federal law with preparing an RTP every 4 years, SCAG has traditionally focused most on the mobility aspects of the region's growth. Under State law, SCAG is also charged with working with its member local governments on planning for an adequate regional housing supply; however, the recent passage of SB 375 at the State level gives SCAG a new area of responsibility—and provides the region with a renewed opportunity to focus on an integrated planning effort for the future.

Under SB 375, the primary goal of the SCS is to provide a vision for future growth in southern California that will decrease per-capita GHG emissions from automobiles and light trucks. The strategies contained in the RTP/SCS will produce benefits for the region far beyond simply reducing GHG emissions. Because it is the latest refinement of an evolving regional blueprint that SCAG has been working on since 2000, the RTP/SCS will help the region deal with many ongoing issues across a wide range of concerns, including placemaking, the cost of living, the environment, health, responsiveness to the marketplace, and mobility.

To meet the SCS, the proposed project is planned to be a multipurpose corridor that would incorporate the rail system, green energy production and transmission facility, and a bicycle facility, as outlined in Chapter 1 of this environmental document.

GHG emissions for transportation projects can be divided into those produced during construction and those produced during operations as discussed below.

Operational Emissions

GHG emissions were calculated for the opening year 2020 and horizon year 2040, as presented in Table 4-1. The emission factors needed for the analysis were obtained from the CT-EMFAC and EMFAC 2011. The project is a transportation facility; therefore, the GHG emissions would include operational GHG emissions from vehicle traffic along the project corridor. Sources of operational GHG emissions are the same as those analyzed for mobile source air toxics (MSATs) and include GHG emissions from travel activities along the project corridor, as well as activities in the project region. Project-related GHG emissions were estimated using the emission factors for on-road mobile sources and vehicle miles traveled (VMTs) within the analysis area in the same fashion as the MSAT analysis, comprised of an area 606 mile-by-mile square. The following GHG emissions estimate is presented for the purpose of disclosing project-related emissions.

Table 4-1 Summary of Regional Operational GHG Emissions

	Summary of VMT Used for GHG Calculation (Mile)*	GHG Emissions (Million MTPY)	
		CO_2	CO_2 with Pavley Clean Standards
Base Year, 2010	7,722,930	1.217	1.266
Opening Year, 2020			
No-Build	10,071,438	1.732	1.323
Change from Base Year		*0.462*	*0.058*
FWY/EXP or FWY/EXP with HSR	12,369,704	2.107	1.614
Change from Base Year		*0.837*	*0.349*
Change from No-Build		*0.375*	*0.291*
FWY/Toll or FWY/Toll with HSR	11,736,991	1.990	1.518
Change from Base Year		*0.719*	*0.253*
Change from No-Build		*0.257*	*0.195*
Horizon Year, 2040			
No-Build	13,666,032	2.353	1.628
Change from Base Year		*1.083*	*0.363*
FWY/EXP or FWY/EXP with HSR	17,012,874	2.835	1.966
Change from Base Year		*1.564*	*0.700*
Change from No-Build		*0.482*	*0.337*
FWY/Toll or FWY/Toll with HSR	16,234,481	2.709	1.872
Change from Base Year		*1.438*	*0.606*
Change from No-Build		*0.356*	*0.247*

Note: * VMT presented here is a summary of VMT within each of the 606 mile-by-mile square grid. Speed at each grid varies depending on type of roadway and traffic volume. Note also that these VMT data were provided by the traffic analysis team for use as input to the GHG calculations.

Source: Modified from Air Quality Report, 2014

The project GHG emissions were compared to the following baselines:

- The changes in the future GHG emissions within the analysis area in comparison to the CEQA baseline (i.e., emissions in 2010); and
- The changes in GHG emissions for the build alternatives within the analysis area in comparison to the emissions of the no-build scenario in the same year.

These comparisons provide estimated changes in project GHG emissions based on forecast traffic data. These GHG emissions estimates are only useful when comparing alternatives or analysis years. The estimates are not an accurate reflection of actual GHG emissions because GHG emissions are dependent on other factors such as the fuel mix and consumption, rate of acceleration, and the aerodynamics and efficiency of the vehicles. CT's EMFAC model emission rates are only for direct engine-out CO_2 emissions and do not account for a full fuel cycle. Fuel cycle emission rates can vary dramatically depending on the amount of additives such as ethanol and the source of the fuel components.

CO_2 emissions for the baseline year (2010) were estimated at about 1.3 million metric ton per year (MTPY). CO_2 emissions are the main GHG of concern, as vehicle operation does not result in appreciable amounts of other GHGs (e.g., methane, nitrous oxides). With the project, in the opening year (2020), the CO_2 emissions are estimated to increase from 2010 levels by about 0.8 million MTPY for the alternatives without a toll and about 0.7 million MTPY for the alternatives with a toll; and increase from the no-build level of the same year about 0.4 million MTPY for the alternatives without a toll and about 0.3 million MTPY for the alternatives with a toll. In the horizon year (2040), the CO_2 emissions are estimated to increase from 2010 levels by about 1.6 million MTPY for the alternatives without a toll and about 1.4 million MTPY for the alternatives with a toll; and increase from the no-build level of the same year about 0.5 million MTPY for the alternatives without a toll and about 0.4 million MTPY for the alternatives with a toll.

Table 4-1 also presents estimates of operational emissions of GHGs reflecting implementation of two important California rules/standards [AB 1439 (Pavley) and AB 32 via the Low Carbon Fuels Standard], which establish stricter standards to reduce GHG emissions from passenger cars and light-duty trucks. These emissions were estimated using the EMFAC2011 Model, which includes data for CO_2 emissions for the fleet mix with implementation of these new standards.

The emissions of CO_2 with the Pavley Clean Car Standards were also estimated for each segment along the proposed corridor based on the corridor-level VMT data. A summary of total corridor-level emissions is provided below only for the proposed HDC build alternatives.

Table 4-2 Summary of Corridor-Level CO_2 Emissions with Pavley Clean Car Standards

	Summary of VMT Used for GHG Calculation (Mile)*	CO_2 Emissions with Pavley Clean Car Standards (Million MTPY)
Opening Year, 2020**		
FWY/EXP or FWY/EXP with HSR	4,305,895	0.532
FWY/Toll or FWY/Toll with HSR	6,892,708	0.386
Horizon Year, 2040		
FWY/EXP or FWY/EXP with HSR	5,991,701	0.668
FWY/Toll or FWY/Toll with HSR	8,303,004	0.514
Note: * VMT presented here is a summary of VMT at four different time periods of the day. Speed at each time period varies depending on traffic volume. Note also that these VMT data were provided by the traffic analysis team for use as input to the GHG calculations. ** Data for Base Year and No Build are not available because there was no corridor in 2010 (Base Year) and there would be no corridor to project the No Build condition.		

Source: Modified from Air Quality Report, 2014

These comparisons provide illustration of estimated changes in project emissions of GHG based on forecast traffic data. Note that GHG emissions are only useful for a comparison between alternatives or between analysis years. It should be noted that, while the CO_2 emissions factor does assume certain reductions in vehicle emissions due to future vehicle models operating more efficiently, additional reductions in vehicle emissions would also occur in response to new and stricter legislated standards as they become implemented. Therefore, the numbers are not an accurate reflection of what the true CO_2 emissions would be and may actually overstate the expectations because CO_2 emissions depend on other factors that are not part of the model representation, such as fuel mix, rate of acceleration, and aerodynamics and efficiency of the vehicles themselves.

ARB's EMFAC model emission rates are only for direct engine-out CO_2 emissions and do not account for a full fuel cycle. Fuel-cycle emission rates can vary dramatically depending on the amount of additives, such as ethanol and the source of the fuel components. Tables in Appendix I of the Air Quality Report summarize changes in GHG emissions of the build alternatives in comparison to the baselines as discussed above. Appendix J of the Air Quality Report provides illustration of the changes in GHG emissions in comparison to the baselines.

Construction Emissions

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. Based on the preliminary information on construction duration and engineering, the construction CO_2 emissions have been estimated using Sacramento Metropolitan Air Quality Management District's *Road Construction Emissions Model, Version 7.1.4* and are summarized in Table 4-3. While the model was developed for Sacramento conditions in terms of fleet emission factors, silt loading, and other modeling assumptions, it is considered adequate for estimating road construction emissions by the San Joaquin Valley Air Pollution Control District under its Indirect Source regulations and the South Coast Air Quality Management District in its CEQA guidance, and is used for that purpose in this project analysis. See Appendix A of the Air Quality Report for construction emissions calculation based on the engineer's estimate of construction activities.

Table 4-3 Estimate of Carbon Dioxide Emissions during Construction

	CO_2 Emissions (Tons)
Total On-Structure	20,039.2
Total At-Grade	45,602.7
Total Project CO_2	65,641.9
Annual CO_2 (Tons/Year)	14,587.1

Source: Air Quality Report, 2014

The proposed alignments for the alternatives and route variations are relatively similar in lengths and components (i.e., total lengths of structures). In addition, the proposed HSR service is proposed to be constructed in the median except at its termini. As the construction emissions are estimated based on the length of the proposed project on structures or at-grade, the total aggregate construction emissions are anticipated to result in the same for all of the alternatives and route variations.

Limitations and Uncertainties with Modeling

EMFAC

Although EMFAC can calculate CO_2 emissions from mobile sources, the model does have limitations when it comes to accurately reflecting changes in CO_2 emissions due to impacts on traffic. According to the National Cooperative Highway Research Program report, *Development of a Comprehensive Modal Emission Model* (April 2008) and a 2009 University of California study,[17] brief but rapid accelerations, such as those occurring during congestion, can contribute significantly to a vehicle's CO_2 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

17 Matthew Bartha, Kanok Boriboonsomsin. 2009. Energy and emissions impacts of a freeway-based dynamic eco-driving system. Transportation Research Part D: Transport and Environment Volume 14, Issue 6, August 2009, Pages 400–410

idling) in the operation of a vehicle and instead estimate emissions by average trip speed. This limitation creates an uncertainty in the model's results compared to the estimated emissions of the various alternatives with baseline in an attempt to determine impacts. Although work by EPA and ARB is underway on modal-emission models, neither agency has approved a modal emissions model that can be used to conduct this more accurate modeling.

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

> REVISION: Both the EMFAC and OFFROAD Models develop carbon dioxide ($CO_{2)}$ and methane (CH_4) emission estimates; however, they are not currently used as the basis for [California Air Resources Board's] official [greenhouse gas] inventory which is based on fuel usage information. http://www.arb.ca.gov/cc/inventory/inventory.htm. However, Air Resources Board is working towards reconciling the emission estimates from the fuel usage approach and the models.[18]

Other Variables

With the current science, project-level analysis of GHG emissions has limitations. 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 CO_2 emissions.

First, vehicle fuel economy is increasing. EPA's annual report, "Light-Duty Automotive Technology and Fuel Economy Trends: 1975 through 2012,"[19] 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 at a record high. Corporate Average Fuel Economy (CAFE) standards remained the same between model years 1995 and 2003 and subsequently began setting increasingly higher fuel economy standards for future vehicle model years. EPA estimates that light-duty fuel economy rose by 16 percent from 2007 to 2012. Table 4-4 shows the increases in required fuel economy standards for cars and trucks between Model Years 2012 and 2025 as available from the National Highway Traffic Safety Administration for the 2012-2016 and 2017-2025 CAFE Standards.

18 http://www.arb.ca.gov/msei/offroad.htm

19 http://www.epa.gov/oms/fetrends.htm

Table 4-4 Average Required Fuel Economy (mpg)

	2012	2013	2014	2015	2016	2018	2020	2025
Passenger Cars	33.3	34.2	34.9	36.2	37.8	41.1-41.6	44.2-44.8	55.3-56.2
Light Trucks	25.4	26	26.6	27.5	28.8	29.6-30.0	30.6-31.2	39.3-40.3
Combined	29.7	30.5	31.3	32.6	34.1	36.1-36.5	38.3-38.9	48.7-49.7

Source: EPA 2013, http://www.epa.gov/fueleconomy/fetrends/1975-2012/420r13001.pdf

Second, near zero carbon vehicles will come into the market during the design life of this project. According to the 2013 Annual Energy Outlook (AEO2013):

> "LDVs [light duty vehicles] that use diesel, other alternative fuels, hybrid-electric, or all-electric systems play a significant role in meeting more stringent greenhouse gas emissions and Corporate Average Fuel Economy Standards over the projection period. Sales of such vehicles increase from 20 percent of all new LDV sales in 2011 to 49 percent in 2040 in the Annual Energy Outlook 2013 Reference case."[20]

The greater percentage of alternative fuel vehicles on the road in the future will reduce overall GHG emissions compared to scenarios in which vehicle technologies and fuel efficiencies do not change.

Third, California recently adopted a low-carbon transportation fuel standard in 2009 to reduce the carbon intensity of transportation fuels by 10 percent by 2020. The regulation became effective on January 12, 2010 (codified in Title 17, California Code of Regulations, Sections 95480-95490). Beginning January 1, 2011, transportation fuel producers and importers must meet specified average carbon intensity requirements for fuel in each calendar year.

Lastly, 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,"[21] the Congressional Budget Office found the following results based on data collected from California: (1) freeway motorists adjust to higher gas prices by making fewer trips and driving slower; (2) the market share of sports utility vehicles is declining; and (3) the average prices for larger, less-fuel-efficient models declined from 2003 to 2008 as average prices for the most-fuel-efficient automobiles have risen, showing an increase in demand for the more fuel-efficient vehicles. More recent reports from the Energy Information Agency[22] and Bureau of Economic Analysis[23] also show slowing regrowth of vehicle sales in the years since its dramatic

[20] http://www.eia.gov/forecasts/aeo/pdf/0383(2013).pdf
[21] http://www.cbo.gov/ftpdocs/88xx/doc8893/01-14-GasolinePrices.pdf
[22] http://www.eia.gov/oiaf/aeo/tablebrowser/aeo_query_server/?event=ehExcel.getFile&study=AEO2013 &region=0-0&cases=ref2013-d102312a&table=114-AEO2013&yearFilter=0
[23] Historical Vehicle Sales: www.bea.gov/national/xls/gap_hist.xls

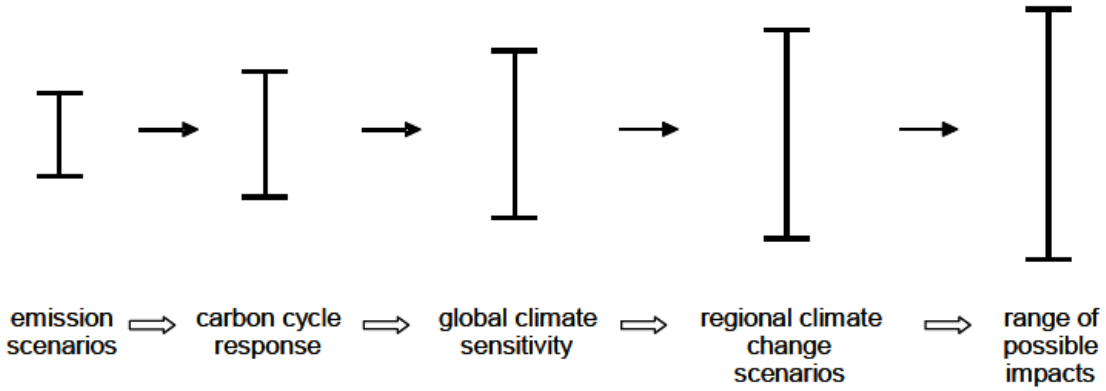
drop in 2009 due to the Great Recession as gasoline prices continue to climb to $4 per gallon and beyond.

Limitations and Uncertainties with Impact Assessment

Taken from p. 5-22 of the National Highway Traffic Safety Administration Final Environmental Impact Statement for Mid-Year 2017–2025 Corporate Average Fuel Economy Standards (July 2012), Figure 4-3 illustrates how the range of uncertainties in assessing GHG impacts grows with each step of the analysis:

> "Moss and Schneider (2000) characterize the "cascade of uncertainty" in climate change simulations (Figure 4-3). As indicated in Figure 4-3, the emission estimates used in this EIS have narrower bands of uncertainty than the global climate effects, which are less uncertain than regional climate change effects. The effects on climate are, in turn, less uncertain than the impacts of climate change on affected resources (such as terrestrial and coastal ecosystems, human health, and other resources […] Although the uncertainty bands broaden with each successive step in the analytic chain, all values within the bands are not equally likely; the mid-range values have the highest likelihood."[24]

Figure 4-3 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 CO_2 emissions would mean for climate change given the overall California GHG emissions inventory of approximately 430 million tons of CO_2 equivalent. This uncertainty only increases when viewed globally. The Intergovernmental Panel on Climate Change (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,

[24] http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/FINAL_EIS.pdf. page 5-22

the amount of overall growth, and the steps taken to reduce GHG emissions. Non-mitigation IPCC scenarios project an increase in global GHG emissions by 9.7 up to 36.7 billion metric tons CO_2 from 2000 to 2030, which represents an increase between 25 and 90 percent.[25]

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 CO_2 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.

CEQA Conclusion

As discussed above, both the future with project and future no build show increases in CO_2 emissions over the existing levels; the future build CO_2 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 CO_2 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 cumulative contribution 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

Caltrans continues to be involved on the Governor's Climate Action Team as ARB works to implement EOs 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 Former Governor Arnold Schwarzenegger's Strategic Growth Plan for California. The Strategic Growth Plan targeted a significant decrease in traffic congestion below 2008 levels and a corresponding reduction in GHG emissions, while accommodating growth in population and the economy. The Strategic Growth Plan relies on a complete systems approach to attain CO_2 reduction goals: system monitoring and evaluation, maintenance and preservation, smart land use and demand management, and operational improvements, as shown in Figure 4-4.

Caltrans is supporting efforts to reduce VMT 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

[25] 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.

authority. Caltrans also assists efforts to improve the energy efficiency of the transportation sector by increasing vehicle fuel economy in new cars and light- and heavy-duty trucks; Caltrans is doing this by supporting ongoing research efforts at universities, supporting legislative efforts to increase fuel economy, and participating on the Climate Action Team. It is important to note, however, that control of fuel economy standards is held by EPA and ARB.

Figure 4-4 The Mobility Pyramid

Caltrans is also working towards enhancing the State's transportation planning process to respond to future challenges. Similar to requirements for regional transportation plans under SB 375 (Steinberg 2008), SB 391(Liu 2009) requires the State's long-range transportation plan to meet California's climate change goals under AB 32.

The California Transportation Plan (CTP) is a statewide, long-range transportation plan to meet our future mobility needs and reduce GHG emissions. The CTP defines performance-based goals, policies, and strategies to achieve our collective vision for California's future, statewide, integrated, multimodal transportation system.

The purpose of the CTP is to provide a common policy framework that will guide transportation investments and decisions by all levels of government, the private sector, and other transportation stakeholders. Through this policy framework, the CTP 2040 will identify the statewide transportation system needed to achieve maximum feasible GHG emission reductions while meeting the State's transportation needs.

Table 4-5 summarizes Caltrans and statewide efforts that it is implementing to reduce GHG emissions. More detailed information about each strategy is included in the Climate Action Program at Caltrans (December 2006).

Caltrans Director's Policy 30 (DP-30) Climate Change (June 22, 2012) is intended to establish a Caltrans policy that will ensure coordinated efforts to incorporate climate change into Caltrans' decisions and activities.

Table 4-5 Climate Change/CO_2 Reduction Strategies

Strategy	Program	Partnership		Method/Process	Estimated CO_2 Savings Million Metric Tons (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, California Energy Commission (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	.0045	0.0065 0.045 0.0225
Nonvehicular Conservation Measures	Energy Conservation Program	Green Action Team		Energy Conservation Opportunities	0.117	0.34
Portland Cement	Office of Rigid Pavement	Cement and Construction Industries		2.5 % limestone cement mix 25% fly ash cement mix > 50% fly ash/slag mix	1.2 0.36	4.2 3.6
Goods Movement	Office of Goods Movement	Cal/EPA; ARB; Business, Transportation and Housing Agency (BT&H); MPOs		Goods Movement Action Plan	Not Estimated	Not Estimated
Total					2.72	18.18

Caltrans Activities to Address Climate Change (April 2013)[26] provides a comprehensive overview of activities undertaken by Caltrans statewide to reduce GHG emissions resulting from agency operations.

The following measures will also be included in the project to reduce the GHG emissions and potential climate change impacts from the project:

- Improve mobility by providing dedicated bicycle lanes within the ROW.
- Enhance choice by providing an alternate mode of transportation with the high-speed rail (HSR).
- Incorporate energy production/transmission facility into the corridor. Based on the Draft Green Energy Feasibility Study prepared for this project (June 2014), the following technologies are being recommended for further detailed study: photovoltaic solar highways; non-fossil fuel refueling stations; and opportunity for utility utilization of highway ROW. Inclusion of the green energy component into the proposed project would further improve energy efficiency and reduce GHG.
- Caltrans and the California Highway Patrol (CHP) are working with regional agencies to implement Intelligent Transportation Systems (ITS) to help manage the efficiency of the existing highway system. ITS commonly consists of electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.
- Support intermodal travel, including park-and-ride, rideshare, bicycle, rail, and transit programs.
- Support increased mass transit connectivity and accessibility.
- Promote landscaping strategies that will reduce GHG.
- The project would incorporate the use of energy-efficient lighting, such as light-emitting diode (LED) traffic signals. LED bulbs cost $60 to $70 each, but last 5 to 6 years, compared to the 1-year average lifespan of the incandescent bulbs previously used. The LED bulbs themselves consume 10 percent of the electricity of traditional lights, which will also help reduce the project's CO_2 emissions.[27]
- According to Caltrans Standard Specifications, the contractor must comply with all local Air Quality Management District's (AQMD) rules, ordinances, and regulations for air quality restrictions, including idling restrictions by ARB and Mojave Desert Air Quality Management District (MDAQMD) and Antelope Valley Air Quality Management District's (AVAQMD) Rule 403.

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

[26] http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/projects_and_studies.shtml

[27] Knoxville Business Journal, "[Light-Emitting Diode] Lights Pay for Themselves," May 19, 2008 at http://www.knoxnews.com/news/2008/may/19/led-traffic-lights-pay-themselves/.

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 Council on Environmental Quality (CEQ), the Office of Science and Technology Policy (OSTP), and the National Oceanic and Atmospheric Administration (NOAA), released its interagency task force progress report on October 28, 2011,[28] outlining the federal government's progress in expanding and strengthening the Nation's capacity to better understand, prepare for, and respond to extreme events and other climate change impacts. The report provides an update on actions in key areas of federal adaptation, including building resilience in local communities, safeguarding critical natural resources such as freshwater, and providing accessible climate information and tools to help decision makers manage climate risks.

Climate change adaptation must also involve the natural environment. 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 many 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.

In addition to addressing projected 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 (December 2009),[29] 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, which 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

[28] http://www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation

[29] http://www.energy.ca.gov/2009publications/CNRA-1000-2009-027/CNRA-1000-2009-027-F.PDF

other State agencies were involved in the creation of the Adaptation Strategy document, including the Cal/EPA; Business, Transportation and Housing Agency (BT&H); 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 National Academy of Science was directed to prepare a Sea Level Rise Assessment Report[30] to recommend how California should plan for future sea-level rise. The report was released in June 2012 and included:

- 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 (e.g., roads, public facilities, and beaches), natural areas, and coastal and marine ecosystems.
- A discussion of future research needs regarding sea-level rise.

In 2010, interim guidance was 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 State's infrastructure due to projected sea-level rise. Subsequently, CO-CAT updated the Sea Level Rise guidance to include information presented in the National Academy of Science study.

All State agencies that are planning to construct projects in areas vulnerable to future sea-level rise are directed to consider a range of sea-level rise scenarios for the years 2050 and 2100 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 on local uplift and subsidence, coastal erosion rates, predicted higher high water levels, storm surge, and storm wave data.

All projects that have filed an NOP as of the date of EO S-13-08, and/or are programmed for construction funding through 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.

EO S-13-08 also directed BT&H to prepare a report to assess vulnerability of transportation systems to sea-level rise affecting safety, maintenance and operational

[30] *Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future* (2012) is available at: http://www.nap.edu/catalog.php?record_id=13389.

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 needed 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.