



**Greenhouse Gas Emissions Analysis Report**  
**Draft Greenhouse Gas Emissions Analysis Report**  
**for the Harvard Avenue and Michelson Drive**  
**Intersection Improvement Project Irvine,**  
**California**

October 16, 2019

Prepared for:

City of Irvine  
One Civic Center Plaza  
Irvine, CA 92623-9575

Prepared by:

Stantec  
300 North Lake Avenue Suite 400  
Pasadena, CA 91101-4169




Revision	Description	Author		Quality Check		Independent Review	



## GREENHOUSE GAS EMISSIONS ANALYSIS REPORT

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Prepared by   
(signature)  
**Nasrin Behmanesh, Ph.D., Air Quality and Climate Change Specialist**

Reviewed by   
(signature)  
**Michael P. Weber, Principal Scientist**

Approved by   
(signature)  
**Gilberto Ruiz, Environmental Planner**



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## Abbreviations

AB	Assembly Bill
ARB	Air Resources Board, California Air Resources Board
CAAQS	California Ambient Air Quality Standards
CAA	Clean Air Act
CAP	Climate Action Plan
CEQA	California Environmental Quality Act
CH <sub>4</sub>	Methane
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
CO <sub>2e</sub>	Carbon dioxide equivalent
CTP	California Transportation Plan
EO	Executive order
EPA, USEPA	United States Environmental Protection Agency
GHG	Greenhouse gas
GWP	Global warming potential
LCFS	Low carbon fuel standard
IBC	Irvine Business Complex
NAAQS	National Ambient Air Quality Standards
N <sub>2</sub> O	Nitrous oxide
OPR	Governor's Office of Planning and Research
RPS	Renewable Portfolio Standard
RTP/SCS	Regional Transportation Plan/ Sustainable Community Strategy
SB	Senate bill
SCAB	South Coast Air Basin
SCAQMD	South Coast Air Quality Management District
TMP	Traffic Management Plan



## 1.0 INTRODUCTION

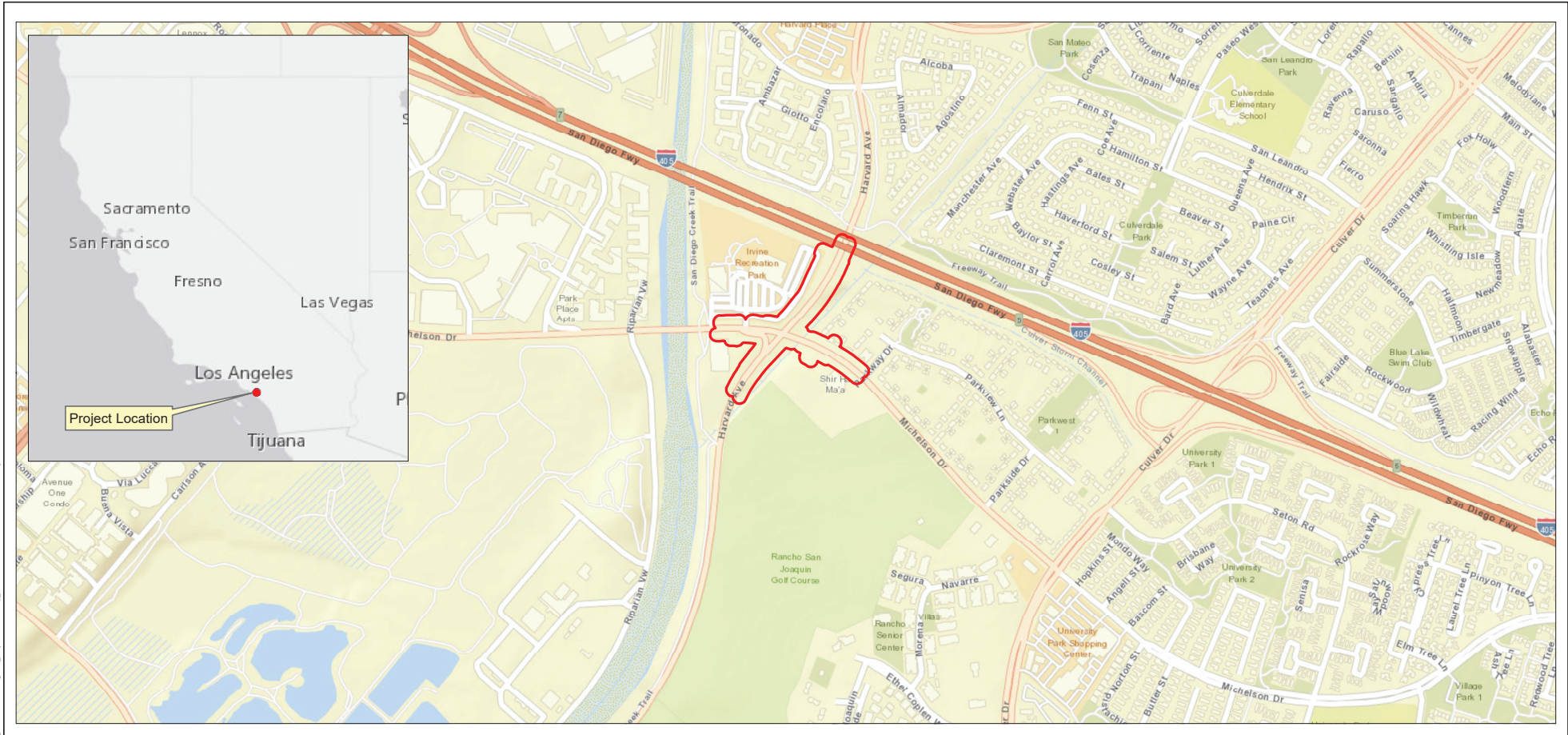
The project area is within the South Coast Air Basin (SCAB) and is under the jurisdiction of South Coast Air Quality Management District (SCAQMD). This Greenhouse Gas Emissions Analysis Report provides assessment of the potential impacts to greenhouse gas (GHG) emissions that are related to the proposed Harvard Avenue and Michelson Drive Intersection Improvement Project (Project). The proposed project is located in Orange County in the City of Irvine (see Figure 1). The Project is one of the mitigations identified in both 2010 and 2015 Irvine Business Complex (IBC) Vision Plan Traffic Studies and would improve circulation in the western portion of the City of Irvine.


The proposed roadway layout and associated improvements, including revised geometries for the Harvard Avenue and Michelson Drive intersection are summarized below. Each location describes the approach to the intersection and for the purpose of this description, Harvard Avenue is considered going north/south and Michelson Drive going east/west.

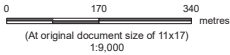
- Northbound Harvard Avenue:
  - Existing – One left-turn lane, two through lanes, and a Class II on-street bike lane;
  - Proposed – Re-stripe to lengthen left-turn lane, maintain two through lanes, and restripe to provide a de facto right turn lane.
- Southbound Harvard Avenue:
  - Existing – one left-turn lane, two through lanes, and one right-turn lane;
  - Proposed – Add one left turn lane for a total of two left-turn lanes, maintain two through lanes and one right turn lane, provide a Class II on-street bike lane towards intersection stop line, add 10-foot off-street shared use path for bikes and pedestrians;
- Eastbound Michelson Drive:
  - Existing – Two left-turn lanes, two through lanes and one non-standard free right-turn lane;
  - Proposed – Maintain two left-turn lanes, two through lanes and remove non-standard free right-turn lane and replace with designated right-turn lane, add a 10-foot off-street shared use path for bikes and pedestrians; narrow west end of existing median
- Westbound Michelson Drive:
  - Existing – One left-turn lane and two through lanes.

In order to accommodate the new roadway design and ensure its safe operation, widening of the southwest and northwest quadrants of Harvard Avenue would be needed. The existing “Pork Chop” along the northeast quadrant of Harvard Avenue will be eliminated in order to improve the intersection’s operational characteristics. Additional project components include a shared use path to accommodate the heavy pedestrian and bike traffic, Class II on-street bike lane, reconstructed storm drain/catchment basin, reconstructed and landscaped slope, and other related roadway improvements (e.g., lane restriping, relocation of street lights).





 Study Area



**Project Location**  
Irvine, California  
**Client/Project**  
Harvard Avenue and Michelson Drive  
Intersection Improvement Project  
**Figure No.**  
2042557300

**Title**  
**Project Location**

**Notes**  
1. Coordinate System: NAD 1983 2011 StatePlane California VI FIPS 0406 F1 US  
2. Data Sources:  
3. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community  
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

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### 1.1 ENVIRONMENTAL SETTING

Climate change refers to long-term changes in temperature, precipitation, wind patterns, and other elements of the earth's climate system. An 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 related to human activity that include carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), tetrafluoromethane, hexafluoroethane, sulfur hexafluoride (SF<sub>6</sub>), and hydrofluorocarbons (HFCs).

GHGs vary considerably in terms of global warming potential (GWP). The GWP is the potential of a gas to trap heat in the atmosphere over a specified time period (typically 100 years). The reference gas for GWP is CO<sub>2</sub>, which has a GWP of one. Methane has a GWP of 21, which means that it has 21-times greater global warming effect than CO<sub>2</sub> on a mass basis. N<sub>2</sub>O has a GWP of 310. To assess the effect of GHG emissions, the combined emissions of various GHGs from a source are presented as a CO<sub>2</sub> equivalent (CO<sub>2</sub>e). The total CO<sub>2</sub>e is calculated by multiplying the amount of each GHG emitted from the project by its GWP and adding them up.

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) are the largest contributors of GHG emissions. The dominant GHG emitted is CO<sub>2</sub>, mostly from fossil fuel combustion.

#### 1.1.1 Regulatory Setting

Regulatory oversight authority regarding air quality rests at the federal, state, and local levels with the, U.S. Environmental Protection Agency (USEPA), California Air Resources Board (CARB), and South Coast Air Quality Management District (SCAQMD), respectively. Plans, policies, and regulations that are relevant to the proposed project are discussed in the following sections.

##### **Federal**

At the federal level, currently there is no overarching law related to climate change or the reduction of GHGs. The EPA is developing regulations under the CAA to be adopted in the near future, pursuant to the EPA's authority under the CAA. Foremost amongst recent developments have been the settlement agreements between the EPA, several states, and nongovernmental organizations (NGOs) to address GHG emissions from electric generating units and refineries; the U.S. Supreme Court's decision in *Massachusetts v. EPA*; and EPA's "Endangerment Finding," "Cause or Contribute Finding," and "Mandatory Reporting Rule." On Sept. 20, 2013, the EPA issued a proposal to limit carbon pollution from new power plants. The EPA is proposing to set separate standards for natural gas-fired turbines and coal-



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fired units. Although periodically debated in Congress, no federal legislation concerning GHG limitations is has yet been adopted. In *Coalition for Responsible Regulation, Inc., et al. v. EPA*, the U.S. Court of Appeals upheld the EPA's authority to regulate GHG emissions under CAA. Furthermore, Under the authority of the CAA, the EPA is beginning to regulate GHG emissions starting with large stationary sources. In 2010, the EPA set GHG thresholds to define when permits under the New Source Review Prevention of Significant Deterioration (PSD) standard and Title V Operating Permit programs are required for new and existing industrial facilities. In 2012, EPA proposed a carbon pollution standard for new power plants.

### State

California has been innovative and proactive in addressing GHG emissions through passage of legislation including Senate and Assembly bills and executive orders, some of which are listed below.

*Assembly Bill 1493 – Pavley Vehicular Emissions: greenhouse Gases, 2002.* The bill required CARB to develop and implement regulations to reduce automobile and light truck GHG emissions. These stricter standards were to be applied beginning with the 2009 model-year.

*Executive Order (EO) S-3-05.* In 2005, the governor issued EO S-3-05, establishing statewide GHG emissions reduction targets. The goal of this EO is to reduce California's GHG emissions to year 1990 levels by 2020 and to 80 percent below 1990 levels by 2050. This goal was further reinforced with the passage of Assembly Bill 32 (AB 32) in 2006 and Senate Bill 32 (SB 32) in 2016.

*Assembly Bill 32 (AB 32).* In 2006, California passed the California Global Warming Solutions Act of 2006 (AB 32; California Health and Safety Code Division 25.5, Sections 38500, et seq.), which codified the 2020 GHG emissions reduction goals as outlined in EO S-3-05, while further mandating that CARB create a scoping plan and implement rules to achieve "real, quantifiable, cost-effective reductions of greenhouse gases." The Legislature also intended that the statewide GHG emissions limit continue in existence and be used to maintain and continue reductions in emissions of GHGs beyond 2020 (Health and Safety Code Section 38551(b)). The law requires CARB to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective GHG reductions.

The first Scoping Plan was prepared and approved on December 11, 2008 and was later updated in May 2014. The update highlights California's progress toward meeting the "near-term" 2020 GHG emission reduction goals defined in the original Scoping Plan. It also evaluates how to align the State's longer-term GHG reduction strategies with other State policy priorities, such as for water, waste, natural resources, clean energy and transportation, and land use. The most recent update to the plan is the 2017 Climate Change Scoping Plan (CARB, 2017c) which sets the state on an aggressive course to reduce greenhouse gas emissions an additional 40% below 1990 levels by 2030 under SB 32.

*Senate Bill 97 (SB 97).* Chapter 185, 2007, Greenhouse Gas Emissions: This bill requires 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.



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Senate Bill 375 (SB 375), Chapter 728, 2008, Sustainable Communities and Climate Protection: This bill requires ARB to set regional emissions reduction targets for 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 how it will achieve the emissions target for its region.

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

Executive Order B-30-15 (April 2015) establishes an interim statewide GHG emission reduction target of 40 percent below 1990 levels by 2030 in order to ensure California meets its target of reducing GHG emissions to 80 percent below 1990 levels by 2050. It further orders all state agencies with jurisdiction over sources of GHG emissions to implement measures, pursuant to statutory authority, to achieve reductions of GHG emissions to meet the 2030 and 2050 GHG emissions reductions targets. It also directs ARB to update the Climate Change Scoping Plan to express the 2030 target in terms of million metric tons of carbon dioxide equivalent (MMTCO<sub>2e</sub>). Finally, it requires the Natural Resources Agency to update the state's climate adaptation strategy, *Safeguarding California*, every 3 years, and to ensure that its provisions are fully implemented.

Senate Bill 32 (SB 32) September 2016. Chapter 249 of the bill codifies the GHG reduction targets established in EO B-30-15 to achieve a mid-range goal of 40 percent below 1990 levels by 2030. SB 32 provides another intermediate target between the 2020 and 2050 targets set in EO S-3-05.

### Renewable Energy Portfolio

The Renewable Portfolio Standard (RPS) promotes diversification of the state's electricity supply and decreased reliance on fossil fuel energy sources. Originally adopted in 2002 with a goal to achieve a 20 percent RE mix by 2020 (referred to as the "initial RPS"), the goals have been accelerated and increased by EOs S-14-08 and S-21-09 to a goal of 33 percent by 2020. Furthermore, on September 10, 2018, Governor Brown signed the SB 100 which aims at eliminating fossil fuel from electricity generation in California. The Bill sets a target of 100 percent carbon-free electricity by 2045.

### Local

The Southern California Association of Governments (SCAG) serves as the federally designated MPO for the Southern California region. SCAG is the regional planning agency for Los Angeles, Orange, Ventura, Riverside, San Bernardino, and Imperial Counties and serves as a forum for regional issues relating to transportation, the economy, community development, and the environment and has been innovative and proactive in addressing GHG emissions through passage of legislation.

The SCAG 2016 Regional Transportation Plan/ Sustainable Community Strategy (2016 RTP/SCS) includes proposed transportation improvements to be integrated and coordinated with proposed land use changes that would lead to reduced congestion, reduced vehicle miles traveled (VMT), and increased transit, walking, and biking options. The RTP/SCS includes integrated transportation and land use strategies to promote active transportation opportunities, compact development, car sharing and ride





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sourcing, and technology in zero-emission vehicles and neighborhood electric vehicles. The Program Environmental Impact Report for the 2016 RTP/SCS determined that across the six counties in the SCAG region, the 2016 RTP/SCS would result in an approximately 24 percent decrease in GHG emissions by 2040. The 2016 RTP/SCS also includes land use strategies that seek to balance the region's land use choices and transportation investments.

### 1.1.2 Thresholds of Significance

In addition to the criteria listed in Appendix G of CEQA Guidelines, CARB and SCAQMD have developed preliminary interim GHG thresholds for two important sectors industrial and residential/commercial.

In October 2008, SCAQMD released a *Draft Guidance Document – Interim CEQA Greenhouse Gas (GHG) Significance Threshold* that suggested a tiered approach to project analysis. The proposed CARB interim significance threshold of GHG emissions in the 2008 Scoping Plan for industrial projects was set at 7,000 metric tons CO<sub>2</sub>e per year (MTCO<sub>2</sub>e/yr), and for residential/commercial projects the interim significance threshold is approximately 6,500 MTCO<sub>2</sub>e/yr. SCAQMD has recommended a threshold of 10,000 MTCO<sub>2</sub>e/yr for industrial sector projects and 3,000 MTCO<sub>2</sub>e/yr for residential/commercial projects. These thresholds include construction emissions amortized over 30 years and added to operational GHG emissions (SCAQMD, 2008b).

The City of Irvine does not have specific significance criteria for GHG emissions, instead recommends applying all relevant measures from regional and local plans, such as CARB Scoping Plan and SCAQMD adopted plans and strategies, to reduce the project related GHG emissions.

The proposed Project is a transportation project, and although there are measures and strategies to achieve sustainability in the Scoping Plan, there are no numeric threshold for transportation projects. However, for the purpose of this analysis, we have used the most conservative threshold of 3,000 MTCO<sub>2</sub>e per year to evaluate the impact of GHG emissions related to the Project implementation.



## 2.0 IMPACT ANALYSIS

**IMPACT GHG-a) *Would the Project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?***

**Less Than Significant Impact.** GHG emissions for transportation projects can be divided into those produced during construction and those produced during operations.

### Construction Impact

Construction GHG emissions would be associated with exhaust emissions from operation of on-site heavy-duty equipment, material processing, construction worker vehicles trips to and from the site, and haul/delivery truck trips. These emissions would be produced at different levels throughout the construction phase (anticipated to last eight months). Similar to criteria pollutants, emissions of GHGs during construction of Project were quantified using the SMAQMD Road Construction Emissions Model, version 8.1.0. GHG emissions for the proposed Project were estimated at 210 MTCO<sub>2</sub>e for the construction period (see Roadmod model results in Appendix A). When amortized over the 30-year life of the Project, annual emissions would be 7.0 metric tons of CO<sub>2</sub>e. Emissions would be well below the 3,000 metric tons of CO<sub>2</sub>e threshold and are, therefore, less than significant and no mitigation measures are required.

**Table 1. Summary of Project Greenhouse Gas Emissions**

Construction Phase/ Component	Emissions (tons)			Metric Tonnes
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Clear and Grub	15.74	0.00	0.00	14.42
Excavation/Grading	81.90	0.02	0.00	75.01
Trenching and construction of subgrade	110.40	0.02	0.00	100.82
Paving and restriping	21.43	0.00	0.00	19.61
Total Construction (tons)	229.47	0.05	0.00	209.87
Amortized Construction Emission over 30 years (MT/year)				7.00
Project Annual Operational Emissions				0.00
Total Project Emissions				<b>7.00</b>
SCAQMD interim significance threshold for commercial projects				3,000

### Operational Emissions Impact

As described in the Project's Traffic Analysis Memorandum impact analysis, operation of the Project would improve the PM peak hour LOS at the intersection and would enhance bicycle safety. However, implementation of the Project would not result in changes in fleet mix or daily traffic volume along Harvard Avenue or Michelson Drive, therefore, no increase in operational emissions would occur.





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Therefore, GHG emissions generated by operation of the proposed project would be less than significant, and no mitigation measures are required.

**IMPACT GHG-b) *Would the Project conflict with an applicable plan, policy or regulation adopted for the purpose of reducing greenhouse gases?***

### **Less Than Significant Impact.**

The City does not have an adopted Climate Action Plan and because the Project is a traffic circulation improvement that is not capacity enhancing, it would not conflict with plans, policies, and applicable regulations. As such, potential climate change impacts would be less than significant.

## **2.2 GREENHOUSE GAS REDUCTION STRATEGY**

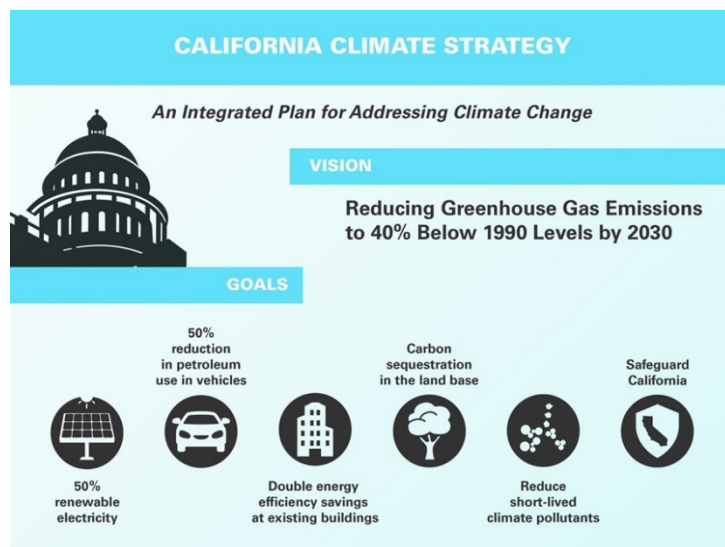
The City of Irvine is in the process of developing a Climate Action Plan (CAP) which will include measures to reduce GHG emissions that contribute to climate change. The following section include the efforts that are currently being undertaken at the state level.

### **2.2.1 Statewide Efforts**

In an effort to further the vision of California's GHG reduction targets outlined in AB 32 and SB 32, Governor Brown identified key climate change strategy pillars (concepts). These pillars highlight the idea that several major areas of the California economy will need to reduce emissions to meet the 2030 GHG emissions target. As shown below in Figure 2, these pillars are (1) reducing today's petroleum use in cars and trucks by up to 50 percent; (2) increasing from one-third to 50 percent our electricity derived from renewable sources; (3) doubling the energy efficiency savings achieved at existing buildings and making heating fuels cleaner; (4) reducing the release of methane, black carbon, and other short-lived climate pollutants; (5) managing farm and rangelands, forests, and wetlands so they can store carbon; and (6) periodically updating the state's climate adaptation strategy, *Safeguarding California*.



**Figure 2. Governor Brown's Climate Change Pillars: 2030 Greenhouse Gas Reduction Goals**



The transportation sector is integral to the people and economy of California. To achieve GHG emission reduction goals, it is vital that we build on our past successes in reducing criteria and toxic air pollutants from transportation and goods movement activities. GHG emission reductions will come from cleaner vehicle technologies, lower-carbon fuels, and reduction of vehicle miles traveled. One of Governor Brown's key pillars sets the ambitious goal of reducing today's petroleum use in cars and trucks by up to 50 percent by 2030.

Governor Brown called for support to manage natural and working lands, including forests, rangelands, farms, wetlands, and soils, so they can store carbon. These lands have the ability to remove carbon dioxide from the atmosphere through biological processes, and to then sequester carbon in above- and below-ground matter.

### Caltrans Activities

California Department of Transportation (Caltrans) continues to be involved on the Governor's Climate Action Team as the ARB works to implement EOs S-3-05 and S-01-07 and help achieve the targets set forth in AB 32. EO B-30-15, issued in April 2015, and SB 32 (2016), set a new interim target to cut GHG emissions to 40 percent below 1990 levels by 2030. The following major initiatives are underway at Caltrans to help meet these targets.

### California Transportation Plan (CTP 2040)

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



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transportation system. It serves as an umbrella document for all of the other statewide transportation planning documents.

SB 391 (Liu 2009) requires the CTP to meet California's climate change goals under AB 32. Accordingly, the CTP 2040 identifies the statewide transportation system needed to achieve maximum feasible GHG emission reductions while meeting the state's transportation needs.

While MPOs have primary responsibility for identifying land use patterns to help reduce GHG emissions, CTP 2040 identifies additional strategies in Pricing, Transportation Alternatives, Mode Shift, and Operational Efficiency.

### **Caltrans Strategic Management Plan**

The Strategic Management Plan, released in 2015, creates a performance-based framework to preserve the environment and reduce GHG emissions, among other goals. Specific performance targets in the plan that will help to reduce GHG emissions include:

- Increasing percentage of non-auto mode share
- Reducing VMT per capita
- Reducing Caltrans' internal operational (buildings, facilities, and fuel) GHG emissions

### **Funding and Technical Assistance Programs**

In addition to developing plans and performance targets to reduce GHG emissions, Caltrans also administers several funding and technical assistance programs that have GHG reduction benefits. These include the Bicycle Transportation Program, Safe Routes to School, Transportation Enhancement Funds, and Transit Planning Grants. A more extensive description of these programs can be found in *Caltrans Activities to Address Climate Change* (2013).

Caltrans Director's Policy 30 (DP-30) Climate Change (2012) is intended to establish a policy that will ensure coordinated efforts to incorporate climate change into departmental decisions and activities. *Caltrans Activities to Address Climate Change* (April 2013) provides a comprehensive overview of activities undertaken by Caltrans statewide to reduce GHG emissions resulting from agency operations.

### **Project-Level GHG Reduction Strategies**

The following mitigation measures will also be implemented for the Project to reduce GHG emissions and potential climate change impacts.

In addition, the proposed Project improvements components include improvements to a bicycle lane which would enhance bicycle safety and may promote active transportation. In addition, the proposed Project includes a shared pathway for both bicyclist and pedestrians which may also promote non-motorized transportation, thereby reducing GHG emissions. Removal of the existing "pork-chop" splitter island on southwest corner would also enhance the intersection operations and improve vehicle safety.



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Provided below are the standards mitigation measures that the proposed Project would be required to implement and which would contribute to reducing GHGs:

- MM GHG-1** During various phases of construction activities, the Project will comply with all applicable rules and regulations, including SCAQMD Rules 401, 402, 403 and Rule 1113.
- MM-TRA.1** A traffic management plan (TMP) will be prepared to optimize roadway operations during construction activities. The TMP will identify temporary measures such as coordination for lane closures, lane closure signage; bicycle lane/pedestrian detours; and the potential need for a construction flag person during peak traffic hours. Minimizing delays and maintaining traffic flow will help reduce GHG emissions from idling traffic during construction.



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## **Appendix A   AIR POLLUTANTS AND GHG EMISSIONS**

- **Emissions Calculation Summary**
- **Road Construction Emissions Model (RoadMod) Output**



## Construction Emissions Calculations Summary

Daily Emission Estimates for -> Harvard-Michelson Intersection														
Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	0.75	5.44	8.68	9.37	0.37	9.00	2.20	0.32	1.87	0.01	1,431.11	0.37	0.02	1,445.38
Grading/Excavation	2.19	17.55	22.58	10.12	1.12	9.00	2.86	0.99	1.87	0.04	3,722.62	0.97	0.04	3,758.45
Drainage/Utilities/Sub-Grade	2.00	19.63	17.81	10.02	1.02	9.00	2.81	0.94	1.87	0.03	3,345.50	0.50	0.03	3,367.71
Paving	1.00	11.36	9.29	0.56	0.56	0.00	0.50	0.50	0.00	0.02	1,947.98	0.43	0.02	1,965.15
Maximum (pounds/day)	2.19	19.63	22.58	10.12	1.12	9.00	2.86	0.99	1.87	0.04	3,722.62	0.97	0.04	3,758.45
Total (tons/construction project)	0.13	1.22	1.28	0.66	0.07	0.59	0.19	0.06	0.12	0.00	229.47	0.05	0.00	231.34

209.924 MT CO2e

## Off-site Emissions - from Data Entry sheet

Grubbing/Land Clearing	0.03	0.49	0.05	0.02			0.01			0.00	160.55	0.00	0.00	161.25
Grading/Excavation	0.12	1.95	0.19	0.08			0.03			0.01	642.21	0.01	0.01	644.98
Drainage/Utilities/Sub-Grade	0.08	1.36	0.14	0.06			0.02			0.00	449.55	0.01	0.01	451.49
Paving	0.06	0.94	0.09	0.04			0.02			0.00	316.49	0.01	0.00	317.82

## Onsite emissions

Grubbing/Land Clearing	0.72	4.95	8.63	9.35			2.19			0.01	1,270.56	0.37	0.01	1,284.13
Grading/Excavation	2.08	15.60	22.39	10.04			2.83			0.03	3080.41	0.95	0.03	3113.47
Drainage/Utilities/Sub-Grade	1.92	18.26	17.68	9.96			2.78			0.03	2895.95	0.49	0.03	2916.22
Paving	0.95	10.42	9.19	0.52			0.48			0.02	1631.49	0.42	0.02	1647.33
Maximum (pounds/day)	2.08	18.26	22.39	10.04			2.83			0.03	3080.41	0.95	0.03	3113.47

## Road Construction Emissions Model, Version 8.1.0

Daily Emission Estimates for -> Harvard-Michelson Intersection														
Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	0.75	5.44	8.68	9.37	0.37	9.00	2.20	0.32	1.87	0.01	1,431.11	0.37	0.02	1,445.38
Grading/Excavation	2.19	17.55	22.58	10.12	1.12	9.00	2.86	0.99	1.87	0.04	3,722.62	0.97	0.04	3,758.45
Drainage/Utilities/Sub-Grade	2.00	19.63	17.81	10.02	1.02	9.00	2.81	0.94	1.87	0.03	3,345.50	0.50	0.03	3,367.71
Paving	1.00	11.36	9.29	0.56	0.56	0.00	0.50	0.50	0.00	0.02	1,947.98	0.43	0.02	1,965.15
Maximum (pounds/day)	2.19	19.63	22.58	10.12	1.12	9.00	2.86	0.99	1.87	0.04	3,722.62	0.97	0.04	3,758.45
Total (tons/construction project)	0.13	1.22	1.28	0.66	0.07	0.59	0.19	0.06	0.12	0.00	229.47	0.05	0.00	231.34
Notes:	Project Start Year -> 2021													
	Project Length (months) -> 7													
	Total Project Area (acres) -> 1													
	Maximum Area Disturbed/Day (acres) -> 1													
	Water Truck Used? -> Yes													
	Total Material Imported/Exported Volume (yd³/day)		Daily VMT (miles/day)											
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck								
Grubbing/Land Clearing	0	0	0	0	200	40								
Grading/Excavation	0	0	0	0	800	40								
Drainage/Utilities/Sub-Grade	0	0	0	0	560	40								
Paving	0	0	0	0	400	40								
PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.														
Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.														
CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1, 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.														
Total Emission Estimates by Phase for -> Harvard-Michelson Intersection														
Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	PM10 (tons/phase)	PM10 (tons/phase)	PM10 (tons/phase)	PM2.5 (tons/phase)	PM2.5 (tons/phase)	PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.01	0.06	0.10	0.10	0.00	0.10	0.02	0.00	0.02	0.00	15.74	0.00	0.00	14.42
Grading/Excavation	0.05	0.39	0.50	0.22	0.02	0.20	0.06	0.02	0.04	0.00	81.90	0.02	0.00	75.01
Drainage/Utilities/Sub-Grade	0.07	0.65	0.59	0.33	0.03	0.30	0.09	0.03	0.06	0.00	110.40	0.02	0.00	100.82
Paving	0.01	0.12	0.10	0.01	0.01	0.00	0.01	0.01	0.00	0.00	21.43	0.00	0.00	19.61
Maximum (tons/phase)	0.07	0.65	0.59	0.33	0.03	0.30	0.09	0.03	0.06	0.00	110.40	0.02	0.00	100.82
Total (tons/construction project)	0.13	1.22	1.28	0.66	0.07	0.59	0.19	0.06	0.12	0.00	229.47	0.05	0.00	209.87
PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.														
Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.														
CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1, 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.														
The CO2e emissions are reported as metric tons per phase.														



## Road Construction Emissions Model Data Entry Worksheet

Version 8.1.0

Note: Required data input sections have a yellow background.

Optional data input sections have a blue background. Only areas with a

yellow or blue background can be modified. Program defaults have a white background.

The user is required to enter information in cells D10 through D24, E28 through G35, and D38 through D41 for all project types.

Please use "Clear Data Input & User Overrides" button first before changing the Project Type or begin a new project.



### Input Type

Project Name

Harvard-Michelson Intersection

Construction Start Year

2021

Enter a Year between 2014  
and 2025 (inclusive)

Project Type

2

- 1) New Road Construction : Project to build a roadway from bare ground, which generally requires more sit
- 2) Road Widening : Project to add a new lane to an existing roadway
- 3) Bridge/Overpass Construction : Project to build an elevated roadway, which generally requires some dif
- 4) Other Linear Project Type: Non-roadway project such as a pipeline, transmission line, or levee constructi

Project Construction Time

7.00

months

Working Days per Month

22.00

days (assume 22 if unknown)

Predominant Soil/Site Type: Enter 1, 2, or 3

(for project within "Sacramento County", follow soil type selection  
instructions in cells E18 to E20 otherwise see instructions provided in  
cells J18 to J22)

2

- 1) Sand Gravel : Use for quaternary deposits (Delta/West County)
- 2) Weathered Rock-Earth : Use for Laguna formation (Jackson Highway area) or the lone formation (Scott
- 3) Blasted Rock : Use for Salt Springs Slate or Copper Hill Volcanics (Folsom South of Highway 50, Ranch

Project Length

0.20

miles

Total Project Area

0.98

acres

Maximum Area Disturbed/Day

0.90

acres

Water Trucks Used?

1

1. Yes
2. No

Note: The program's estimates of construction period phase length can be overridden in cells D50 through D53, and F50 through F53.

Construction Periods	User Override of Construction Months	Program Calculated Months	User Override of Phase Starting Date	Program Default Phase Starting Date
Grubbing/Land Clearing	1.00	0.70	6/1/2021	1/1/2021
Grading/Excavation	2.00	3.15	7/2/2021	2/1/2021
Drainage/Utilities/Sub-Grade	3.00	2.10	9/8/2021	4/3/2021
Paving	1.00	1.05	12/14/2021	7/4/2021