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Plug-in Fuel Cell Electric Vehicles:
A Vehicle and Infrastructure Analysis and Comparison with Alternative Vehicle Types

THESIS

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in Mechanical and Aerospace Engineering

by

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DEDICATION

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NOMENCLATURE

APEP	Advanced Power and Energy Program
BER	Battery Electric Range
BEV	Battery Electric Vehicle
BoP	Balance of Plant
CA	California
CAP	Criteria Air Pollutant
CARB	California Air Resources Board
FASTSim	Future Automotive Systems Technology Simulator
FCEV	Fuel Cell Electric Vehicle
GHG	Greenhouse Gas
HEV	Hybrid Electric Vehicle
HFit	Hydrogen Fueling infrastructure tool
HiGRID	Holistic Grid Resource Integration and Deployment
ICEV	Internal Combustion Engine Vehicle
kg	kilogram
LDV	Light-Duty Vehicle
MPGGE	Miles Per Gallon of Gasoline Equivalent
NHTS	National Household Travel Survey
PEV	Plug-in Electric Vehicle
PFCEV	Plug-in Fuel Cell Electric Vehicle
PHEV	Plug-in Hybrid Electric Vehicle
SMR	Steam Methane Reformation
US	United States
VMT	Vehicle Miles Traveled
WTW	Well-To-Wheels

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ABSTRACT OF THE THESIS

Plug-in Fuel Cell Electric Vehicles:
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By

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Master of Science in Mechanical and Aerospace Engineering

University of California, Irvine, 2017

Professor G. Scott Samuelsen, Chair

Plug-in fuel cell electric vehicles (PFCEVs) combine features of battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs). With a 40-mile battery electric range (BER), the PFCEV provides unusually efficient driving. The BER also affords convenient recharging. The fuel cell and hydrogen fuel facilitate long range and quick refueling, removing range anxiety. With a small battery and fuel cell, the PFCEV maintains weight low and efficiency high. This thesis uses California as a case study of PFCEV deployment, due to regulations that make it the first deployment area of alternative vehicle technology, using vehicle and electric grid simulation tools, travel survey and census data, and geographic information system (GIS) software. If all passenger vehicles in California today were PFCEVs, the hydrogen required would be significantly less than current hydrogen production for petroleum refining in California, and the electricity used would be 19% of California's current total demand. The BER capability leads to far fewer hydrogen fueling stations needed to fuel PFCEVs compared to non-plug-in FCEVs: 93 hydrogen stations are required compared to 1,651. PFCEVs also lead to the most GHG and CAP emissions reductions of any advanced alternative vehicle. Furthermore, this is done at the lowest

cost per emissions reduced. PFCEVs are an attractive candidate as the principal vehicle owned by the majority of the motoring public in the electric vehicle era.

1. INTRODUCTION

Parts of this chapter have been published in the article: B. Lane, B. Shaffer, S. Samuelsen, "Plug-in fuel cell electric vehicles: A California case study," *International Journal of Hydrogen Energy*, vol. 42, no. 20, pp. 14294–14300, 2017.

The world is currently in a state of transition in many ways, from how people get power to how they travel to work. This thesis analyzes various vehicle paradigms that, hopefully, can lead to a change for the better in the transportation sector.

1.1 Emissions from Light Duty Vehicles

The transportation sector is the second-largest emitter of GHGs in the Unites States (U.S.), responsible for more than a quarter of GHG emissions [1]. Furthermore, nearly two-thirds of the transportation GHG emissions come from light-duty vehicles (LDVs) [2]. Transportation is also responsible for 38% of CAPs in the U.S. [3]. These are strong reasons to look into reduction of GHGs and CAPs from personal and other light-duty vehicles as the world attempts to combat climate change and increase air quality.

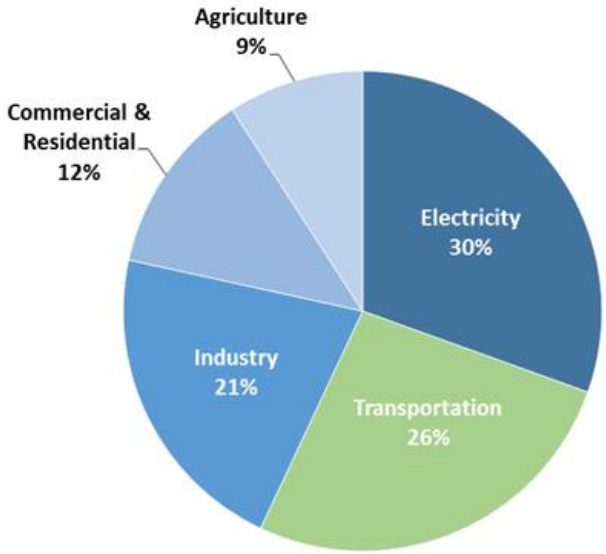


Figure 1: GHG Emissions per Economic Sector in 2014 (From U.S. EPA 2016 [1])

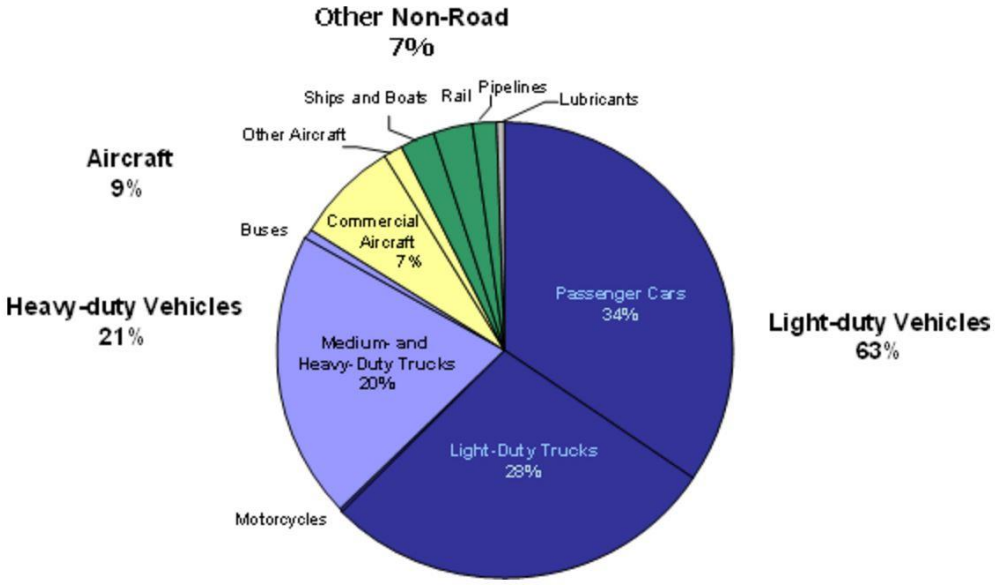


Figure 2: Vehicle GHG Emissions by Vehicle Type in 2006 (From U.S. Department of Transportation 2006 [2])

1.2 Legislation and Political Impetus

California is known as a politically progressive state, particularly with regard to environmental goals and legislation. Some of this legislation attempts to combat climate change in general, while other legislation targets transportation specifically. A summary of some of the most relevant goals and legislation can be found below in *Table 1*.

Table 1: California Goals and Legislation Regarding Energy and Transportation

Climate Change	
AB32: Global Warming Solutions Act	Reduce GHG emissions to 1990 amounts by 2020 [4]
SB 2: Renewable Energy Resources	33% of electricity is renewable by 2020 [5]
SB 375: Sustainable Communities	Reduce GHG emissions by community planning for transportation and land use [6]
Transportation Fuel	
Low Carbon Fuel Standards (LCFS)	Reduce carbon in transportation fuel by 10% in 2020 [7]
AB 1007: State Alternative Fuels Plan	Plan to use more alternative fuels in CA, including details on how to increase hydrogen use [8]
AB 118: California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act	Provides funding for technologies that improve local air quality [9]
Zero Emissions Vehicle (ZEV) Action Plan	Plan to achieve 1.5 million ZEVs in CA by 2025 [10]
Hydrogen	
AB 8: Alternative Fuel and Vehicle Technologies	Allocates $20 million each year for hydrogen fueling stations until 100 are built [11]
SB 1505: Environmental Standards for Hydrogen Production	Requires that hydrogen be 33.3% renewable, and have 30% lower GHGs and 50% lower pollutant emissions than gasoline [12]

These various goals and pieces of legislation reveal three overarching themes that are relevant to this PFCEV research. The first of these themes is that California is attempting to reduce the amount of GHG and CAP emissions to combat climate change and improve air quality for its residents. Therefore, if PFCEVs can reduce the amount of these emissions in the transportation sector, they will likely gain the support of legislators.

The second theme is renewable energy will be an increasingly large percentage of the electric grid. This means vehicles that use grid electricity as fuel have the potential to decrease

their overall emissions. PFCEVs have a battery that can be charged by the electric grid, so they are able to benefit from the increased renewable electricity. By comparing emissions from PFCEVs to those of FCEVs, one can determine whether using electricity from the grid reduces overall vehicle emissions. This analysis will be conducted in this research.

The third theme from this legislation is the transportation sector will have an increasingly renewable fuel supply. Not only will electricity be more renewable as discussed above, but other fuels such as hydrogen will be increasingly renewable as well. In addition to ensuring that these fuels will have a more sustainable supply, renewable fuels also have fewer emissions than conventional transportation fuels such as gasoline. Using carbon-neutral sources such as electrolysis using renewable electricity, or even biogas and biomass fuels from waste, renewable fuels can help meet the emissions reductions goals of California's legislation.

1.3 Goals

The goals of the research are to:

- Characterize the performance of plug-in fuel cell vehicles (PFCEVs)
- For a full transition of passenger vehicles in California to PFCEVs, establish the impact on greenhouse gas (GHG) and criteria air pollutant (CAP) emissions
- Determine the required charging and hydrogen infrastructure along with their cost in contrast to other alternative vehicle types.

1.4 Objectives

The following objectives are met to fulfill the goal of the thesis:

1. Determine the specifications of battery, fuel cell, and hydrogen storage to meet the demands of a typical driver.
2. Input battery and fuel cell data into the National Renewable Energy Laboratory's (NREL's) Future Automotive Systems Technology Simulator (FASTSim) model to simulate a PFCEV.
3. Compare FASTSim results between PFCEVs, FCEVs, BEVs, and PHEVs. Also, compare well-to-wheels emissions of these vehicle types.
4. Calculate electricity and hydrogen usage for PFCEVs and other alternative vehicles if California passenger vehicles are entirely switched to these vehicles.
5. Use electricity and hydrogen usage data as demand inputs for the HiGRID electric grid model to determine overall emissions from a PFCEV fleet. Compare emissions to other alternatively-fueled vehicles.
6. Determine minimum amount of fueling infrastructure required for a light-duty fleet of PFCEVs in California, and calculate its cost.

2. BACKGROUND

Parts of this chapter have been published in the article: B. Lane, B. Shaffer, S. Samuelsen, "Plug-in fuel cell electric vehicles: A California case study," *International Journal of Hydrogen Energy*, vol. 42, no. 20, pp. 14294–14300, 2017.

Before analyzing the PFCEV in relation to the other alternative vehicles, it is important to get a sense of the characteristics of these vehicles as well as the social and political atmosphere of their creation. These details are described below.

2.1 Alternative Vehicle Types Available Today

There are several options available today that reduce emissions compared to conventional internal combustion engine vehicles (ICEVs), but they all have their own pitfalls. Conventional hybrid electric vehicles (HEVs) still use gasoline as their primary fuel, and therefore still have all the emissions associated with gasoline. More advanced vehicle types include plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), and fuel cell electric vehicles (FCEVs). While each of these offers the potential to reduce emissions compared to conventional vehicles, each also has its own issues that impair emissions reductions or driver convenience. Therefore, these advanced vehicles are not being widely adopted and will not have the major emissions reductions needed to combat and ultimately reverse climate change.

2.1.1 Hybrid Electric Vehicles

While HEVs were a creation of the late 19th century, they quickly fell out of popularity in the early 20th century [13]. However, HEVs have since made a comeback. The impetus for the revival was the Californian Zero Emissions Vehicles (ZEVs) mandate of 1990. This mandate called for 2% of vehicles made to be sold in California to be ZEVs by 1998, and increasing amounts for years thereafter up to 10% in 2003. The mandate was adjusted in 1996 to get rid of the vehicle goals prior to 2003 and also to give partial credits for vehicles with very low emissions called partial zero emissions vehicles (PZEVs) [14]. Automakers had to comply with this mandate or risk losing a large market, California. The first step toward this ZEV goal was to make cars with lower emissions, and these cars were HEVs.

One of the major benefits of HEVs is regenerative braking, the ability to use the electric motor in reverse while braking to charge up the battery which can then be used to help accelerate

the car. This decreases the amount of gasoline that an HEV uses because the energy needed is instead provided by the battery.

Toyota released the first modern-day HEV, the Prius, in Japan in 1997. Honda released the first modern-day HEV in the U.S., the Insight, in 1999. Toyota quickly responded by releasing the Prius in the U.S. in 2000. While these HEVs and the ones that followed offered increased efficiency and decreased emissions, they did not qualify as a ZEV or even a PZEV because the HEVs did not have low enough emissions to meet the standards. Thus, the work towards cleaner vehicles continued and more advanced car technologies were developed.

2.1.2 Plug-in Hybrid Electric Vehicles

The next step was to create the plug-in hybrid electric vehicle (PHEV). These vehicles are similar to HEVs but they include a larger battery that offers a modest battery electric range (BER)[1] and the ability to charge the battery from the electric grid. This latter characteristic classifies the PHEV as a plug-in electric vehicle (PEV). Other PEVs will be introduced shortly. PHEVs qualify as PZEVs and therefore help automakers meet the ZEV mandate. PHEVs can cut CO2 emissions by 25% in the near future and 50% in the long term compared to conventional hybrid vehicles [15]. This is a significant considering conventional hybrids already have a battery in their powertrain. Enlarging the battery and allowing for a modest all-electric range cause significant further emissions reductions, as determined by the previously cited study. The issue with PHEVs is that they still use combustion engines that run on gasoline and pollute at the tailpipe. Therefore, PHEVs are a great transition vehicle into the future, but not a long-term

[1] BER. While the battery is the only source of electric power in the PHEV powertrain, this is not the case for the plug-in fuel cell electric vehicle. Therefore, the conventional acronym AER (All Electric Range) is not adequate to describe driving range powered by the battery of a vehicle. The new acronym BER is used to distinguish between the battery and the other power source, whether it is electric or not.

solution for our transportation emissions issue and are not considered advanced alternative vehicles in this thesis.

2.1.3 Battery Electric Vehicles

Battery electric vehicles (BEVs) were the most popular automobiles in the late 19th century until Henry Ford made internal combustion engine vehicles (ICEVs) practical in the early 20th century [16]. Since then, ICEVs have made up the vast majority of automobiles on the road. However, with the recent ZEV mandate, BEVs are becoming more popular as they can be used to comply with the mandate. They are gaining desirability socially as well, as evidenced by their dramatically increased sales in the past few years [17]. BEVs have only a large battery, so they do not rely on gasoline and they have zero tailpipe emissions. Instead of liquid or gaseous fuels, BEVs get their energy in the form of electricity, which is stored in the battery. This means that BEVs are also considered PEVs. BEVs have very high efficiency but typically have short range and slow recharging [18]. While drivers can conveniently recharge their BEV at home, the range and recharge time are both key issues that can deter drivers from purchasing a BEV. Further improvements in battery technology have begun to increase driving range to about 200 miles with moderately priced BEVs, and new, fast PEV charging techniques are being developed to make recharging more convenient [19], [20],[21].

BEVs' overall emissions depend greatly on the energy portfolio of the electric grid being used to charge the BEVs. Therefore, clean sources of electricity to the electricity grid are required for BEVs to lower emissions from transportation. With the current trend of increasing clean renewable power such as wind and solar, emissions of BEVs are on a downward trend [22]. However, this does not affect the issues short range and long recharge times.

2.1.4 Fuel Cell Electric Vehicles

Fuel cell electric vehicles (FCEVs), while also not a new idea, have started gaining in popularity, particularly in California due to the ZEV mandate. FCEVs use hydrogen as fuel and a fuel cell as an electrochemical device instead of an internal combustion engine. The electrochemistry in a fuel cell is fundamentally very similar to that of a battery. A key distinction between the two is that batteries have all of their fuel and oxidant stored in the sealed battery, whereas a fuel cell has open channels through which fuel (often hydrogen) and oxidant (often oxygen from air) flow. This allows for independent sizing of the power of the fuel cell, dictated by the size of the fuel cell itself, and energy, dictated by the size of the hydrogen tank. A schematic of a representative fuel cell, the proton exchange membrane (PEM) fuel cell which is used for FCEVs, can be seen below in Figure *3*: Schematic of PEM Fuel Cell [23]. The use of a fuel cell in a vehicle leads to clean emissions. In fact, the only emission from the tailpipe of FCEVs is pure water.

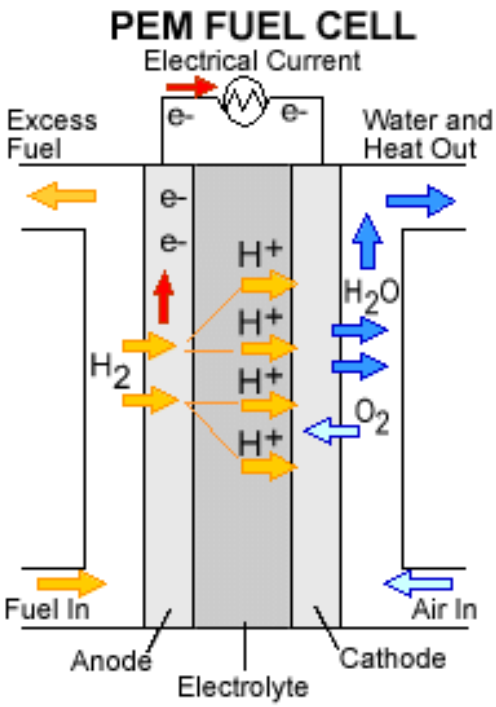


Figure 3: Schematic of PEM Fuel Cell, from U.S. Department of Energy [23]

FCEVs provide drivers with many of the conveniences of ICEVs. They have driving range (nearing 300 miles) and refuel times (just a few minutes) comparable to those of ICEVs, but FCEVs are significantly less efficient than BEVs due to the relative inefficiencies of electrolyzers and fuel cells [6]. Similar to BEVs, FCEVs can also have emissions highly dependent on the electric grid, depending on how the hydrogen is made. Currently, nearly all of the hydrogen that is used in the U.S. comes from natural gas [24]. However, California now requires that at least one third of hydrogen being sold at stations that receive state funds must be renewable [12]. This will lead to more hydrogen production from sources such as biogas, biomass, and electrolysis from renewable electricity. Electrolysis uses electricity to split water into hydrogen and oxygen. Therefore, because electricity will be used more in the production of

hydrogen, emissions from FCEVs will be more dependent on the emissions from electricity production in the future.

While FCEVs are in theory convenient for typical drivers, they have not yet reached that state practically. The main issue with FCEVs is the lack of hydrogen fueling infrastructure. While drivers with conventional vehicles can easily refuel with gasoline at an overwhelming amount of gasoline stations, it is not that convenient to refuel an FCEV with hydrogen. Hydrogen refueling stations are rare in California and nearly non-existent in the rest of the U.S. Worldwide, stations are rare as well. Creating the required infrastructure would be very costly, with hydrogen stations costing on the order of $1 million each [25]. This creates the circular problem that FCEVs will not sell well until hydrogen stations are widely available, but it can be hard to justify the expense of building hydrogen stations if not many people have FCEVs to use them.

2.2 Plug-in Fuel Cell Electric Vehicle

The newest advanced alternative vehicle is the PFCEV, which can be thought of as a PHEV with a fuel cell instead of a gasoline engine as the range extender. By combining the attractive features from all three advanced alternative vehicles discussed above, PFCEVs aim to overcome the issues that each of them have individually. PFCEVs have a moderately-sized battery to provide some all-electric range and refueling from the electric grid, meaning they are a PEV as well. They also have a hydrogen tank and a small fuel cell to use as a range extender. A schematic of a PFCEV can be seen in Figure *4*: Simplified powertrain schematic of PFCEV.

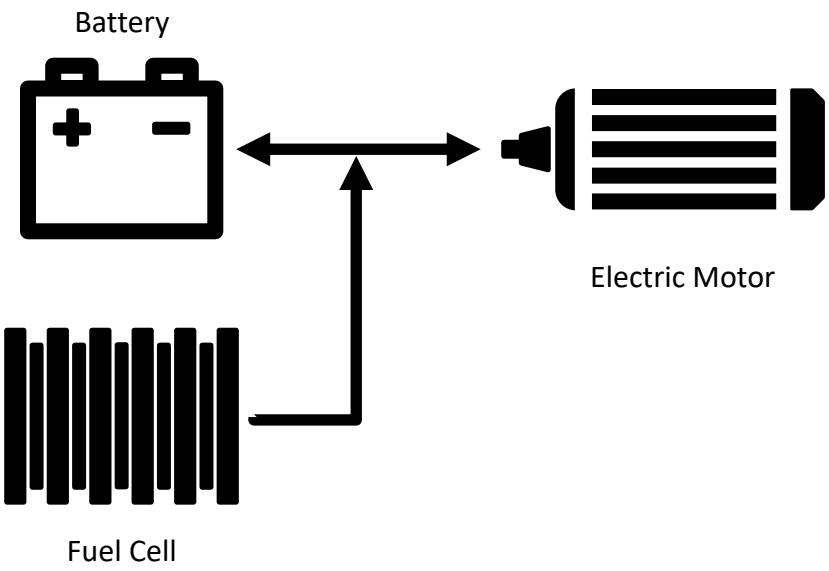


Figure 4: Simplified powertrain schematic of PFCEV

Due to the PFCEV being such a new vehicle type that is currently only in testing, there is not much information on them available. The PFCEV will be further analyzed in this thesis.

2.3 Vehicle Simulation Tools

The computer software FASTSim developed by the National Renewable Energy Laboratory can determine the performance and efficiency of a vehicle given its powertrain characteristics [26]. This software will allow for accurate modeling of a PFCEV in this research. Information such as fuel use (both electricity and hydrogen) and efficiency will be used for the proceeding analysis.

2.4 Alternative Fuel Infrastructure

Regarding the goals for PFCEV infrastructure analysis, similar work has been done for both PEVs and FCEVs. For PEVs, there has been modeling to optimize the location of PEV charging infrastructure [27]. One important result of this modeling is that PHEVs do not require expensive fast charging because they have a range extender; PFCEVs have the same result due to their fuel cell that acts as a range extender. For FCEVs, modeling has been done to determine the optimum number and location of hydrogen stations for refueling [28].

There has yet to be any work done to determine the charging and hydrogen infrastructure that would be required for a shift from conventional vehicles of today to PFCEVs in the light-duty fleet of California.

2.5 Summary

Climate change and declining air quality are forcing scientists and engineers to look for ways to reduce GHG and CAP emissions. Transportation is a major source of these emissions, and in particular transportation from light-duty vehicles (LDVs). While current advanced alternative vehicles are able to reduce emissions, they have issues that prevent widespread adoption. A new option, the PFCEV, could be an alternative that solves these issues while reducing emissions. A summary of the key characteristics of each of these advanced alternative vehicles is provided in **Error! Reference source not found.**.

Table 2: Advanced alternative vehicle types' characteristics

	PFCEV	PHEV	BEV	FCEV
Fast refueling	✓	✓		✓
Fueling station prevalence				
At-home refueling	✓	✓	✓	
Long driving range	✓	✓		✓
Relies on gasoline		✓		
Zero tailpipe emissions	✓		✓	✓
Emissions dependent on electric grid	✓	✓	✓	
Emissions dependent on the production of hydrogen	✓			✓

There has yet to be a study done to determine the infrastructure that would be needed to fuel a California fleet of light-duty passenger PFCEVs and how that compares to cases of FCEVs and BEVs. This research conducts that analysis. From the results, one can be aware of the benefits and drawbacks of each of the advanced alternative vehicle types with respect to their fuel use. The analysis will shed light onto whether or not PFCEVs are worth researching and potentially producing as a vehicle type in the future.

3. APPROACH

The goal of the research is to understand the effects of plug-in fuel cell vehicles (PFCEVs) on greenhouse gas (GHG) and criteria air pollutant (CAP) emissions in the context of

an electric grid of the future and determine the required charging and hydrogen infrastructure along with their cost. The results of the PFCEVs will be compared to other alternative vehicle types.

Task 1. Determine the specifications of battery, fuel cell, and hydrogen storage to meet the demands of a typical driver.

The research starts by defining some basic specifications of the PFCEV. First, determine a reasonable "typical" trip length for BER and an overall total driving range. Calculate energy needed to be stored in the forms of electricity and hydrogen to meet these ranges. Determine power specifications for battery and fuel cell considering typical passenger vehicles.

Task 2. Input battery and fuel cell data into NREL's FASTSim vehicle simulation model to simulate a PFCEV.

The specifications determined in Objective 1 will be used in the National Renewable Energy Lab's FASTSim software. This is done by creating a new vehicle type in FASTSim using a PHEV as a base to start from.

Task 3. Compare FASTSim results between PFCEVs, FCEVs, BEVs, and PHEVs. Also, compare well-to-wheels emissions of these vehicle types.

Run FASTSim using the custom PFCEV vehicle type as well as FCEVs, BEVs, and PHEVs. Illustrate the differences in efficiency, driving range, and use cases for such vehicle types. Using the efficiency results and emissions associated with the fuels used, compute the well-to-wheel emissions from the vehicles.

Task 4. Calculate electricity and hydrogen usage for PFCEVs and other alternative vehicles if California passenger vehicles are entirely switched to these vehicles.

Use 2009 NHTS data for CA as representative data for drivers. Using the trip lengths, determine electricity and hydrogen use for CA. Scale up results to reflect electricity and hydrogen use for all of CA for the year 2050. Repeat with a similar analysis for FCEVs and BEVs. Compare results between vehicle types.

Task 5. Use electricity and hydrogen usage data as demand inputs for the HiGRID electric grid model to determine overall emissions from a PFCEV fleet. Compare emissions to other alternatively-fueled vehicles.

Input the amount of electricity and hydrogen used in 2050 as a demand in HiGRID, an electric grid modeling tool, to determine emissions associated with fuel production. Do so for PFCEVs, FCEVs, BEVs, and PHEVs. Compare emissions from light-duty fleets composed of each of these vehicle types.

Task 6. Determine minimum amount of fueling infrastructure required for a light-duty fleet of PFCEVs in California, and calculate its cost.

Considering the electricity and demand for PFCEVs, determine the minimum electricity and hydrogen infrastructure that would be needed. Use the mapping capability of ArcGIS to site hydrogen fueling stations as well as production facilities. Compare infrastructure requirements to those for a California light-duty fleet of all FCEVs and of all BEVs. Compute costs of each.

4. OBJECTIVE 1 RESULTS

Parts of this chapter have been published in the article: B. Lane, B. Shaffer, S. Samuelsen, "Plug-in fuel cell electric vehicles: A California case study," *International Journal of Hydrogen Energy*, vol. 42, no. 20, pp. 14294–14300, 2017.

Determine the specifications of battery, fuel cell, and hydrogen storage of the PFCEV to meet the demands of a typical driver.

The PFCEV is a new alternative vehicle type that currently does not exist in the consumer market. PFCEVs are currently only in testing by automobile manufacturers [29][30]. Therefore, looking to existing PFCEVs as a source for vehicle specifications is impossible. This work must be carried out here, in this thesis.

Two major areas of specifications for the PFCEV are required for the analysis of this thesis in the area of fuel use and emissions. These two areas are the power of the vehicle and the energy storage of the vehicle. To ensure that these requirements are accurate, the mass of the PFCEV must first be estimated. This is because passenger vehicle performance is dictated largely by the vehicle's mass. A heavier vehicle requires more power to reach speeds fast enough for driver demand, and a heavier vehicle also requires more energy in the form of fuel to accelerate and to simply maintain speed.

4.1 Vehicle Mass

The mass of the PFCEV can be estimated by taking a vehicle available today and adjusting its mass according to differences in powertrains. The Chevrolet Volt is a popular PHEV sedan that can be used as a base for estimating the mass of a PFCEV. See Table *3*: Mass of PFCEV Calculation for the calculation for PFCEV mass.

Table 3: Mass of PFCEV Calculation

Part Added	Part Removed	Mass Change (kg)
Volt (used as template)		+1715 [1]
	Internal combustion engine	-136 [2]
Fuel cell stack		57 [3]
Fuel cell balance of plant		57
New battery		92.3 [4]
	Old battery	-198.1 [1]
Compressed hydrogen tank		87.5 [5]
	Gasoline tank	-10
Total mass		**1664.7**

[1-5] Data taken from Ref. [31]–[35], respectively. Mass of fuel cell balance of plant is estimated as the same as the mass of the fuel cell stack itself. Mass of the PHEV transmission is assumed equal to the increased mass of electronic controllers for the PFCEV, and therefore these are both neglected in the above calculation.

Advancement in battery technology in the past few years has helped decrease the weight of vehicle batteries significantly. Current technology, using the energy density of Tesla cars, allow for a battery that can provide 40 miles of BER at only 92.3 kg [34]. This is less than half the mass of the battery used in the 2013 Volt which has a nearly 40 mile BER.

Another interesting comparison is between the internal combustion engine and the fuel cell and its balance of plant (BoP), which is the other necessary equipment required for a fuel cell including compressors, cooling equipment, and other components [36]. Estimating the fuel cell BoP to have the same weight as the fuel cell itself, the fuel cell and its BoP are slightly lighter weight than the comparable internal combustion engine.

The above two notions lead to the PFCEV being a slightly lighter vehicle than the PHEV by about 50 kg, or 110 pounds. This lower weight leads to higher efficiency as discussed earlier in this chapter.

4.2 Power Specifications

The power of a vehicle must meet the expectations of the typical driver. Namely, the vehicle must have enough power to accelerate fast enough to not irritate the driver and also to avoid possible dangerous events that may occur while driving. While lower power typically leads to more efficient vehicles, vehicles must have enough power to satisfy consumers if they are going to be widely adopted.

Power specifications of the PFCEV used in this thesis are based off the power specifications of 2016 Chevrolet Volt PHEV. As mentioned before, a PFCEV can be thought of as a PHEV with a fuel cell instead of a gasoline engine. Because both PFCEVs and PHEVs are so similar in terms of powertrain components, selecting a PHEV as a base for a PFCEV model is justified. The Volt has been one of the most popular PHEV models in the U.S. and worldwide since it was first sold in 2010 [17]. Therefore, it is safe to assume that the Volt has adequate power to satisfy typical drivers and is a good vehicle to emulate in the form of a PFCEV.

PFCEVs have both a battery and a fuel cell, and specifications must be selected for both. Due to our strategic selection of the Volt to base our specification on, we have both battery and fuel cell specifications (or, for the PHEV, engine specifications) which we can use. The battery of the Volt is rated at 111 kW, so that is the power of the battery used in the modeling of the PFCEV. The engine of the Volt is rated at 75 kW, so that is the power of the fuel cell used in the modeling of the PFCEV.

Lastly, both PFCEVs and PHEVs have an electric motor. For the Volt, a PHEV, the electric motor is used to direct the power from the battery, and only the battery, to the wheels. The engine produces mechanical work, so it is not connected to the electric motor. Therefore, the electric motor of the Volt has the same power specification as the battery. For the PFCEV, the

electric motor must direct power from both the battery and the fuel cell to the wheels. This is because the fuel cell produces electrical work, so its power must also be routed through the electric motor. This analysis assumes that the electric motor will have the same power specification as the battery.

4.3 Energy Storage Specifications

Vehicles must have enough fuel stored on the vehicle to provide drivers with the driving range to make them comfortable, avoiding the issue known as range anxiety. This is a very complex idea that includes a variety of factors such as fuel storage capacity, trip length, refueling station placement, and refueling time. Drivers want a vehicle that has enough driving range to take them to the places they need and want to go. Every driver has a unique driving trip length pattern which often has some sort of general pattern, such as going to work and back. However, many trips are often sporadic, such as trips to the market to buy an ingredient for a special meal. Therefore, the driving range that drivers would like from a vehicle is not as simple as calculating the average distance to work and back. Additionally, the prevalence of refueling stations can also impact how much driving range drivers want from their vehicles. If refueling stations are not easily accessible, that issue can be at least partially resolved by increasing the driving range of the vehicle. Lastly, the amount of time required to refuel can impact the desired driving range of a vehicle. If a vehicle refuels quickly, a shorter driving range may be acceptable. All of the above factors affect the driving range with which drivers would feel comfortable.

The PFCEV gets driving range from both the battery and the fuel cell; therefore, energy storage specifications must be determined for both the size of the battery and the amount of hydrogen stored for the fuel cell.

The energy specifications for the battery can be determined by analyzing the distance of trips that drivers make. The data that is used for this analysis is 2009 NHTS data for California drivers of LDVs [37]. According to these data, about 85% of California LDV trips are 40 miles or less, which can be seen in Figure *5*. This overwhelming majority of trips is justification for using a 40 mile BER for the PFCEV.

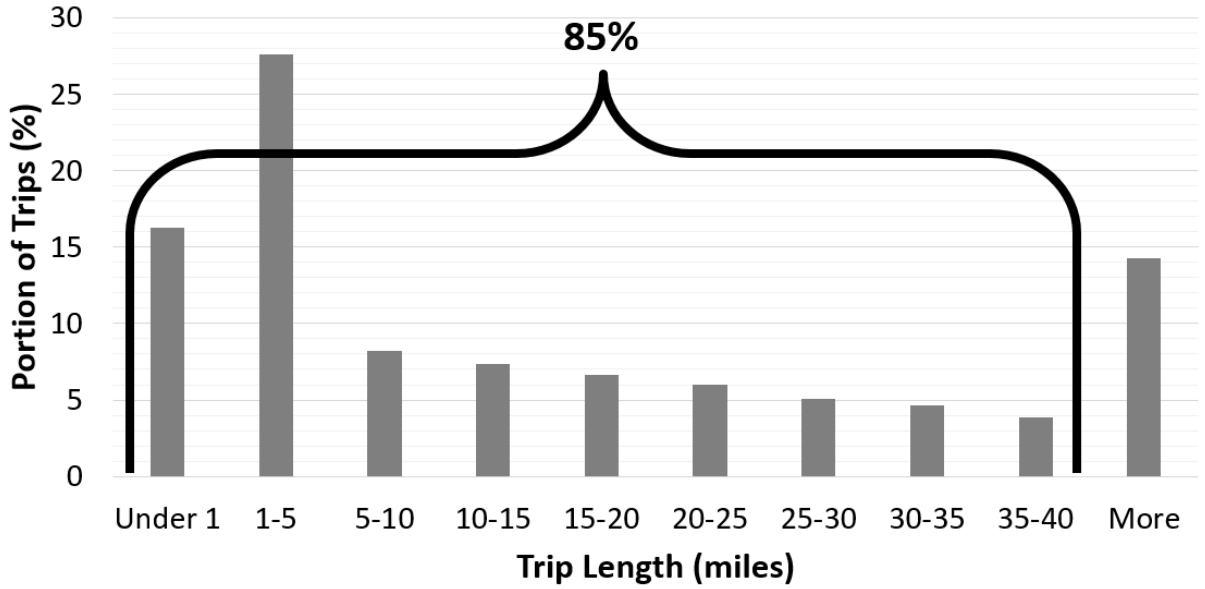


Figure 5: Distribution of Driving Distance for CA Passenger Vehicles

Using BEV efficiency to get an estimated battery size for 40 miles BER as a starting point and then iteratively running the vehicle simulation tool FASTSim leads to a battery with an energy storage capacity of 13.0 kWh to achieve a 40 mile BER with a PFCEV.

To get an idea of how this compares to other vehicles, consider the 2016 Nissan Leaf. The Leaf is a popular BEV with moderate driving range. A battery of 24 kWh leads to a driving range of 84 miles [38]. This means the PFCEV being simulated has a similar, but slightly lower, efficiency compared to the Nissan Leaf when the PFCEV is using battery only. This is

understandable when considering the PFCEV has a fuel cell, its BoP, and a hydrogen tank that are on-board even when it is operating on its battery only.

Energy specifications for the hydrogen storage are determined by the driving range to which drivers have become accustomed. ICEVs have a driving range that exceeds 300 miles. Therefore, this analysis will use a hydrogen tank that can provide an addition 300 miles in addition to the 40 mile BER. This gives the PFCEV a total range of 340 miles, which is comparable to what drivers expect from their ICEVs. For example, the popular Toyota Corolla sedan and the Hyundai Tuscon small SUV both have a range of about 300 to 400 miles, depending on driving habits [39], [40]. Using FCEV efficiency to get an estimated hydrogen amount for 340 total miles as a start, and then again iteratively using FASTSim leads to a hydrogen tank holding 3.99 kg of hydrogen.

Again, to see how this compares to other vehicles, consider the Toyota Mirai. The Mirai is one of the few FCEVs available today. It has a hydrogen capacity of 5.0 kg and a driving range up to 300 miles [33]. Neglecting the 40 mile BER of the PFCEV, both the PFCEV and the FCEV have driving ranges of about 300 miles. However, the PFCEV requires 20% less hydrogen due largely to the addition of the battery.

4.4 Objective 1 Conclusions

A prototypical PFCEV fit for passenger use is now designed. Under the guidance of travel data and using characteristics of the most popular alternative vehicles, the PFCEV herein is assured to meet customers' needs for a passenger vehicle. The power requirements are satisfied by adequately specifying the powertrain components, namely the battery, fuel cell, and electric motor. The fuel requirements, in the form of both electricity in the battery as well as

hydrogen for the fuel cell, ensure that drivers need not worry about driving range. This point will be further strengthened in Chapter 9. OBJECTIVE 6 RESULTS as the infrastructure for PFCEVs is developed.

The PFCEV compares well to current BEVs and FCEVs in terms of their fuel consumptions. Further analysis on the efficiencies of these three vehicle types will be detailed in the following chapter.

5. OBJECTIVE 2 RESULTS

Parts of this chapter have been published in the article: B. Lane, B. Shaffer, S. Samuelsen, "Plug-in fuel cell electric vehicles: A California case study," *International Journal of Hydrogen Energy*, vol. 42, no. 20, pp. 14294–14300, 2017.

Input battery and fuel cell data into NREL's FASTSim plug-in hybrid model to simulate a PFCEV.

The specifications determined in Task 1 will be used in the National Renewable Energy Lab's FASTSim vehicle simulation model. This is done by creating a new vehicle type in FASTSim using a PHEV as a base to start.

5.1 FASTSim PFCEV Inputs

As discussed in chapter 4, a PFCEV can be thought of as a PFCEV with a fuel cell instead of a combustion engine. Therefore, using the 2012 Chevrolet Volt preset vehicle configuration in FASTSim is a convenient starting point for the PFCEV model. From here, the

power of the energy converter (here a fuel cell), power of the battery, power of the electric motor, energy storage in the hydrogen, energy storage in the battery, mass of the fuel converter (a fuel cell), mass of the battery, and energy density of the hydrogen, and fuel converter (fuel cell) efficiency were all changed to reflect values of a PFCEV. A comprehensive table of inputs for the PFCEV can be found in APPENDIX A: Detailed FASTSim PFCEV Inputs. A summary of the most significant changes can be seen below in Table *4*: PFCEV Inputs for PFCEV Modeling.

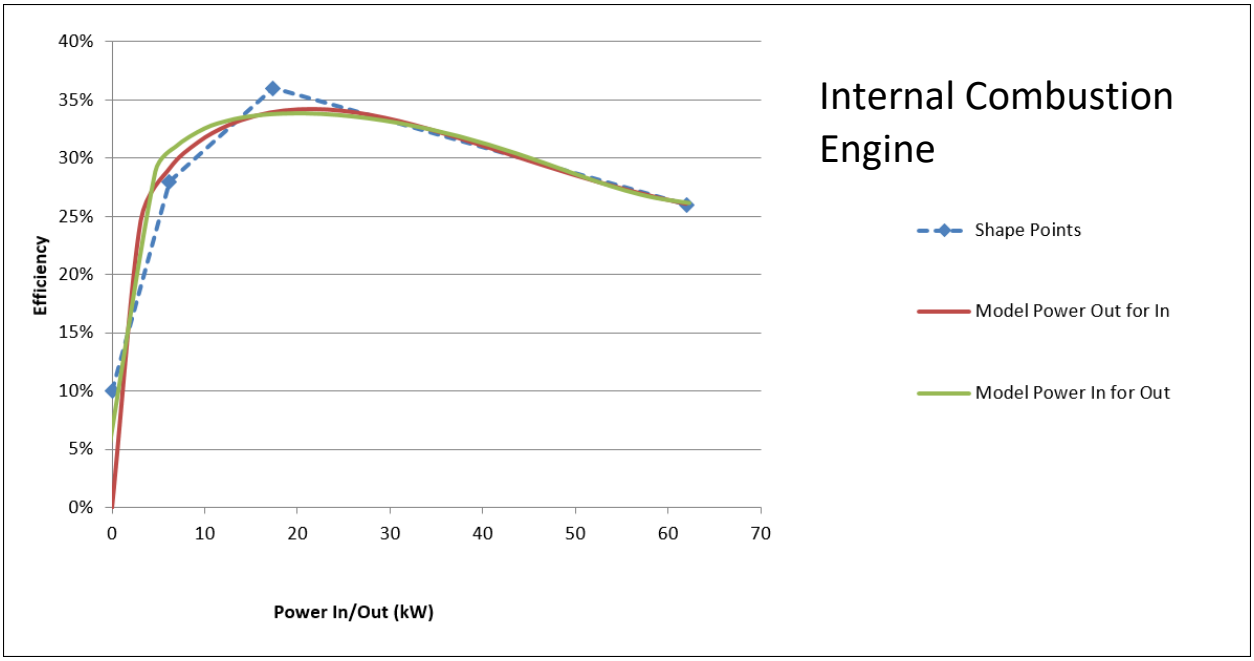
Table 4: PFCEV Inputs for PFCEV Modeling

Heading	Entry	Value	Units
Vehicle	Mass	1664.7	kg
	Glider mass (no powertrain)	1322.34	kg
Fuel storage	Hydrogen storage energy	133	kWh
	Fuel cell fuel and fuel storage mass	1.9	kWh/kg
Fuel converter power	Fuel converter power	74.57	kW
	Fuel converter specific power	1.30 [1]	kW/kg
Electric motor	Electric motor power	111.855	kW
Traction battery	Battery power	111.855	kW
	Battery energy	13	kWh
	Battery mass	7.1	Kg/kWh
	Battery base mass	92.3	kg

[1] Data same as Toyota Mirai, a leading FCEV available today [33]

The peak efficiency of the power curve was changed to reflect a maximum efficiency of 62%, the efficiency of a modern proton exchange membrane fuel cell, the type of fuel cell which is used in a vehicle [41]. The general shape of the efficiency vs. power curve was changed to better match the curve of a fuel cell as depicted in the literature, namely moving peak efficiency

to lower power levels and having a more straight downward slope [42]. Figure *6* shows the changes made to the efficiency mapping in FASTSim to account for a fuel cell instead of an internal combustion engine. The green and red curves represent the power output and input for the fuel converter, respectively, and the blue rhombi represent data points that can be altered to calibrate the model.



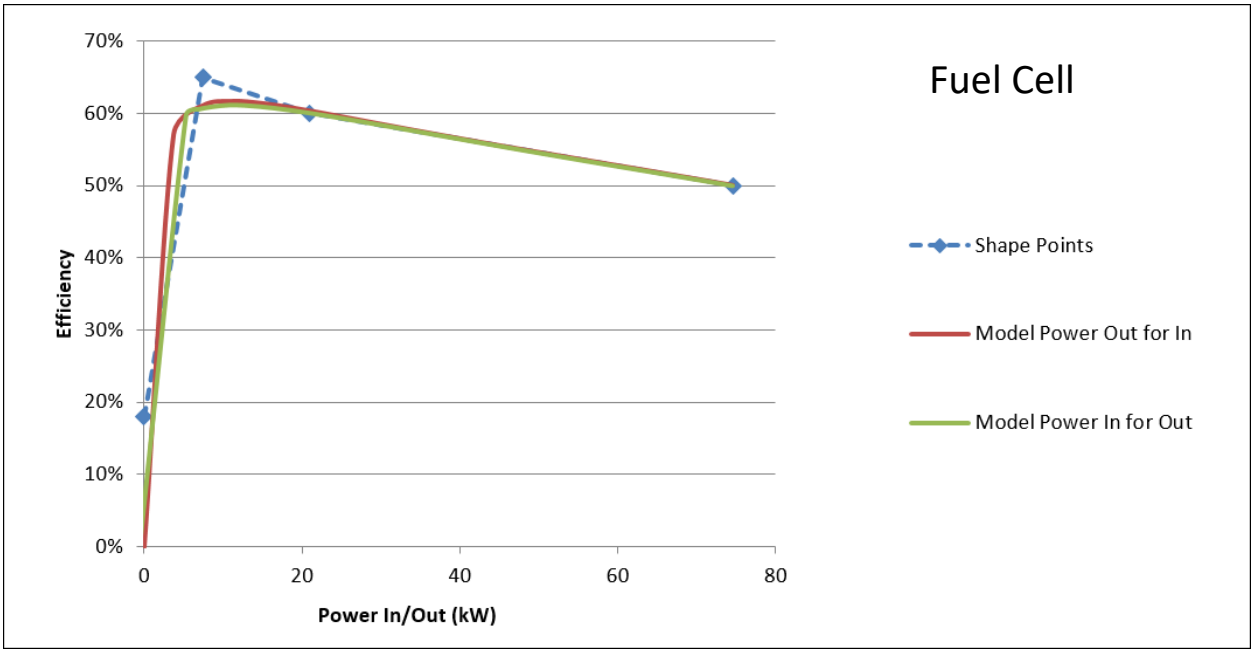


Figure 6: FASTSim Efficiency Mapping for Internal Combustion Engine and Fuel Cell

5.2 FASTSim PFCEV Results

Key FASTSim results for the PFCEV are listed below in Table 5: PFCEV FASTSim Results. More complete results for PFCEVs as well as results for a representative BEV, FCEV, and PHEV can be found in APPENDIX B: FASTSim Results for PFCEVs, BEVs, FCEVs, and PHEVs.

Table 5: PFCEV FASTSim Results

Result	Value	Units
BER	42.3	mi
Total range	343	mi
Charge sustaining efficiency (city/highway combined)	0.335	MPGGE [1]
Charge depleting efficiency (city/highway combined)	0.322	kWh/mi

0-60 mph time	6.3	s

[1] MPGGE (Miles Per Gallon of Gasoline Equivalent) is an efficiency measure similar to conventional vehicles' MPG. The energy contained in one kilogram of hydrogen fuel is about equal to the energy in one gallon of gasoline. The MPGGE number of non-gasoline-fueled vehicles can be compared directly to the MPG number of gasoline-fueled vehicles to gauge efficiency.

The desired 40 mile BER was achieved, as well as the 340 mile total range. The charge sustaining efficiency is the efficiency of the vehicle while maintaining the same amount of electricity stored in the battery. This allows for some minor use of the battery at times of high fuel cell load or regenerative braking, but the state of charge of the battery is kept nearly constant. This means the vast majority of the power used by the vehicle is coming from the hydrogen fuel cell when considering the charge sustaining efficiency. For the charge depleting efficiency, the vehicle is only using the electricity stored in the battery.

5.3 Objective 2 Conclusions

FASTSim provides versatile vehicle modeling that allows for the simulation of a PFCEV. By wisely selecting a PHEV as the starting point and then changing key vehicle parameters to better resemble the powertrain components of the PFCEV, we gain an understanding of how PFCEVs operate. These efficiency results will be given context in the following chapter as they are compared with those of the other alternative vehicle types.

6. OBJECTIVE 3 RESULTS

Parts of this chapter have been published in the article: B. Lane, B. Shaffer, S. Samuelsen, "Plug-in fuel cell electric vehicles: A California case study," *International Journal of Hydrogen Energy*, vol. 42, no. 20, pp. 14294–14300, 2017.

Compare FASTSim results between PFCEVs, PHEVs, BEVs, and FCEVs. Also, compare well-to-wheels emissions of these vehicle types.

For comparison purposes, models of a PHEV, a BEV, and a FCEV were created in FASTSim. By comparing the efficiencies and driving ranges, one can determine which vehicle types are best fit for drivers' demands.

6.1 Alternative Vehicle Types to Compare

The PHEV used for this analysis was a 2016 Chevrolet Volt. The Volt is a leading PHEV, with the highest sales of any PHEV for the past several years in the U.S., so it is an important vehicle to include in this comparison [17]. The BER of the Volt is about 53 miles, and the total driving range is 420 miles. Similar to the PFCEV, the PHEV allows for short trips to use electricity from the electric grid and also allows for long range by using the gasoline range extender. The 2012 Volt is a pre-configured model in FASTSim, so creating the 2016 Volt was done by changing the vehicle weight as well as updating the battery and fuel specifications to achieve the new BER and total ranges [43].

The BEV in this analysis is a 2012 Nissan Leaf. The Leaf has been either the best-selling or second-best-selling BEV in the U.S. for several years [17]. While the Tesla Model S has sold more than the Leaf in the past couple of years, it is also much more expensive than the Leaf and thus not a car for the mass market. Very recently, the Tesla Model 3 and the Chevrolet Bolt have been released. These BEVs offer longer range, over 200 miles, and cost around $35,000 [20][19]. However, the Model 3 is currently being sold almost exclusively for Tesla employees and the Bolt has been off to a slow start due to production limitations [38][39]. Therefore, the

Leaf is the BEV used in this comparison between vehicles at their current state. When looking to the future, however, the new generation of longer-range BEVs must be considered.

The 2012 Leaf has a modest BER of just over 70 miles, which is in the typical range for current prominent BEVs, besides the Tesla Model S which is too expensive to consider in this analysis of massive vehicle adoption. The new 2016 Leaf is very similar to the 2012 Leaf except for the slightly increased range of 84 miles due to improved battery technology [38]. The existing 2012 Leaf model in FASTSim is therefore an adequate vehicle to use in this comparison.

The FCEV in this analysis is based off the 2016 Toyota Mirai [33]. It is part of the first generation of FCEVs available to the public, one of only three such vehicles. The Mirai is one of the only two currently available FCEV sedans and the first one to go on sale, so it is a fitting car to include in this comparison.

6.2 FASTSim Results Comparison

The major results from the FASTSim simulations are presented in Table *6*: FASTSim Results for Various Alternative Vehicles.

Table 6: FASTSim Results for Various Alternative Vehicles

	PFCEV	**PHEV (2016 Volt)**	**BEV (2012 Leaf)**	**FCEV (2016 Mirai)**
BER range (mi)	42.3	36.2	72	0
Total range (mi)	341	401	72	295
Battery capacity (kWh)	13.0	16.0	24.0	0
Fuel storage (kWh)	123	313	0	167
Charge depleting efficiency (kWh/mi)	0.322	0.346	0.345	N/A

Charge sustaining efficiency (MPGGE)	82.0	39.5	N/A	59.7

The first thing to note is that the PHEV uses gasoline as fuel. This means that as California and the rest of the world move towards more sustainable fuels and technology, the PHEV is not an ultimate passenger vehicle type. The other three vehicle types use electricity and fuel that can be sustainably made. The PHEV does not. This leaves the PHEV as an incremental improvement over conventional vehicles on the way to more sustainable alternatives.

Second, the difference in driving range between these vehicle types leaves the BEV with a major hindrance. While most people's trips are 40 miles or less, not every trip is. Many trips are longer than even the approximately 100 mile range of the updated Nissan Leaf. This prevents BEVs it from being the vehicle type for the majority of people today. The new generation of affordable BEVs with ranges above 200 miles, this issue is slightly relieved. However, the range is still not quite what drivers are accustomed to with ICEVs. The other three vehicle type all have ranges much closer to ICEV driving range. The PFCEV has an advantage over the FCEV, but the PHEV gives the longest driving range of all these alternative vehicles.

Lastly, the PFCEV has the highest efficiency for both driving on battery alone (charge depleting efficiency) and driving on fuel alone (charge sustaining efficiency). The PFCEV's high efficiency results are due in part to the relatively light weight of the PFCEV. Using a small battery and a small fuel cell keep the weight of the vehicle down. The PFCEV is lighter than its PHEV counterpart, as detailed in Table *3*: Mass of PFCEV Calculation of Chapter 4. The low weight means less energy is required to move the vehicle.

Note that the Mirai does not have charge depleting efficiency because it does not have any BER and the Leaf does not have charge sustaining efficiency because it does not run off fuel but instead electricity from the battery alone.

6.3 Well-to-Wheel Emissions

Before moving on to a more fleet-based analysis, it is beneficial to look at one last individual-vehicle characteristic, the well-to-wheel (WTW) GHG emissions. WTW GHG emissions are the GHG emissions from the fuel feedstock, processing the fuel, distributing the fuel, and emissions from the vehicle tailpipe. Calculating the WTW GHG emissions from the PFCEVs requires the emissions from BEVs and FCEVs in order to represent the two driving modes of the PFCEV. The fraction of miles that are driven in each of these two modes is also required. The fraction of miles driven using the battery is designated as the "utility factor."

Using a methodology developed by the UCI Advanced Power and Energy Program (APEP), the WTW GHG emissions associated with various vehicle types were compared [46]. Taking the emissions from BEVs using the California electric grid and the emissions from FCEVs using 33% renewable hydrogen, and weighing the emissions by the fraction of miles that are driven using the battery and the fuel cell, the total WTW GHG emissions of PFCEVs in California can then be calculated. California requires that at least one third of hydrogen being sold at vehicle refueling stations that receive state funds must be renewable [12]. Therefore, because this study is focused on PFCEV deployment in California, the PFCEV and FCEV scenarios for this calculation use 33% renewable hydrogen.

Figure *7* below depicts the WTW GHG emissions of various vehicle types. The graph has been updated from the prior APEP report to include PFCEVs and also to remove some vehicle

types to make comparison simpler [46] . The various sources for the data used in this calculation are as follows: emissions related to hydrogen for FCEVs and PFCEVs are from an analysis conducted by Stephens-Romero [47]; emissions for the feedstock of natural gas which is used for charging electric vehicles are from Argonne's GREET model [48]; the mixture of sources for the California electric grid is from the California Energy Commission [49]; all vehicle efficiencies except for those of the PFCEV (which is calculated using FASTSim) are taken from the California Air Resources Board's EMFAC [50]; the emissions of the gasoline vehicle and the gasoline portion of the PHEV are from California's Air Resources Board's Low Carbon Fuel Standard [7]; the utility factor of the PHEV is from SAE J2841 [51]; and the utility factor of the PFCEV is calculated using data from the 2009 NHTS data for California trips [37].

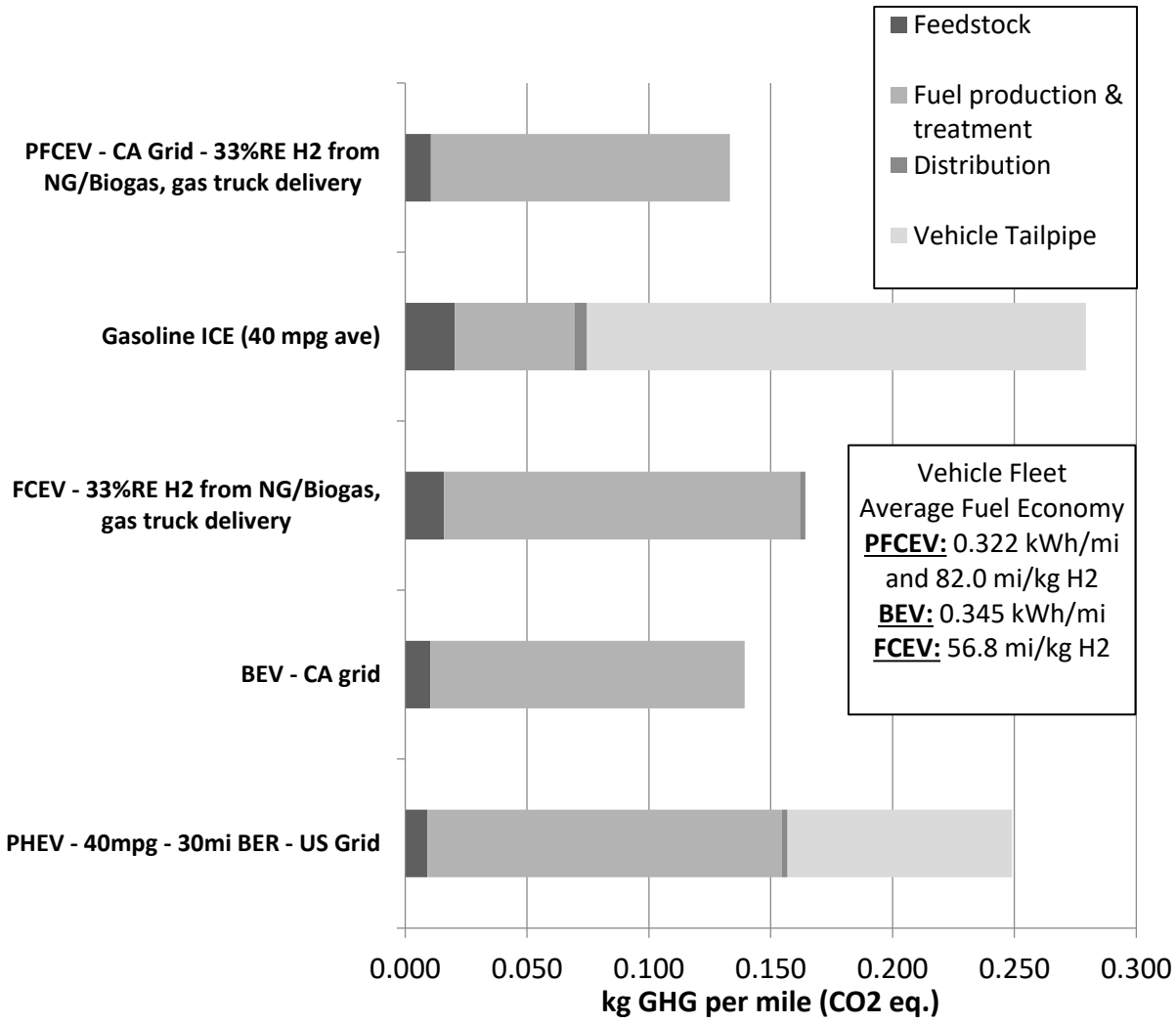


Figure 7: WTW GHG Emissions from various vehicle types

Extending the analysis that the APEP conducted on WTW GHG emissions to include PFCEVs shows that PFCEVs have the lowest emissions of all vehicle types. This shows that the use of extremely efficient batteries for most trips, as well as fuel cells with California's partially-renewable mix of hydrogen fuel as a range extender, lead to very clean transportation.[2] These results are in agreement with prior studies of alternative vehicles done at the national scale and

[2] For a comparison between many more vehicle types, see the analysis in the paper seen at the following link: http://www.apep.uci.edu/3/ResearchSummaries/pdf/SustainableTransportation/WTW_vehicle_greenhouse_gases_Public.pdf.

by using California electric grid emissions [52] [53]. The study in this paper, however, includes the updated driving habit data for California passenger vehicles, while the previous studies do not.

6.4 Objective 3 Conclusions

When comparing the FASTSim results between these alternative vehicles, the PFCEV stands out in terms of its ability to meet drivers' demands while providing the opportunity to be powered by the increasingly sustainable electricity and fuel going into the future. At this point in the analysis, the FCEV stands out similarly, with its long driving range and zero tailpipe emissions as well. When comparing emissions, the PFCEV stands out as having the lowest WTW GHG emissions of all vehicle types considered in this thesis. This is due to the strategic mix of powertrain components that is efficient, lightweight, and versatile.

7. OBJECTIVE 4 RESULTS

Parts of this chapter have been published in the article: B. Lane, B. Shaffer, S. Samuelsen, "Plug-in fuel cell electric vehicles: A California case study," *International Journal of Hydrogen Energy*, vol. 42, no. 20, pp. 14294–14300, 2017.

Calculate electricity and hydrogen usage for PFCEVs and other alternative vehicles if California passenger vehicles are entirely switched to these vehicles.

In investigating these alternative vehicle types, it is imperative to analyze the fuel they use and the amount of fuel consumed. All of the vehicles have no tailpipe emissions (while the

PHEV does have tailpipe emissions, it is not herein considered a future alternative vehicle due to its reliance on gasoline, a fossil fuel). With no tailpipe emissions, all of the emissions associated with these vehicles come from fuel production and potentially distribution. Therefore, calculating the amount of fuel needed by these vehicles will give insight into how each of these vehicles can help meet environmental goals.

Fuel use is a function of driver habits. Drivers that tend to accelerate quickly do use more fuel to travel the same distance as a driver that accelerates more gently. However, fuel use is generally proportional to the number of miles driven. Therefore, in order to determine the fuel use of these vehicles, information on the length of trips drivers make is needed.

It is also important to set a date at which these vehicle types will be compared. This allows for three main factors that will be key for this comparison. Because this study focuses on comparing the merits of the vehicles themselves, the date must be selected far enough in the future to allow for wide-scale adoption of the vehicles. This allows the comparison to be about the inherent properties of vehicles instead of their current state. An appropriate year that is far enough in the future for any of the alternative vehicles to be widely adopted is 2050. This will be the year on which most of the proceeding analyses will be based. Second, selecting a date allows for calibration of the power and fuel mix. The sources of power and fuels are constantly evolving, currently trending towards cleaner and more sustainable as time goes on. Because of this constant evolution, setting a time for a comparison allows for using a set mix of power and fuel sources that the vehicles would use in that time. As will later be demonstrated, a goal for the characteristics of the electric grid in 2050 which will meet environmental goals has been specified, which will assist in analyses in Chapters 8 and 9. Lastly, selecting a date gives a set number of miles that will be traveled as projected by factors such as population growth. As

discussed above, this also sets an amount of fuel that will be required when using any of the alternative vehicles being considered.

7.1 National Household Travel Survey Data

Travel survey data from the 2009 National Household Travel Survey (NHTS) was used to simulate vehicle trips [37]. These data provide a sample of the trips in the nation by the people who participated in the survey. By looking at only the California trips and scaling the results up to match the total number of passenger vehicle miles traveled in 2009, these data can represent of all of California's passenger vehicle trips. The total number of vehicle miles traveled (VMT) for the same year as the trip data, 2009, was also recorded by the NHTS, so such an extrapolation to all California passenger vehicles is simple [54]. Next, to scale these data to the year 2050, the California Air Resources Board (CARB) predicts that VMT will increase with population to 2050, resulting in 1.4 times as many VMT in 2050 compared to 2009 [55]. This approach can be used to determine how much vehicle fuel for the different vehicle types would be needed in 2050.

To calculate the electricity and hydrogen that would be used by PFCEVs in California, some of the individual trips had to be modified to account for the BER of the PFCEV. Vehicles making multiple trips in a row deplete their battery electric range and start to use hydrogen if needed until they stop at home or work, where level 2 PEV chargers can be expected to be widely available in the next few decades. Level 1 chargers are defined as chargers with up to 1.9 kW of power; level 2 chargers go up to 19.2 kW, and level 3 chargers are 20 kW and above [56]. For this analysis, a charging time of 81 minutes was required for the 40 mile electric range to be recharged, otherwise the battery electric range was not fully recharged. Based on a charge time

for level 2 charging provided by Tesla, a charging time of 81 minutes was specified for the 40 mile BER (otherwise the BER was not recharged) [57]. It is reasonable to assume that most drivers will be stopped long enough at home or work for a full charge, so partial charging was not considered. For vehicles that did not stop at either home or work for at least 81 minutes, the battery charge level would continue to decrease on the next trip or hydrogen would be used as fuel, depending on the charge state of the battery. In this data set, over 70% of trips to work or home stayed parked for at least 81 minutes, which is required for a full charge [54]. Therefore, allowing for only a full charge or no charge at all is adequate for this analysis.

To calculate and compare the fuel used by FCEVs and BEVs, a similar analysis was used. The same trips from the 2009 NHTS data were used, but this time hydrogen was used for all FCEV trips and electricity was used for all BEV trips. Average efficiencies for BEVs and FCEVs were gathered from prior research and actual vehicle testing [46], [6].

It is important to note that while the projected VMT based on population may be used as a guideline, it is possible that future vehicle paradigms such as autonomous vehicles could change VMT. For example, in a recent survey on how autonomous vehicles may change driver habits, only two-thirds of drivers believed their VMT would be the same in an autonomous vehicle paradigm. For those that thought their VMT would change, nearly three times as many thought their VMT would increase as opposed to decrease [58]. A review paper by Fagnant and Kockelman state there could be an increase in VMT by as much as 20% or more, depending on the percentage of vehicles that are autonomous, among other factors [59]. As listed by Litman, there are several reasons why VMT would either increase or decrease and it is uncertain which scenario will win out, or if VMT may be relatively unchanged by autonomous vehicles [60].

These issues are beyond the scope of this thesis, so using population increase to extrapolate the VMT will be used.

Another interesting tangent to ponder is how autonomous vehicles may change the trip length distribution. BEVs are best suited for shorter trips and a schedule that allows for enough time for charging between trips. FCEVs are best suited for long-range trips and in situations where fast refueling is needed. PFCEVs are best suited for a mix of the preceding two scenarios. Currently, it is too early to know which of these scenarios would be most prevalent in a world dominated by autonomous vehicles. While changes in overall VMT may not change the relative benefits of one vehicle type over the other, changes in the trip length distribution can. If a future vehicle technology paradigm such as autonomous vehicles alters the trip length distribution, it could alter which vehicle type would be most appropriate.

Given that the future is so uncertain regarding autonomous vehicles, the analyses conducted in this thesis do not consider the effects of autonomous vehicles. The reader should, however, be aware of these issues, especially given the rapid growth in autonomous vehicle research and development.

7.2 Fuel Use in 2016

Fuel use results obtained by using FASTSim and NHTS data for the most recent full year, 2016, are displayed in Table *7*: 2016 Fuel Use for Advanced Alternative Vehicle Types. These are calculated by using the efficiency results from FASTSim and applying them to the vehicle trip data from NHTS and scaling up the total VMT from the year of the survey, 2009. The VMT for 2016 was nearly the same for the year 2009, so there is no issue with using the VMT of the year of the 2009 survey [55].

Table 7: 2016 Fuel Use for Advanced Alternative Vehicle Types

Vehicle type	Electricity use (MWh/yr)	Hydrogen use (kg/yr)
BEV	$7.9x10^7$	0
FCEV	0	$4.1\ x10^9$
PFCEV	$5.6x10^7$	$6.8\ x10^8$

The results are also represented visually in Figure *8* as annual fuel demand along with California's annual use of electricity and hydrogen for petroleum refining [61] [62].

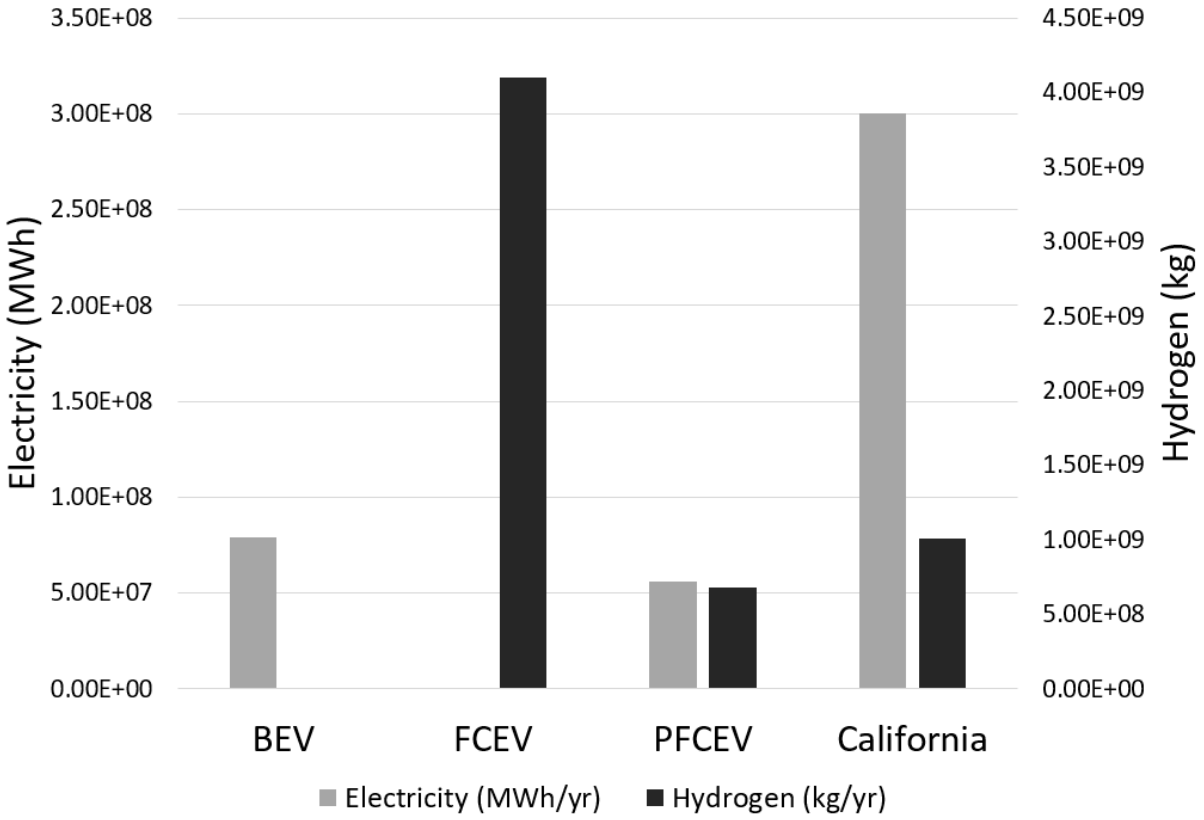


Figure 8: Annual Electricity and Hydrogen Demand in 2016

The results show that, if California adopted PFCEVs as passenger vehicles, 82% less hydrogen would be needed than if FCEVs were used. The significant reduction of hydrogen fuel

needed compared to FCEVs in California matches well to previous studies conducted on these alternative vehicles in general [63]. This suggests that PFCEVs may significantly reduce the number of hydrogen stations and associated infrastructure (electrolyzers, distribution, etc.) that would be otherwise required to support the vehicles compared to FCEVs. This point will further be investigated in Chapter 9. Interestingly, hydrogen production for petroleum refining in California today exceeds the amount needed to fuel all passenger vehicles in the state if they were PFCEVs [61]. The majority of that petroleum is refined to produce gasoline [64]. Unfortunately, the vast majority of the hydrogen that is used in the U.S. today is produced from natural gas, a fossil fuel, in a process known as steam methane reformation (SMR) [24]. However, even relying on natural gas for hydrogen production still reduces GHG emissions by half compared to gasoline in ICEVs [24]. Going a step further, if unused Californian biogas from landfills and wastewater treatment plants were used to produce hydrogen, the entire PFCEV population could be fueled by renewable, carbon-neutral hydrogen, a promising result for deploying PFCEVs in California in the near future [65]. It is important that such an abundance of fuel for PFCEVs exists today because it allows for fast deployment in the near future that would foster growth to mass-deployment by 2050.

PFCEVs also reduce the electricity required for charging compared to BEVs by about 29%. This helps ease the burden on the electric grid, especially as more renewable electricity generation, which is variable and intermittent, is added. For reference, California uses approximately 300 TWh of electricity annually [62]. This means that BEVs would use about 26% of California's current electricity demand on average while PFCEVs would use about 19%. Both of these are significant increases, and a brief analysis on the required electric grid improvements will be conducted in Chapter 9.

One detail to note is that due to the approximation of this analysis in not accounting for partial charges, in reality hydrogen use will be slightly decreased and electricity use will be slightly increased from the results herein. This is because, with partial charging, drivers can replenish some of their BER while parked, even when their stay does not allow for a full recharge. However, due to the fact that the vast majority of stays are expected to be at home or work where longer stays are typical, the assumption of full-charging for this analysis is a reasonable approximation for the expected reality.

7.3 Fuel Use in 2050

Fuel use results obtained by using FASTSim and NHTS data for 2050 are displayed in Table *8*: 2050 Fuel Use for Advanced Alternative Vehicle Types. These were calculated by using the efficiency results from FASTSim and applying them to the vehicle trip data from NHTS and scaling up the total VMT to that which is projected for 2050, which is 1.4 times higher than the VMT in 2009.

Table 8: 2050 Fuel Use for Advanced Alternative Vehicle Types

Vehicle type	Electricity use (MWh/yr)	Hydrogen use (kg/yr)
BEV	1.1×10^8	0
FCEV	0	5.7×10^9
PFCEV	7.9×10^7	9.6×10^8

The results for 2050 are also represented visually in Figure *9* as annual fuel demand.

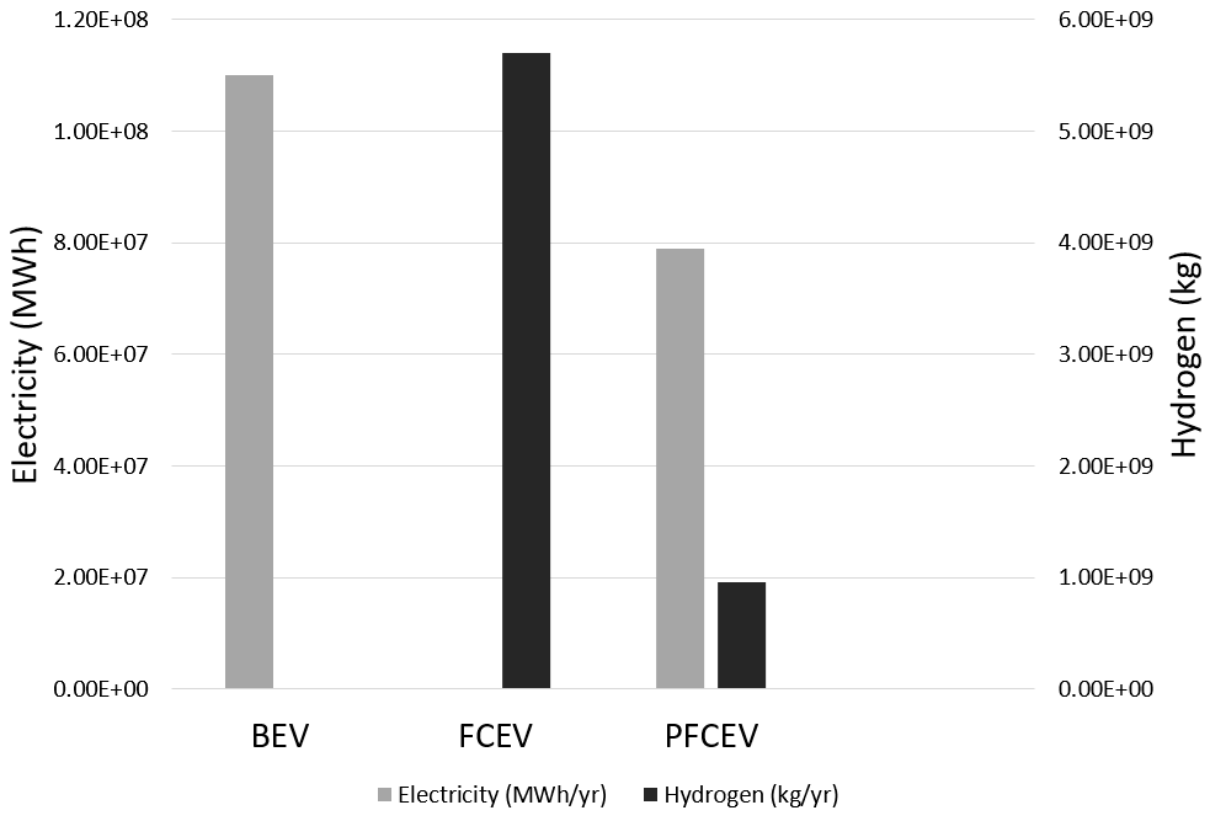


Figure 9: Annual Electricity and Hydrogen Demand in 2050

The numbers for 2050 fuel use are in the same proportion as for 2016, but they are all 1.4 times greater due to the 1.4 times increase in VMT. Of course, the remarks made for the 2016 case regarding the amount of hydrogen used for petroleum refining, the amount of landfill biogas available, and the amount of electricity consumption will not be valid for 2050. However, the relative amount of fuel required by each of these vehicle types remains the same as in the 2016 results.

Also interesting is the quantity of miles that are traveled on electricity and hydrogen in 2050. These numbers are given in Table 9: PFCEV Miles Traveled by Fuel Type.

Fuel used	Miles traveled in 2050
Electricity	2.44×10^{11}
Hydrogen	7.83×10^{10}

Table 9: PFCEV Miles Traveled by Fuel Type

This shows that 75.7% of miles traveled by PFCEV in 2050 use electricity as their fuel, and the remaining 24.3% of miles are traveled on hydrogen fuel. This makes sense considering the powertrain specifications of the PFCEV were set to take advantage of the high efficiency of batteries and the fact that the vast majority of trips in CA are 40 miles or less, as described in Chapter 4.

7.4 Objective 4 Conclusions

Results from Objective 4 show that PFCEVs have the unique ability to use the hydrogen that is currently used to refine petroleum to instead meet all of the demand for fuel today. Of course, moving forward it will be necessary to transition to a cleaner and more sustainable method for producing the hydrogen, but the demand can be met initially. This cannot be said for FCEVs.

The electric demand of PFCEVs, while significant compared to the total California usage, is nearly 30% lower than that of BEVs. However, due to both the PFCEVs' and BEVs' large electricity use, they will require strengthening of the electric grid to support such an increase in load. This will be analyzed in Chapter 9.

8. OBJECTIVE 5 RESULTS

Use electricity and hydrogen usage data as demand inputs for HiGRID to determine overall emissions from a PFCEV fleet. Compare emissions to other alternatively-fueled vehicles.

In Chapter 7, the fuel use for a future scenario of California passenger vehicles in 2050 composed entirely of PFCEVs, BEVs, or FCEVs. Because all three of these vehicles have no tailpipe emissions, all emissions associated with each of these paradigms are associated with the production of hydrogen or electricity, or both in the case of PFCEVs. Production of hydrogen and electricity both lead to GHG and CAP emissions, but in various quantities depending on how they are made and what resources are used in the electric grid.

Due to the issues of climate change and air quality, which are introduced and discussed in Chapter 2, determining the emissions associated with each of these vehicle paradigms is valuable. The emissions, along with other criteria such as driver convenience (which was discussed in Chapter 2) and cost (which will be briefly analyzed in Chapter 9), are a major determining factor in what California's goals should be regarding passenger vehicles. If one vehicle type provides a clear benefit over the others in terms of emissions, this should be deeply considered as California moves forward with legislation and goals for the future of personal transportation.

8.1: The 2050 Electric Grid

Vehicles are moving towards electric powertrains. Starting with the HEV in the modern vehicle history, vehicle manufacturers have been increasing the number of vehicles that have electric powertrains. Powertrain electrification continued with PHEVs, BEVs, FCEVs, and, most

recently, PFCEVs. All of these vehicle types, excluding the HEV which is not considered an alternative vehicle in this study due to its minor improvements over ICEVs, have the capability to use electricity from the grid as either fuel directly for the vehicle (for PHEVs, BEVs, and PFCEVs) or as a primary input for fuel production (for FCEVs and PFCEVs). Therefore, it is imperative to determine the electric grid for 2050, the time at which this comparison is taking place as set in Chapter 7. The composition of the electric grid will determine the emissions associated with each of these vehicle types.

Fortunately, the evolution of the electric grid is something that has been studied in depth. One such study was conducted by Energy and Environmental Economics, Inc., or E3, using their PATHWAYS model. As a task for several California public environmental agencies, E3 created various paths by which California could start with the current electric grid and evolve it to meet California's 2050 goals for 80% GHG emissions reduction compared to 1990. Several options were explored, with various methods for when and how to invest in emissions reductions while still meeting the goals. While all options meet the 2050 goals, each ends up with a different electric grid composition based on how investments were made. For this thesis, the option selected is the "straight line base," which starts with immediate emissions reductions investments and continues them linearly until 2050 at which point the goal of 80% GHG emissions reductions is reached. E3 provides the composition of the electric grid, in the form of the installed capacity of the various power generation technologies, for every year up to 2050 [66]. Also included in the study is the amount of energy storage for the grid. Energy storage can take several forms, including batteries, flow batteries (which are similar to batteries but allow for separate energy storage instead of containing it in a sealed battery), hydrogen storage, and many other technologies. These each have their own specifications for speed of charge and discharge,

ability to independently size power and energy capacity, efficiency, and other characteristics. Flow batteries are a good choice for the future 2050 electric grid due to relatively high efficiency, ability to independently size power and energy capacity for versatility, and are able to be deployed at large scales required for the future grid [67]. Therefore, flow batteries are used in HiGRID to meet the energy storage capacity specified by E3.

E3's projected electric grid composition is shown in Table *10* [66]. Three-quarters of electricity will be made by clean, sustainable technologies (hydroelectric, biomass, geothermal, solar, and wind).

Table 10: 2050 Electric Grid Installed Capacities

Technology	Capacity (MW)	Percentage of Total (%)
Natural Gas Combined Heat and Power (CHP)	1,530	0.46
Natural Gas	68,000	20.38
Hydroelectric	15,100	4.51
Biomass	950	0.28
Geothermal	3,110	0.93
Solar Photovoltaic (1 axis)	94,000	28.15
Solar Photovoltaic (rooftop)	20,200	6.05
Wind (regional)	118,000	35.45
Imports	12,600	3.78
Total	**334,000**	100
Energy storage	3,750	-

Note: All data is from a study by E3 [66].

8.2 The HiGRID Tool

With the 2050 fuel demand for each of the vehicle types calculated and the 2050 electric grid specified, it is now possible to calculate the emissions associated with the vehicle types. To do so, a tool to simulate the electric grid with all of its various electricity generation components

is required. The Holistic Grid Resource Integration and Deployment (HiGRID) tool created by researchers at the APEP is such a tool. HiGRID models the electric grid with a specified portfolio of electricity generation profiles and calculates, among many other things, GHG and CAP emissions from electricity generation [68].

As noted previously, because the advanced alternative vehicles in this study have zero tailpipe emissions, all that is needed to determine emissions from these vehicles is to calculate the emissions from the fuel production and distribution. The two fuels for the three alternative vehicle types are electricity and hydrogen. Electricity generation emissions will of course come from HiGRID by specifying the amount of electricity demand for each of the vehicle types, as calculated in Chapter 7. Emissions from hydrogen production takes a bit more planning.

8.2.1 Hydrogen Production

Just like electricity, hydrogen can be produced in various manners. As mentioned in Chapter 7, nearly all of the hydrogen produced in the U.S. today is made by SMR from natural gas, a fossil fuel [24]. However, as CA and the US move towards cleaner fuel, this fact will likely not remain true. Instead, a process known as electrolysis will likely be the leading production method for hydrogen. Electrolysis is the splitting of water apart into hydrogen and oxygen gas through the application of electricity. The device that performs this process is an electrolyzer. An electrolyzer can be thought of the reverse of a fuel cell, which was introduced in Chapter 2. Instead of converting hydrogen and oxygen into electricity and water, electrolyzers convert water and electricity into hydrogen and oxygen. Just as there are various forms of fuel cells, there are corresponding various electrolyzers. The three major ones are proton exchange membrane (PEM) electrolyzers, alkaline electrolyzers, and solid oxide electrolyzers [69]. In

choosing an electrolyzer technology for this analysis, it makes sense to pick the most efficient one that is feasible. While solid oxide electrolyzers are the most efficient of these electrolyzer technologies, they require very high temperature heat inputs to achieve and maintain their high operating temperatures. Alkaline electrolyzers are the next-most efficient, and they do not have the high heat requirements of solid oxide electrolyzers [69] [70].

By using electricity, electrolysis is able to make use of the increasingly clean and sustainable electricity grid. Again, the electric grid will be 75% clean and sustainable in 2050, meaning hydrogen produced by electrolysis will be 75% renewable. The water requirements for this method of hydrogen production will be investigated in Chapter 9.

Other opportunities for clean, sustainable hydrogen do exist. As noted during the WTW GHG emissions analysis done in Chapter 6, one third of the current hydrogen that is sold at hydrogen stations for FCEVs in CA is renewable by law [12]. The portion that is renewable comes from SMR using biogas from landfills and wastewater treatment plants [71]. This method works well now to provide FCEVs with partially clean and sustainable hydrogen fuel. However, as the electric grid becomes cleaner, making hydrogen from electrolysis provides a simple opportunity to take advantage of the improvements of the electric grid. Therefore, electrolysis will be the method of hydrogen production for this study.

With hydrogen being produced by electrolysis, whose inputs are electricity and water, the only emissions from hydrogen production are from the electricity needed for the electrolysis. Therefore, HiGRID can be used to calculate the emissions from hydrogen production.

8.3 Alternative Vehicle Emissions in 2050

As with all comparisons, it is a good idea to have a base case to which the results can be compared. For this study, two base cases are included. The first is an advanced ICEV with an efficiency of 45 MPG, a worst-case scenario of drivers continuing to use gasoline vehicles but accounting for the expected increase in efficiency by 2050 [34]. The second scenario to be used as a reference is a vehicle paradigm of PHEVs. For this case, PHEVs behave very similarly to PFCEVs with the same BER but a slightly less efficient charge depleting efficiency due to the heavier weight (see APPENDIX B: FASTSim Results for PFCEVs, BEVs, FCEVs, and PHEVs for further PHEV data from FASTSim) and a reliance on gasoline as fuel instead of hydrogen. This means that PHEVs will use slightly more electricity for driving on the battery (from the lower charge depleting efficiency) and will most likely have higher emissions from gasoline use instead of hydrogen. To account for gasoline emissions, the gasoline portion of the PHEVs will be assumed to be compliant with the Ultra Low Emissions Vehicles (ULEV) standards, which is reasonable to assume would be achieved by the vast majority of CA passenger vehicles by 2050 [72]. Combining the emissions factors from ULEVs with the number of miles traveled on gasoline (the same number of miles driven by PFCEVs on hydrogen), the gasoline portion of PHEV emissions can be calculated.

For PEV charging, various charging powers could be used. For this analysis in 2050, it will be assumed that level 2 charging at 6.6 kW will be available at all residences as well as work [56]. This is due to level 2's much faster charging speeds compared to level 1, allowing drivers the convenience of faster battery recharging.

Required specifications for HiGRID for the vehicles in this comparison are listed in Table *11*: Vehicle Specifications for HiGRID.

Table 11: Vehicle Specifications for HiGRID

	PFCEV	FCEV	BEV	PHEV	ICEV	Unit
Charge-depleting efficiency	0.322	N/A	0.345	0.346	N/A	kWh/mi
Charge sustaining efficiency	82.0	59.6	N/A	45.76	45.76	MPGGE
BER	40	N/A	250	40	N/A	

Note: All numbers except ICEV and charge-sustaining PHEV efficiency are from FASTSim results from Chapters 5 and 6 as well as APPENDIX B: FASTSim Results for PFCEVs, BEVs, FCEVs, and PHEVs. ICEV and charge-sustaining PHEV efficiency from Tarroja et al. [34].

Due to the very tight integration of these alternative vehicles with the electric grid, the emissions associated with both the electric grid and the transportation sector are given together as a sum. The GHG and CAP emissions of the advanced alternative vehicle types as well as the two reference cases are displayed in Figure *10*, Figure *11*, and Figure *12*. Here and for the rest of this thesis, GHGs are represented by carbon dioxide (CO_2) and CAPs are represented by both nitrogen oxides (NO_x) and sulfur dioxide (SO_2). As a prevalent GHG, CO2 is largely responsible for climate change. Both NO_x, mostly in the form of NO_2, and SO2 are responsible for health hazards, particularly respiratory damage [73] [74]. For CAP emissions, a range of emissions is given. Those labeled with the ending of "_H" are high estimates and those labeled with the ending of "_L" are low estimates. High estimates for the CAP emissions associated with the electric grid are from Shaffer et al. [75] and the California Energy Commission [76], and low estimates are from the California Air Resources Board [77]. CAP emissions for gasoline are from Argonne National Lab and DieselNet [78] [72].

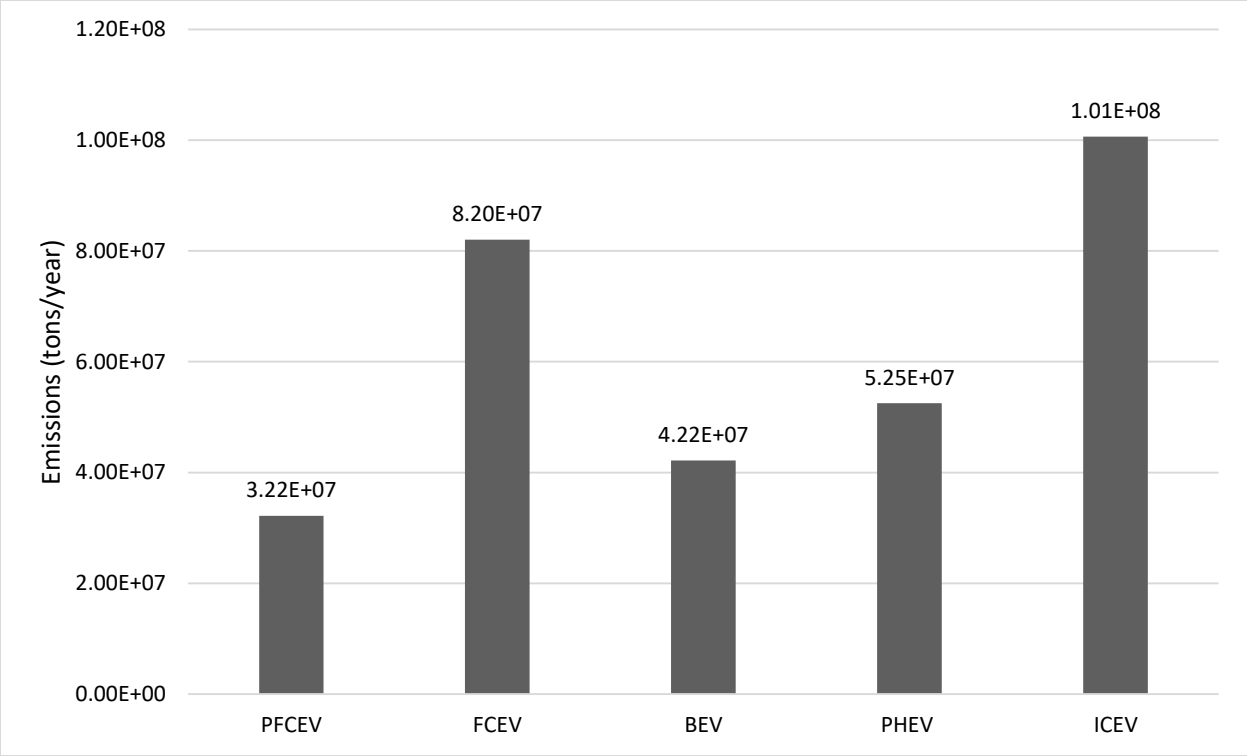


Figure 10: CO_2 Emissions by Vehicle Type

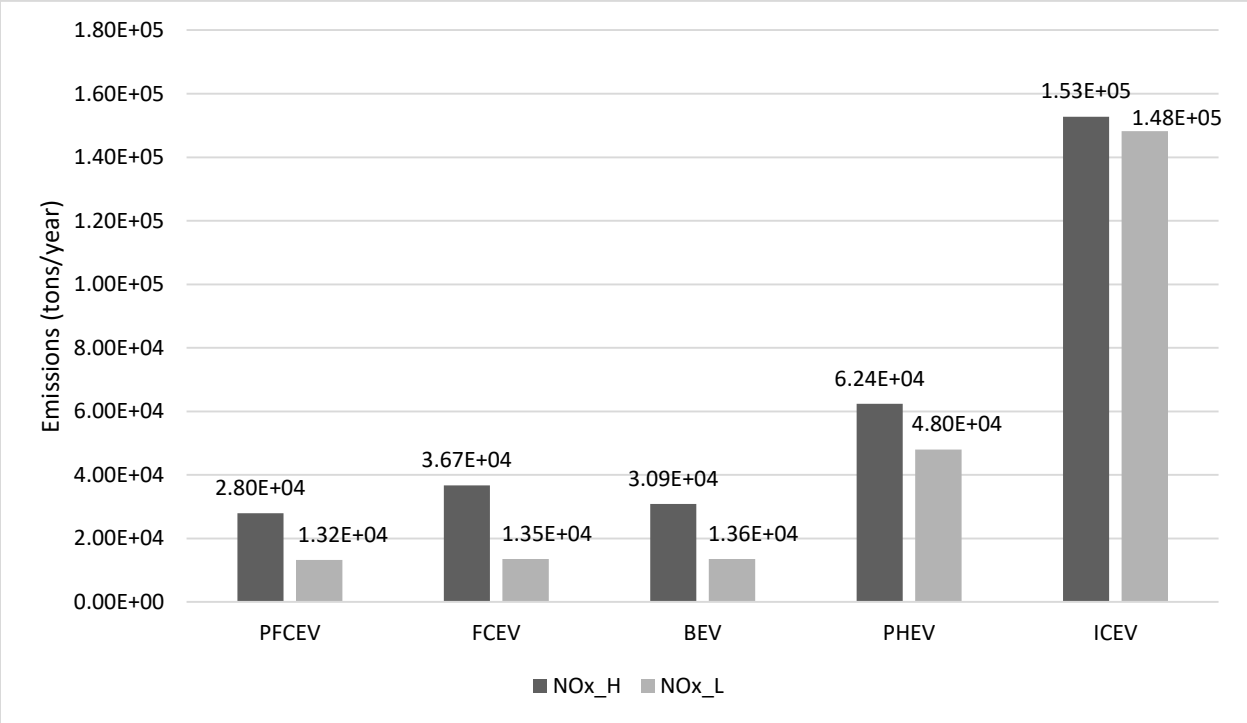


Figure 11: NO_x Emissions by Vehicle Type

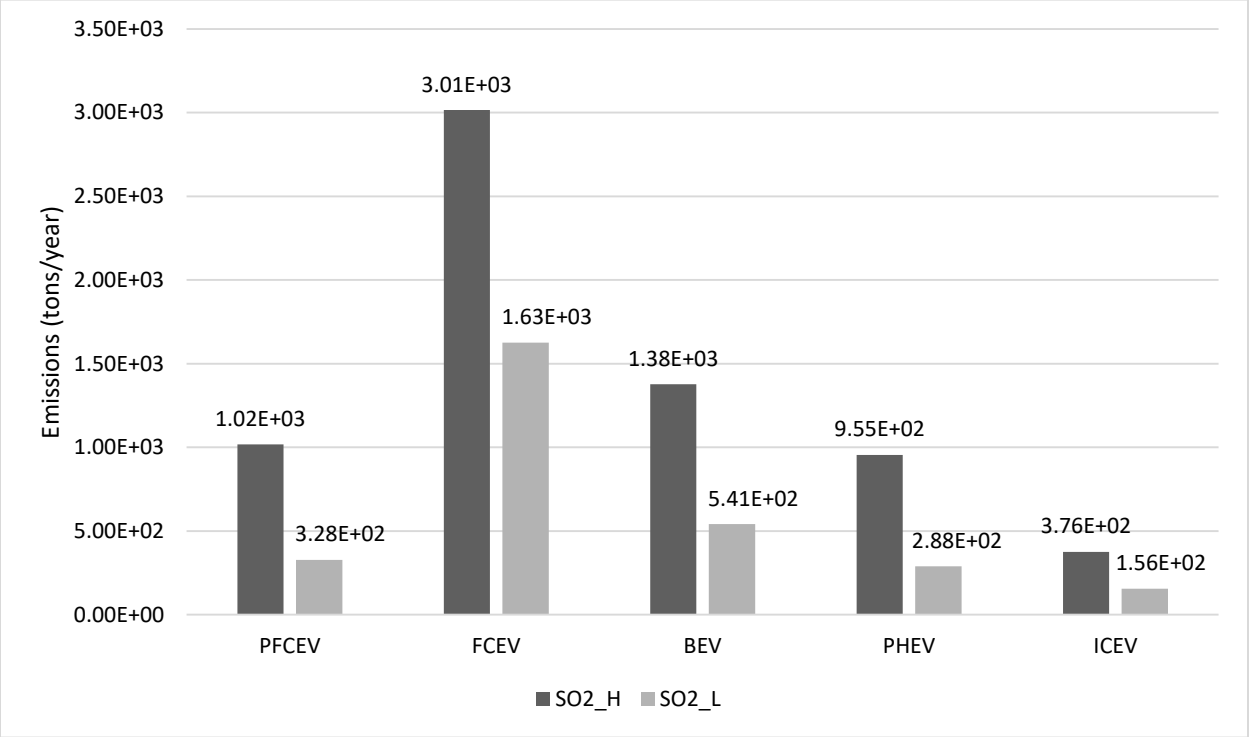


Figure 12: SO_2 Emissions by Vehicle Type

The PFCEV is the clear leader in CO_2 emissions, offering a significant reduction in emissions compared to all other vehicle types. The PFCEV also has the lowest NO_x emissions, narrowly undercutting the BEV. Surprisingly, the ICEV and the PHEV have the lowest SO_2 emissions, which is due to gasoline's very low sulfur content [79]. The sulfur in the natural gas, which is used in the electric grid, is responsible for the SO_2 emissions of the advanced alternative vehicles. Of the advanced alternative vehicles, the PFCEV scenario has the lowest SO_2 emissions.

Another surprise is the high emissions of the FCEV, particularly the CO_2 emissions. Tarroja et al. had a similar result, and explain it with the relatively low overall efficiency of electrolysis and the fuel cell of the FCEV [34]. While this issue is also present in the PFCEV

case, most of the miles driven by PFCEVs use the BER, avoiding the issue except for long trips which are more efficient using hydrogen due to weight savings compared to batteries.

The issue of emissions associated with fuel distribution will be addressed in Chapter 9 due to its reliance on first determining the hydrogen refueling stations and hydrogen generation facilities.

8.4 Objective 5 Conclusions

The PFCEV is looking even more attractive as the potential future personal vehicle of the future. So far the PFCEV has been able to uniquely meet driver demands beyond the other alternative vehicles currently available, it has been shown to be particularly efficient, and has the lowest GHG and CAP emissions of all advanced alternative vehicles. The last area to analyze will be the infrastructures for these vehicles.

9. OBJECTIVE 6 RESULTS

Determine minimum amount of fueling infrastructure required for a light-duty fleet of PFCEVs in California, and calculate its cost.

An important area to consider for any alternatively-fueled vehicle is the fuel infrastructure. For liquid and gaseous fuels, such as gasoline and hydrogen, this includes the fueling stations, the fuel production plants, and any method used to transport the fuel from production plant to fueling station which can include trucking or piping. For electricity, infrastructure includes vehicle chargers, electricity generation methods that are required for the

electricity used as fuel, and any grid modifications that must be made to ensure robustness for the added stress of electric vehicles, often including the transformers that change the voltage of the electricity from the high voltage used for delivering electricity to a lower voltage that can be used by consumer products including PEVs [80].

The advanced alternative vehicles that are being analyzed in this thesis (PFCEVs, FCEVs, and BEVs) all have zero tailpipe emissions. This means that all the emissions associated with these vehicle types are entirely from the infrastructure for them. This is in contrast with conventional vehicles that have the majority of their emissions associated with their tailpipes [46]. In the previous chapter, the emissions associated with electricity and fuel production for all of the vehicle types were calculated. This means that all that remains is to calculate the emissions associated with distribution of the fuel. To do so, the infrastructure for these vehicle types must be determined.

The electric grid is already very robust in California. Households have reliable electricity for use all day long. For PEVs in this analysis (PFCEVs and BEVs), it will be assumed that all households and all business locations will have level 2 charging at 6.6 kW. Thus, the electric charging infrastructure has been easily determined. Cost for the PEV infrastructure will be analyzed shortly.

For hydrogen refueling, stations must be sited such that they maximize the number of people that they can serve while minimizing the number of stations required to meet the demand of California's population. The method for doing so will be discussed in the next section.

9.1 PFCEV Hydrogen Fueling and Electric Charging Infrastructure

PFCEVs have two fuels, hydrogen for the fuel cell and electricity for the battery. Therefore the infrastructure for these two fuels must both be analyzed to fully understand the required infrastructure for PFCEVs.

9.1.1 PFCEV Hydrogen Fueling Station Allocation

One of the major attractive features of the PFCEV is the potential for decreasing the amount of costly hydrogen infrastructure compared to FCEVs. By having the majority of vehicle trips fueled by electricity from the grid, this drastically reduces the amount of hydrogen that is needed for PFCEVs. As determined in Chapter 7, PFCEVs reduce the amount of hydrogen needed for fuel by 82% compared to FCEVs. This in turn leads to less hydrogen infrastructure, such as production facilities and compression stations.

To determine the hydrogen fueling infrastructure, the mapping software ArcGIS created by Esri is used [81]. The infrastructure that is considered is the hydrogen refueling stations, the hydrogen production plants, as well as the infrastructure used to transport the hydrogen from the production plants to the hydrogen refueling stations. Hydrogen stations are sited at existing gasoline stations to make permitting for fuel easier, among other benefits. There are currently 48 hydrogen stations that are either opened for public use or are somewhere in the process of opening [82]. These 48 stations will be considered required stations for this analysis, meaning they will all be chosen as a hydrogen station for 2050. The rest of the stations that are needed will be placed at a current gasoline station location.

An interesting notion of the PFCEV is how the fuel cell is used as a range extender. This means that there will not have to be as many refueling stations for PFCEVs compared to FCEVs

or conventional gasoline vehicles. To account for this, the notion of connector stations is introduced. Because most trips use the BER, hydrogen can be thought of as a "secondary" fuel in the sense that it is reserved for long-range trips or in situations where battery charge is low and drivers do not have the time to recharge. Therefore, hydrogen stations can be placed further apart than they might otherwise if the vehicle only had one fuel. The spacing of these connecting stations is set as the 40 mile BER, the range that the PFCEV can travel on the electricity stored in the battery alone. This is set with the idea that PFCEV drivers could recharge their battery and, with a full charge, could reach a hydrogen fueling station even if the PFCEV had run completely out of hydrogen no matter where the driver is. Of course, this is the worst-case scenario. It is easy to imagine that many people have a hydrogen station closer than 40 miles away from them, so a completely full battery is not always necessary to get to the nearest hydrogen station. However, if one is completely out of hydrogen, the PFCEV would indeed be able to drive to a hydrogen station and refuel.

The Location-Allocation feature of ArcGIS is used for both hydrogen station placement as well as for hydrogen production facilities and transport. Details on the methodology are given in the sections of this chapter to follow. Included in this research are the allocation of refueling infrastructure, the cost of such infrastructure, and the emissions associated the fuel production using that infrastructure.

The inputs used are population data, gasoline station locations, and the 48 already built and currently planned hydrogen fueling stations. The population data used is from Oak Ridge National Laboratory [83]. The gasoline station locations are from the U.S. Department of Energy [84] The current and planned hydrogen stations are listed by the California Fuel Cell Partnership [82]. Using these inputs with the settings described above, ArcGIS runs to meet all hydrogen

demand that could potentially be met by placing a hydrogen station at as few of gasoline station locations as possible while still meeting hydrogen demand.

The resulting hydrogen station siting is displayed below in Figure *13*, Figure *14*, and Figure *15*. The green circles are the 48 current hydrogen stations and the blue circles are locations selected by ArcGIS to meet the PFCEVs' demand with the 40 mile distance requirement.

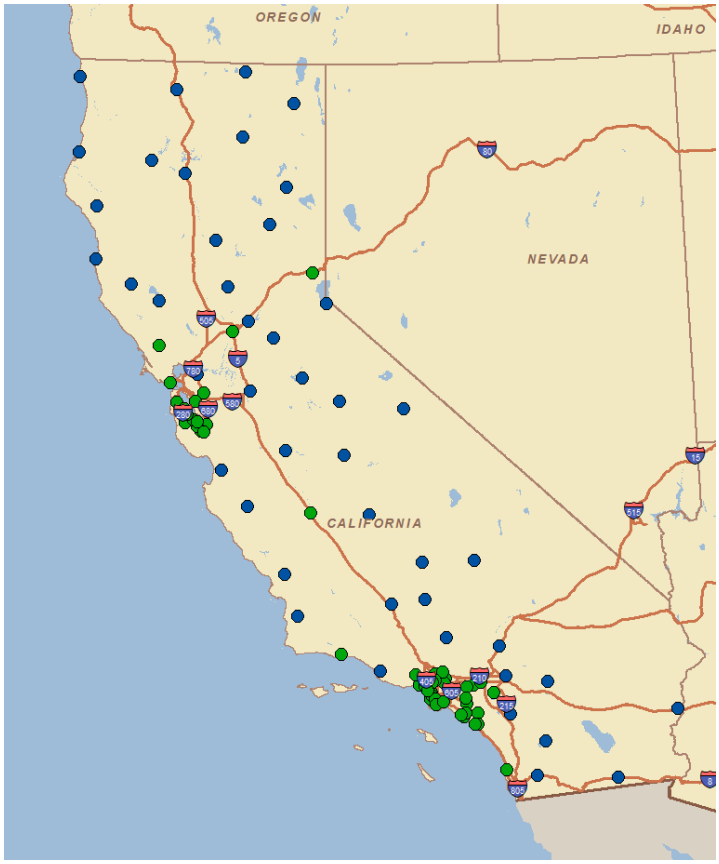


Figure 13: PFCEV Hydrogen Stations in California

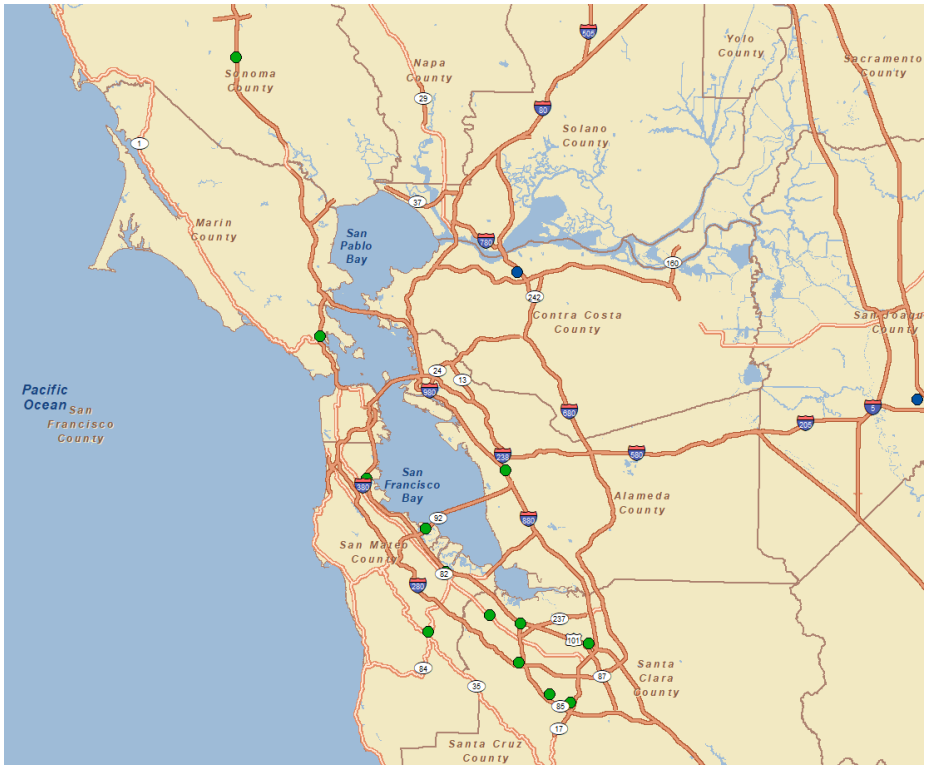


Figure 14: PFCEV Hydrogen Stations in Bay Area

Figure 15: PFCEV Hydrogen Stations in Los Angeles Area

A total of 93 hydrogen stations are needed for PFCEVs. This includes the 48 current and planned hydrogen stations, and the addition of 45 hydrogen stations. This is encouraging to hear, because the current count of hydrogen stations is already over half of the required stations for PFCEVs.

It is clear that the 48 current hydrogen stations are placed heavily in the Bay Area and the Los Angeles area. This makes sense because these areas have the majority of California's population. There are currently a handful of stations outside of these areas, and these are mainly connector stations that allow for travel between Northern and Southern California, as well as to the destination area of Truckee and Lake Tahoe.

The 45 new stations chosen by ArcGIS fulfill the role of connector stations well, mainly outside of the two dense CA areas in the north and south. This allows for the vast majority of the population to be well-served by PFCEVs.

The next step is to determine the hydrogen dispensing capacity of each of these stations. The total CA hydrogen demand for PFCEVs was calculated in Chapter 7. ArcGIS, as part of its Location-Allocation feature, calculates the "weighted demand" at each station which accounts for the number of people that are covered by each station. Taking the weighted demand of each station divided by the sum of the weighted demand of all stations provides the fraction of hydrogen demand allocated to each station. Multiplying that fraction by the total hydrogen demand then gives the hydrogen capacity that each station must have. The capacities of each of the hydrogen stations, along with more results that will shortly be detailed, can be found in

APPENDIX C: Hydrogen Fueling Infrastructure Results.

The average station size is just over 28,000 kg per day. This is two orders of magnitude higher than the current hydrogen stations [85]. While this presents a challenge going forward, hydrogen station builders are already planning for their next round of stations to have increased capacity to keep up with increased demand. Therefore, it should not be a concern to have larger stations in this 2050 scenario.

Having said that, it is important to note that some of the stations are quite large. The largest of which is about 180,000 kg per day in Carmel Valley, San Diego, with the next largest being a few nearly 100,000 kg per day stations in the Los Angeles and Bay areas. These stations would need very large storage tanks, or several large ones. Considering the hydrogen to be liquid with a density of 70.8 kg per cubic meter, the largest station would have about 2,600 cubic meters of hydrogen. For reference, an Olympic swimming pool is 2,500 cubic meters in volume. This station is very large compared to today's hydrogen stations, but with careful planning and management, along with continual technology improvements as hydrogen stations get larger even today, it is not impossible to image such large stations in the next 30 years. It will also be possible to split up such large stations into smaller ones in the same area, relieving some of the stress if such stations are still impractical by 2050.

9.1.2 PFCEV Hydrogen Production Facilities Allocation

Now that hydrogen refueling stations have been determined for the PFCEV scenario, it is time to determine the hydrogen production facilities. As discussed in Chapter 8, this analysis will consider hydrogen produced from electrolysis. The two inputs for electrolysis are water and electricity. The electricity demand has already been analyzed in Chapter 8. Due to the large

amounts of hydrogen that are required for both PFCEVs and FCEVs, it is necessary to analyze how one might procure enough water for these vehicles' fuel.

The California Aqueduct comes to mind as a potential water source. The Aqueduct is an expansive system that distributes water around California to meet its water needs [86]. To understand if it would be feasible to use water from the Aqueduct to make vehicle fuel, the actual water demand for the fuel must be calculated. This is done in using the chemical formulas for hydrogen and water, as seen in the following equation:

$$PFCEV\ water\ demand = \frac{2.62 \times 10^6\ kg\ H_2}{day} * \frac{18.02\ kgH_2O}{1.01\ kg\ H_2} * \frac{1m^3\ H_2O}{1000\ kg\ H_2O} * \frac{1\ Mm^3}{1 \times 10^6\ m^3}$$

$$= \frac{4.67 \times 10^{-2}\ Mm^3 H_2O}{day}$$

Next, compare this to the amount of water that flows through the aqueduct. There are many segments and stations in the aqueduct, so it is important to be strategic in where the hydrogen production facilities should be placed. Looking at the hydrogen stations from the previous section, it seems beneficial to have two hydrogen production facilities: one in Northern California and one in Southern California. This would make distribution of hydrogen easier than having one large central plant by decreasing the distance the hydrogen would need to travel. Two production facilities also allows for large electrolyzer plants to take advantage of economies of scale, a rule of thumb that allows larger electrolyzer plants to be up to 60% more capital-efficient than small-scale electrolyzer plants [87]. Therefore, a strategy of two hydrogen production facilities is pursued.

Again looking at the hydrogen station results, it seems wise to place the hydrogen production production facilities close to the hydrogen station- and population-dense areas of the Bay Area and the Los Angeles area. Not only are there many stations in these areas, but the stations are large due to the high population and therefore high hydrogen demand. This can be confirmed by looking at the hydrogen station capacities in

APPENDIX C: Hydrogen Fueling Infrastructure Results. Consulting a map of the Aqueduct, there are segments that pass by both the Bay Area and the Los Angeles area [88], [89]. From the maps and corresponding data, it is apparent that the beginning of the Aqueduct at the Sacramento Delta, which is fed by nine reservoirs, has high water flow and is located near the Bay Area. Similarly, Castaic Lake is well-situated for hydrogen production in Southern California [90].

With the two hydrogen production facilities located, it is time to determine which hydrogen stations each one will be producing hydrogen for, as well as the required capacity for the production facilities. This is done in ArcGIS by creating an "OD Matrix", or Origin-Destination Matrix, which finds the nearest desired number of stations (in this case just one) for each of the production facilities and also calculates the distance that must be driven to go from one to the other. This latter result will be useful for distribution, which will be discussed shortly.

The results of the OD Matrix calculation are displayed below in Figure *16*.

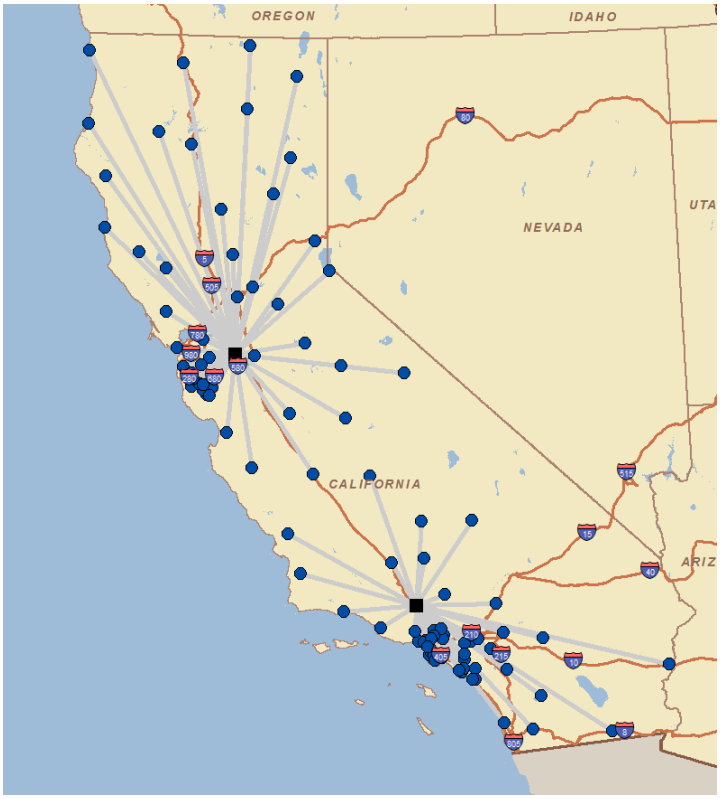


Figure 16: PFCEV Hydrogen Production Facilties

As planned for, the hydrogen stations in the high density areas of the Bay Area and the Los Angeles area are indeed served by the hydrogen production facilities placed near them. This ensures that the distance for distributing the hydrogen to the stations is kept to a minimum, decreasing the distribution costs and emissions. These characteristics will be analyzed further in subsection 9.1.4 PFCEV Infrastructure Cost.

Now that the production facilities have been determined, it is prudent to make sure that the amount of water required by these facilities can be met by the Aqueduct sections at which they are located. Data used for water flow is from the CA Department of Water Resources [91]. The water demand as a percentage of Aqueduct flow is present in Table *12*. Also included is the amount of water that is used for gasoline refining extrapolated to 2050, as a point of reference.

Table 12: PFCEV Water Demand

	Sacramento Delta	Castaic Lake	Units
Water flow	741	26.6	Mm^3/d
PFCEV water demand	0.0169	0.0298	Mm^3/d
PFCEV percentage of aqueduct segment	0.00228	0.112	%
Gasoline water demand*	0.00427	0.00756	Mm^3/d
Gasoline percentage of aqueduct segment	0.000577	0.0285	%

* Data for the gasoline demand is from the EIA [92]. The increase in VMT and the increase in vehicle efficiency lead to a similar amount of gasoline used in 2050 according to the EIA [93]. Water demand for gasoline production is from Jacobs Consultancy [94].

It is clear from this calculation that the California Aqueduct has plenty of water for the hydrogen fuel demand of the PFCEVs. While water deliveries in the Aqueduct are a serious matter, particularly due to the high water demands in areas that do not get much rain such as Southern California, it is not unreasonable to assume that the very small amounts of water needed for PFCEVs would be procurable [95]. This is also helped by the fact that switching to PFCEVs would remove the need for the water that would be used for gasoline production.

Regarding the water use for gasoline, it is important to remember that more water is indirectly involved with gasoline production. Hydrogen is needed in refining, and whether hydrogen is made with SMR as it is currently or with electrolysis as it will likely be made in 2050, this will increase the amount of water needed for gasoline compared to the data used in Table *12*.

Now is an appropriate time to discuss the distribution of hydrogen from production facilities to refueling stations. Current gasoline stations are refilled by tanker truck, so a similar solution for hydrogen should be considered as it is logistically simple. With the trip distance

between the production facilities to each station that is part of the OD Matrix result from ArcGIS, the routes and distances traveled by a hydrogen tanker are known. The amount of hydrogen fuel required by each station is also already determined. Gasoline tankers are limited primarily by the gross vehicle weight limit of 80,000 pounds [96]. Tankers typically hold 9,000 gallons of gasoline, which weighs 56,700 pounds, or about 25,000 kg. This means that a hydrogen fuel tanker could carry 25,000 kg of hydrogen, assuming an adequate tank is developed. Using this tanker capacity along with each station's capacity and the distance required to reach each station, the total amount of miles that must be traveled by hydrogen tanker can be calculated. The tankers can be considered to be hydrogen fuel cell tankers, which will get around 13 miles per kilogram of hydrogen [97]. This leads to a total hydrogen use of 2,445 kg each day for the hydrogen tankers to deliver the required hydrogen to the refueling stations. This number is quite small compared to the 2.63 million kg of hydrogen per day needed to fuel the PFCEVs. Therefore, the emissions associated with fueling the hydrogen tankers are also negligible. The emissions presented in Chapter 8.3 Alternative Vehicle Emissions in 2050 are the overall emissions of a PFCEV paradigm.

9.1.3 PFCEV Electric Charging Infrastructure

As discussed in the beginning of this chapter, the electric grid in California is already expansive. Electricity in households is ubiquitous. Therefore, much of the infrastructure for the distribution of electricity for charging the PFCEVs' battery is already in place. However, by adding such a substantial load to the electric grid, much of it must be made more robust. There are already issues of neighborhoods with multiple PEVs needing to upgrade transformers [80]. While there may be some other modifications needed for the grid such as new lines in some

locations, upgrading transformers will be the only electric grid enhancement considered in this thesis.

The Senior Energy Analyst of the California Public Utilities Commission, Adam Langton, notes that typically four to seven homes share a transformer [80]. Due to the large increased electricity demand caused by PFCEVs, the worst-case scenario of 4 homes per transformer will be used. This also accounts for any underestimating of cost that could potentially be occurring by not considering components besides transformers.

This analysis considers that level 2 charging will be at every home and office for charging of the PFCEV battery. Therefore, the number of homes and offices must be determined. Consulting the U.S. Census, it is found that there are approximately 14 million housing units in California. Housing units are defined as any individual residence, whether it is a detached house, an apartment in a multi-unit dwelling, or another form of residence [98]. While multi-unit dwellings would not use the same transformer as a group of detached houses, accounting for the many apartments that are in one multi-unit dwelling does account for the increased robustness required. For example, an apartment building with 100 apartments would need a more substantial transformer than a group of four detached houses. However, by considering the 100 apartments as residences the same as detached houses, the estimation is the apartment building needs 25 transformers (one for every four apartments). Therefore, every four housing units from the census will be given a new transformer to estimate the cost of the electric grid upgrades.

The Census also notes that there are approximately 900,000 physical office establishments [98]. These offices on average likely have higher electricity demand and therefore each should get their own transformer upgrade. Combining this with the number of housing units gives the total number of transformer upgrades needed for homes and businesses.

Transformers at substations will need to be upgraded as well. There are 3,200 substations in California [99]. These substations have large transformers that will have to be upgraded with the large increase in electric load from the charging of PFCEVs. Assuming that each substation will need a transformer upgraded, this gives a total of 3,200 transformers at substations that will need to be upgraded.

Thinking ahead to the comparison with BEV, it is wise to consider the BEV the vehicle that would need all of the above transformer upgrades while the PFCEV would need only a fraction of such infrastructure upgrades due to the lower electric charging demand. This fraction should be the fraction of electricity that is used as fuel for the PFCEV compared to the BEV. This fraction is 7.9×10^7 MWh per year divided by 1.1×10^8 MWh per year, or 0.72. Therefore, the PFCEV transformer requirements are 72% of the numbers detailed above.

Level 2 charging stations must also be installed at homes and offices to charge the PFCEV battery quickly. Each home and office must therefore have adequate level 2 vehicle charging. Homes will be given one level 2 charger each. Offices will be given one per employee. The number of employees can again be found from the Census data. Both the number of employees in California as well as the number of physical offices are given, so the average number of employees at each office is simply the number of employees divided by the number of offices [98]. Each employee will need a level 2 charger.

Lastly, the numbers previously stated must be extrapolated to 2050. This is done by multiplying each by 1.4, which is the factor by which population will increase [55]. A summary of the required electric charging infrastructure upgrades for PFCEVs is given in Table *13*. All decimals are rounded up to ensure whole numbers of equipment and adequate upgrades.

Table 13: PFCEV Electric Charging Infrastructure

Transformers		
	Housing units	19,684,735
	Housing transformers	3,543,252
	Office locations	1,271,368
	Office transformers	915,386
	Substations	4,480
	Substation transformers	3,226
Level 2 chargers		
	Housing units	19,684,735
	Housing chargers	19,684,735
	Office locations	1,271,368
	Employees	20,055,528
	Office chargers (average)	16

Note: All housing and office data are from the U.S. Census [98] and then extrapolated to 2050 with a population increase of 1.4 [55].

9.1.4 PFCEV Infrastructure Cost

The cost for the hydrogen infrastructure includes the cost for the hydrogen stations as well as the hydrogen production facilities. The cost for hydrogen stations can be calculated using the National Renewable Energy Laboratory's number of $3,370 per kg in addition to the total hydrogen demand for all of the stations [85]. This leads to a total cost of $8.82 billion for the 93 hydrogen stations in the PFCEV scenario.

The cost for the hydrogen production facilities can be found per unit of power, which the U.S. Department of Energy expects to be $300 per kW of electrolyzer for the system [100]. Using the amount of hydrogen required and the efficiency of alkaline electrolyzers which is 50

kWh of electricity per kg of hydrogen, the power of the electrolyzers required is calculated to be 5.45 million kW. This leads to a hydrogen production facility cost of $1.63 billion.

Determining the PFCEV electric charging infrastructure cost is similarly simple. The required infrastructure was determined in the previous section. The cost of the required upgrades for this analysis is simply the cost of a transformer times the number of transformers to upgrade in addition to the cost of the level 2 chargers, with installation, times the number of level 2 chargers to install.

Transformer costs for residences and offices are $1,000, as noted by Pérez-Fortes et al. [101]. This leads to The cost of an appropriately-sized transformer for a substation, with a rating of 10 MVA, is nearly one quarter million dollars [102]. Level 2 chargers with installation and the required reinforcements cost about $10,000 [103].

The infrastructure and associated cost for PFCEVs is presented in Table *14*.

The cost is very much dictated by the level 2 chargers. In fact, 96% of the cost for the PFCEV infrastructure is from the level 2 chargers installed at homes and offices. This makes one wonder if it would be possible for the PFCEVs to use level 1 charging instead, which would get rid of nearly all of the electric charging infrastructure for the PFCEV scenario. This infrastructure will be briefly discussed next.

Table 14: PFCEV Infrastructure Cost

Hydrogen			**Cost ($)**
	Hydrogen stations	93	8,820,000,000
	Hydrogen production facilities	2	1,630,000,000
Transformers			
	Housing units	19,684,735	
	Housing transformers	3,543,252	3,543,252,000
	Office locations	1,271,368	
	Office transformers	915,386	915,386,000
	Substations	4,480	
	Substation transformers	3,226	798,435,000
Level 2 chargers			
	Housing units	19,684,735	
	Housing chargers	19,684,735	196,847,350,000
	Office locations	1,271,368	
	Employees	20,055,528	200,555,280,000
	Office chargers (average)	16	
Total			413,109,703,000

In the U.S., 63% of people own their own homes, and these are mostly detached homes. The remaining 37% rent, and of those people, 61% live in multi-unit dwellings [104]. These 22.6% of people living in multi-unit dwellings, or 3,177,679 households, need small infrastructure additions for level 1 vehicle charging. Including the vehicle charger and installation, the cost for each of these households is approximately $1,000. This leads to about

$3.2 billion for the electric charging infrastructure for PFCEVs if using level 1 charging. The low power transfer of level 1 charging means no transformers need to be upgraded.

This level 1 charging scenario for PFCEVs leads to a total PFCEV infrastructure cost of about $13.6 billion. This cuts the PFCEV infrastructure cost by an astounding 96.7%.

The question now is how reasonable is it to use only level 1 charging with the PFCEVs. A study by Zhang found that charging infrastructure beyond level 1 is not required for PHEVs [27]. PFCEVs behave very similarly to PHEVs in terms of their charging and refueling, due to the fact that both vehicle types have a modest BER and then fuel in the form of either gasoline or hydrogen for longer range driving. Therefore, Zhang's conclusion supports the idea that level 1 charging can be used for PFCEVs.

For a PFCEV scenario with level 1 charging, the proportion of miles driven on the battery or the fuel cell would be somewhat different. This is due to the fact that during the analysis for trips, a vehicle was required to stay at either home or work for a certain amount of time to recharge. If a level 1 scenario is desired, the amount of time a vehicle must be at home or work to recharge would be significantly longer due to the lower recharging power. This could increase the amount of hydrogen used and decrease the amount of battery used. However, due to the fact that this analysis is only considering recharging at home or work, places where people typically stay for several hours at a time, this factor may not alter the proportion of battery to hydrogen miles. Therefore, the amount of miles travelled on battery and on hydrogen can be assumed to be relatively the same whether using level 1 or level 2 charging at home and work.

Also, the emissions from the electric grid would be altered due to the fact that level 1 charging uses less power but stretches the charging over longer periods of time, meaning that more or less renewable power could be used depending on the renewable power profiles.

Updated emissions plots with results for both PFCEVs and PHEVs with level 1 charging are included in Chapter 10. SUMMARY AND CONCLUSIONS.

For perspective on infrastructure cost, $96 million has been spent on 49 hydrogen stations and $40.7 million on 7,490 PEV recharging stations [105]. This works out to about $2 million per hydrogen station and about $5,500 per PEV recharging station. This analysis has much larger hydrogen stations so the average cost will be much higher. Also, this analysis considers further reinforcement of the electric grid with PEV charger installations, which is likely not considered in the $5,500 figure from the California Energy Commission.

9.2 FCEV Hydrogen Fueling Infrastructure

9.2.1 FCEV Hydrogen Fueling Station Allocation

The FCEVs do not have the BER that PFCEVs do, so all of the miles travelled by FCEVs are fueled by hydrogen. Again, the Location-Allocation of ArcGIS is used to determine hydrogen refueling stations. Instead of the 40 mile distance between stations that was used for PFCEVs, this FCEV infrastructure will use 6 minutes of driving time. The 6 minute coverage technique is a method developed by the APEP in FCEV hydrogen infrastructure buildout that has been accepted by the California Energy Commission [106]. The rest of the details from the PFCEV hydrogen fueling infrastructure methodology is the same in this FCEV scenario.

Using these inputs and with the settings described above, ArcGIS runs to meet all hydrogen demand that could potentially be met by placing a hydrogen station at as few of gasoline station locations as possible while still meeting hydrogen demand.

The resulting hydrogen station siting is displayed below in Figure *17*, Figure *18*, and Figure *19*. The green circles are the 48 current hydrogen stations and the red circles are locations selected by ArcGIS to meet the FCEVs' demand with the 6 minute driving time requirement.

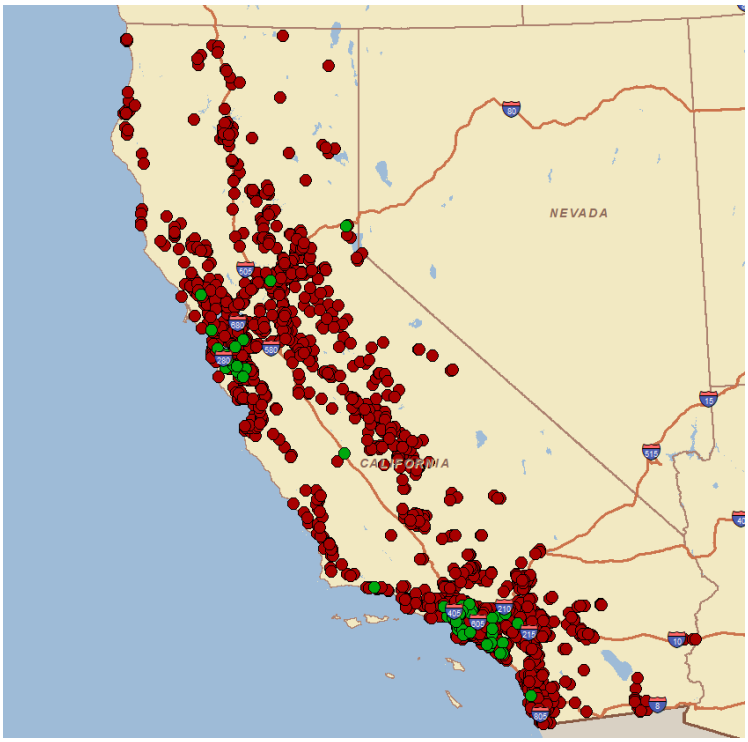


Figure 17: FCEV Hydrogen Stations in California

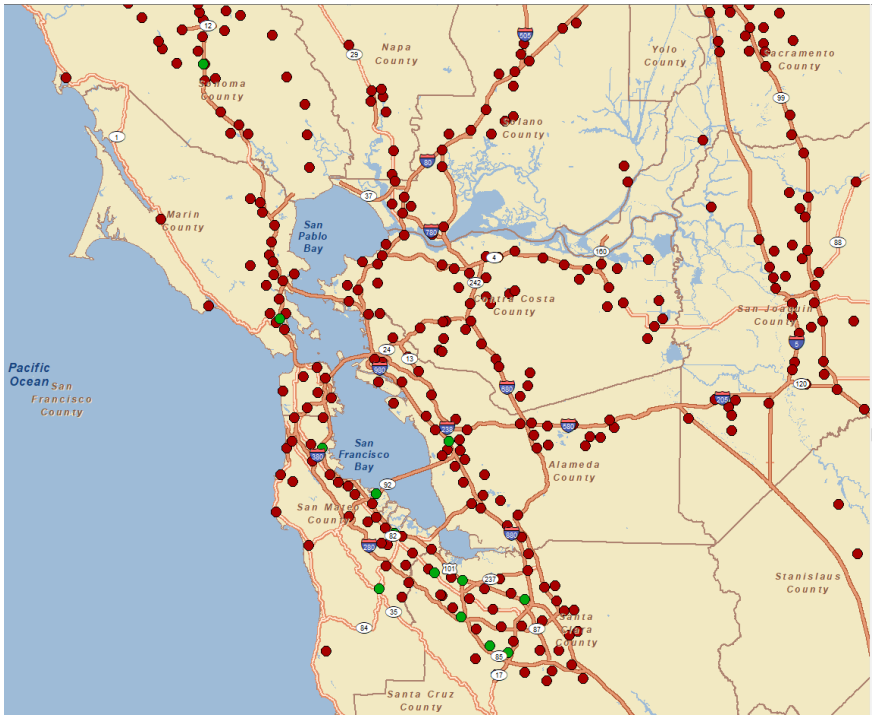


Figure 18: FCEV Hydrogen Stations in Bay Area

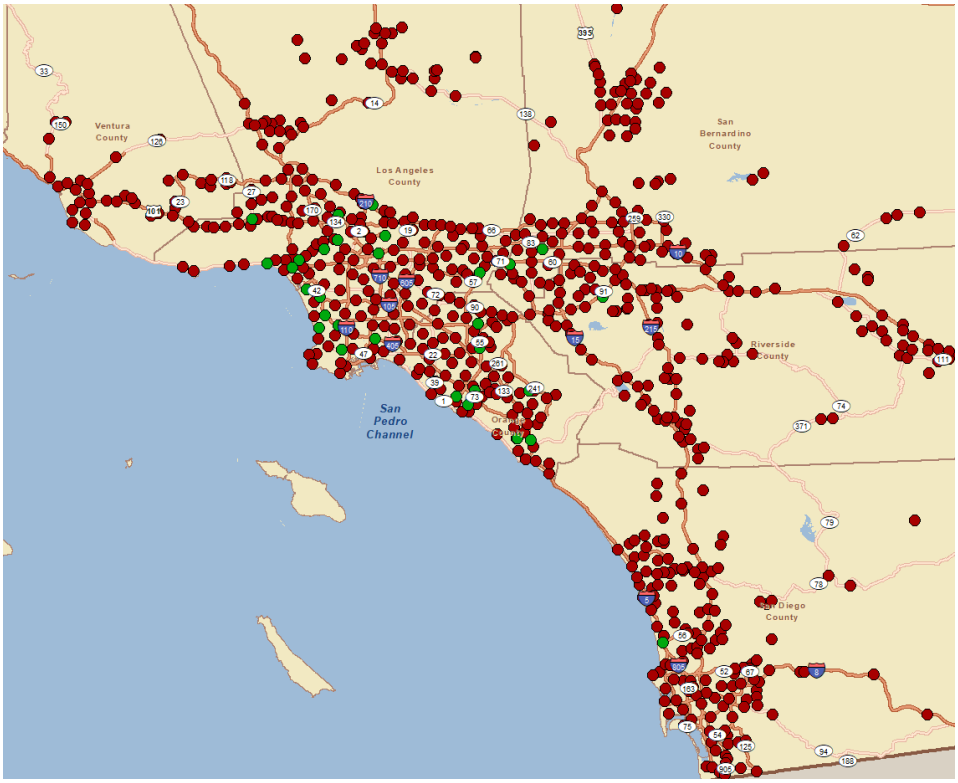


Figure 19: FCEV Hydrogen Stations in Los Angeles Area

A total of 1,651 hydrogen stations are needed for FCEVs. This includes the 48 current and planned hydrogen stations, and the addition of 1,603 hydrogen stations. This result agrees with the previous report for the California Energy Commission for number of stations required for full buildout with FCEVs [106].

The capacities of each of the hydrogen stations, along with more results that will shortly be detailed, can be found in

APPENDIX C: Hydrogen Fueling Infrastructure Results.

One interesting result from ArcGIS was the Coalinga station, in the green existing station center of the state. Due to no one living within 6 minutes of driving to that station, ArcGIS calculated its demand to be zero. However, that station is quite important in reality. It serves as a connector station between Northern and Southern California. To determine an adequate hydrogen capacity for that station, a worst-case scenario is developed. Caltrans traffic data is used to determine the number of vehicles that drive past the Coalinga station on the Interstate 5 freeway [107]. It is assumed that every driver passing by needs a full tank of 5 kg of hydrogen. This leads to a required station capacity of 29,750 kg per day.

The average station size is about 9,500 kg per day, compared to the 28,000 kg per day average for PFCEVs. This much lower average, despite the fact that FCEVs require about six times more hydrogen than PFCEVs, is due to the much larger number of hydrogen stations in the FCEV scenario. Using over 1,600 stations compared to just under 100 relieves the stations of the stresses of high hydrogen demands.

The largest hydrogen station in the FCEV scenario is about 95,000 kg per day, and there are a few that are on the order of 80,000 kg per day, split between Northern and Southern California. While the largest FCEV scenario station is about half that of the PFCEV scenario, it is interesting to see it is on the same order, despite there being so many more hydrogen stations. One could imagine that due to the order of magnitude difference in number of hydrogen stations, there would similarly be an order of magnitude difference in largest station size. This is not the case. Both the PFCEV and FCEV scenarios must deal with these six-figure kg of hydrogen per day capacities.

9.2.2 FCEV Hydrogen Production Facilities Allocation

Now that hydrogen refueling stations have been determined for the FCEV scenario, it is time to determine the hydrogen production facilities. As before, this analysis will consider hydrogen produced from electrolysis. The water demand is calculated as:

$$FCEV\ water\ demand = \frac{1.56 \times 10^7\ kg\ H_2}{day} * \frac{18.02\ kgH_2}{1.01\ kg\ H_2} * \frac{1m^3\ H_2}{1000\ kg\ H_2} * \frac{1\ Mm^3}{1 \times 10^6\ m^3}$$

$$= \frac{0.278\ Mm^3 H_2O}{day}$$

Again, both the Sacramento Delta and Castaic Lake are selected as the hydrogen production facilities again, as in the PFCEV scenario. The results of the OD Matrix calculation are displayed below in Figure *20*.

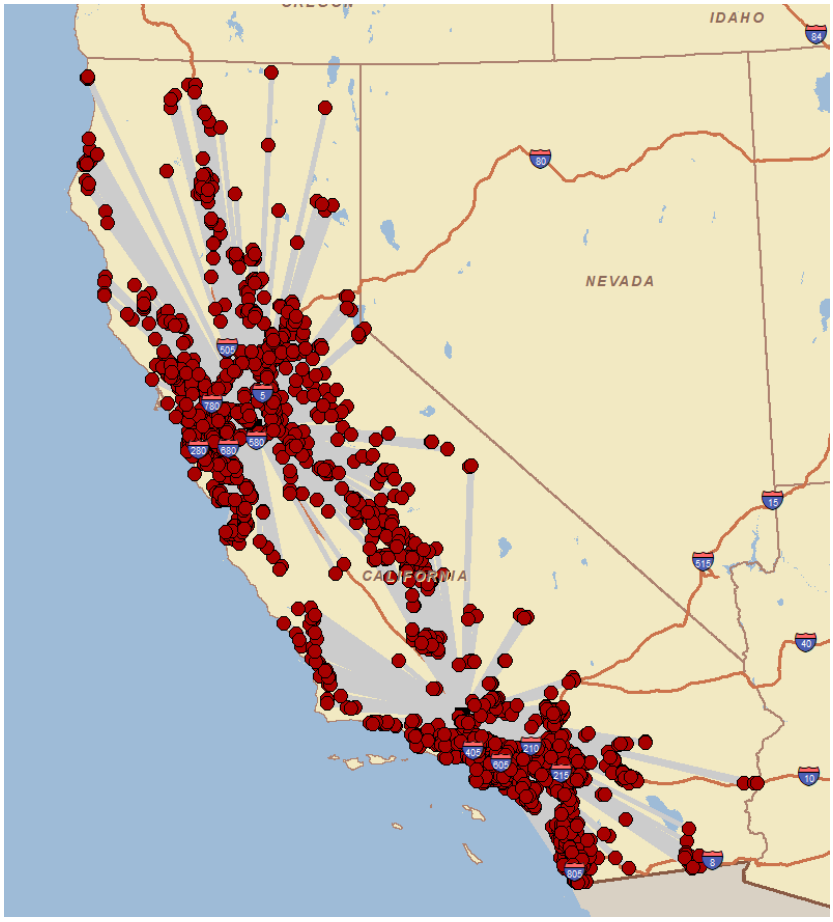


Figure 20: FCEV Hydrogen Production Facilities

Next, compare this to the amount of water that flows through the aqueduct. The water demand as a percentage of Aqueduct flow is present in Table *15*. Also included is the amount of water that is used for gasoline refining extrapolated to 2050, as a point of reference.

While the California Aqueduct has plenty of water for the hydrogen fuel demand of the FCEVs, it is approaching 1% of the Castaic Lake segment. This could make it more difficult to procure water for FCEVs from the Aqueduct compared to PFCEVs.

Table 15: FCEV Water Demand

	Sacramento Delta	Castaic Lake	Units
Water flow	741	26.6	Mm^3/d
FCEV water demand	0.100	0.177	Mm^3/d
FCEV percentage of aqueduct segment	0.0135	0.666	%
Gasoline water demand*	0.00427	0.00756	Mm^3/d
Gasoline percentage of aqueduct segment	0.000577	0.0285	%

* Data for the gasoline demand is from the EIA [92]. The increase in VMT and the increase in vehicle efficiency lead to a similar amount of gasoline used in 2050 according to the EIA [93]. Water demand for gasoline production is from Jacobs Consultancy [94].

Now to discuss the distribution of hydrogen from production facilities to refueling stations. Again, hydrogen fuel cell trucks will be considered to distribute hydrogen from the production facilities to refueling stations. Conducting the same analysis for trucking distance as in the case for PFCEVs, the result is a total of 28,370 kg is needed each day for the hydrogen tankers. This number is quite small compared to the 15.6 million kg of hydrogen per day needed to fuel the FCEVs. Therefore, the emissions associated with fueling the hydrogen tankers are also negligible. The emissions presented in Chapter 8.3 Alternative Vehicle Emissions in 2050 are the overall emissions of an FCEV paradigm.

9.2.3 FCEV Infrastructure Cost

The cost for the hydrogen infrastructure includes the cost for the hydrogen stations as well as the hydrogen production facilities. The cost for hydrogen stations is again calculated using the National Renewable Energy Laboratory's number of $3,370 per kg in addition to the total hydrogen demand for all of the stations [85]. This leads to a total cost of $52.4 billion for the 1,651 hydrogen stations in the FCEV scenario.

The cost for the hydrogen production facilities can be found per unit of power, which the U.S. Department of Energy expects to be $300 per kW of electrolyzer for the system [100]. Using the amount of hydrogen required and the efficiency of alkaline electrolyzers which is 50 kWh of electricity per kg of hydrogen, the power of the electrolyzers required is calculated to be 32.4 million kW. This leads to a hydrogen production facility cost of $9.73 billion.

The infrastructure and associated cost for PFCEVs is presented in Table *16*.

Table 16: FCEV Infrastructure Cost

Hydrogen			**Cost ($)**
	Hydrogen stations	1,651	52,400,000,000
	Hydrogen production facilities	2	9,730,000,000
Total			62,100,000,000

The cost is approximately six times higher than the hydrogen infrastructure cost for the PFCEV scenario. This makes sense because FCEVs require about six times as much hydrogen as FCEVs, and the cost of both the hydrogen stations and the production facilities is proportional to the size in terms of hydrogen.

9.3 BEV Electric Charging Infrastructure

9.3.1 BEV Electric Charging Infrastructure

The details from the PFCEV electric charging infrastructure methodology are applicable in this BEV scenario. The only difference is that the PFCEV infrastructure was set to be 72% of the BEV infrastructure, due to the fact that PFCEVs would have 72% less electricity used for the

battery and therefore the electric load would not be as stressful on the infrastructure. For BEVs, the full infrastructure reinforcement is carried out. The reinforcements to the grid can be seen below in Table *17*.

Table 17: BEV Electric Charging Infrastructure

Transformers		
	Housing units	19,684,735
	Housing transformers	4,921,184
	Office locations	1,271,368
	Office transformers	1,271,368
	Substations	4,480
	Substation transformers	4,480
Level 2 chargers		
	Housing units	19,684,735
	Housing chargers	19,684,735
	Office locations	1,271,368
	Employees	20,055,528
	Office chargers (average)	16

Note: All housing and office data are from the U.S. Census [98].

9.3.2 BEV Infrastructure Cost

Again, the analysis for the BEV infrastructure cost is quite similar to the electric charging infrastructure cost of the PFCEV. The details are not repeated here, but the cost information is presented in Table *18*.

Table 18: BEV Infrastructure Cost

Transformers			**Cost ($)**
	Housing units	19,684,735	
	Housing transformers	4,921,184	4,921,184,000
	Office locations	1,271,368	
	Office transformers	1,271,368	1,271,368,000
	Substations	4,480	
	Substation transformers	4,480	1,108,800,000
Level 2 chargers			
	Housing units	19,684,735	
	Housing chargers	19,684,735	196,847,350,000
	Office locations	1,271,368	
	Employees	20,055,528	200,555,280,000
	Office chargers (average)	16	
Total			404,393,617,000

Unfortunately, due to electric charging being the only way to refuel the BEV, level 2 charging is required at home and work for driver convenience. Switching to the cheaper level 1 charging would increase recharging times too much to make BEVs practical for the typical driver. The level 2 chargers remain the driving force in the very high cost of BEV infrastructure.

9.4 PHEV Gasoline Refueling and Electric Charging Infrastructure

Like PFCEVs, PHEVs have two fuels. However, for PHEVs, the fuels are gasoline for the internal combustion engine and electricity for the battery. Again, the infrastructure for these two fuels must both be analyzed to fully understand the required infrastructure for PHEVs.

9.4.1 PHEV Gasoline Refueling Infrastructure

The gasoline refueling infrastructure for PHEVs is already completed with the current array of gasoline stations. There are approximately 9,800 gasoline stations, an ample amount to serve the California population with stations often across the street from each other. The gasoline stations can be seen in Figure *21*.

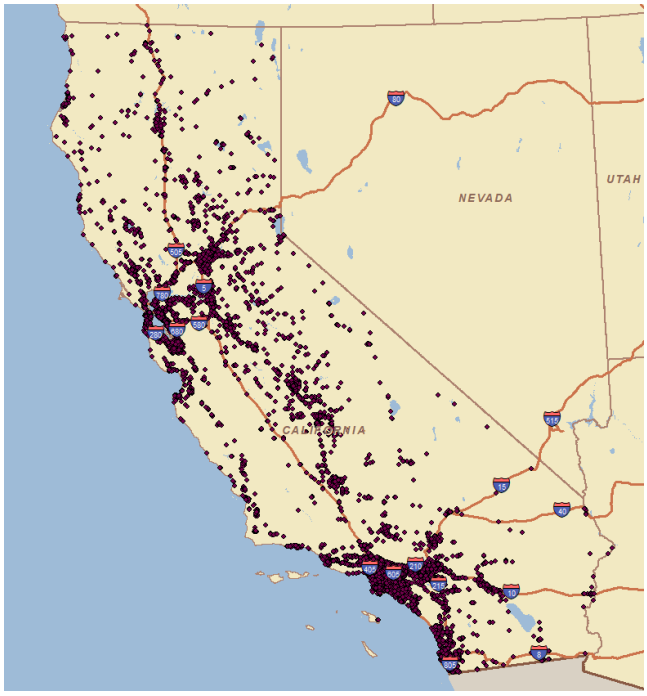


Figure 21: Gasoline Stations

The gasoline stations that exist today are far more numerous than what is planned for any future scenario of hydrogen stations. While there may not be as many options for where to refuel hydrogen in the future compared to gasoline today, the future fueling infrastructure will likely be far more planned and efficient in terms of meeting demand with fewer stations. The much higher cost of hydrogen stations is a major factor in this. As is the case for PFCEV and FCEV scenarios, assume that trucking the gasoline is negligible for emissions

9.4.2 PHEV Electric Charging Infrastructure and Cost

The electric charging infrastructure for PHEVs, and therefore its cost is the same as for PFCEVs electric charging infrastructure. For brevity, the results will not be repeated here. Please see sections 9.1.3 PFCEV Electric Charging Infrastructure-9.1.4 PFCEV Infrastructure Cost for details on the PHEV electric charging infrastructure and its cost. The point regarding level 1 charging being adequate is applicable for PHEVs as well, which brings down the cost significantly just as it did for PFCEVs.

9.5 Objective 6 Conclusions

PFCEVs may at first glance seem to have a disadvantage in terms of infrastructure because they have two fuels and therefore a more complicated fueling infrastructure. In considering level 2 charging for PFCEVs, that intuition proves correct. PFCEVs do have the most expensive infrastructure to build out. However, considering the fact that level 1 charging can be used for PFCEVs and still meet drivers' demands, this allows the PFCEV infrastructure to be the cheapest of the alternative vehicle types considered, excluding PHEVs which already have their gasoline structure built out.

10. SUMMARY AND CONCLUSIONS

10.1 Summary

Due to climate change and poor air quality, a clean vehicle paradigm must be chosen. However, current alternative vehicle types fail to meet all of a typical drivers' demands while providing drastic GHG and CAP emissions reductions. Therefore, the new vehicle type of the PFCEV is offered and analyzed.

The PFCEV meets typical drivers' demands while drastically reducing emissions by offering very efficient 40 mile BER, convenient at-home and at-work charging, long range with a hydrogen fuel cell, and fast refueling at hydrogen stations. All of these features combine to make the PFCEV an attractive vehicle to drivers while offering the highest efficiency of any alternative vehicle and the lowest WTW GHG emissions.

Analyzing this vehicle in the context of the 2050 electric grid, a time by which any of these alternative vehicles could be adopted on a wide scale in California, makes the PFCEV even more attractive. Consider a scenario in which every passenger vehicle in California has switched to an advanced alternative vehicle, namely a PFCEV, an FCEV, or a BEV. When integrated into the electric grid, the PFCEV has the lowest GHG and CAP emissions of any of these vehicle types. A series of figures below depicts these results.

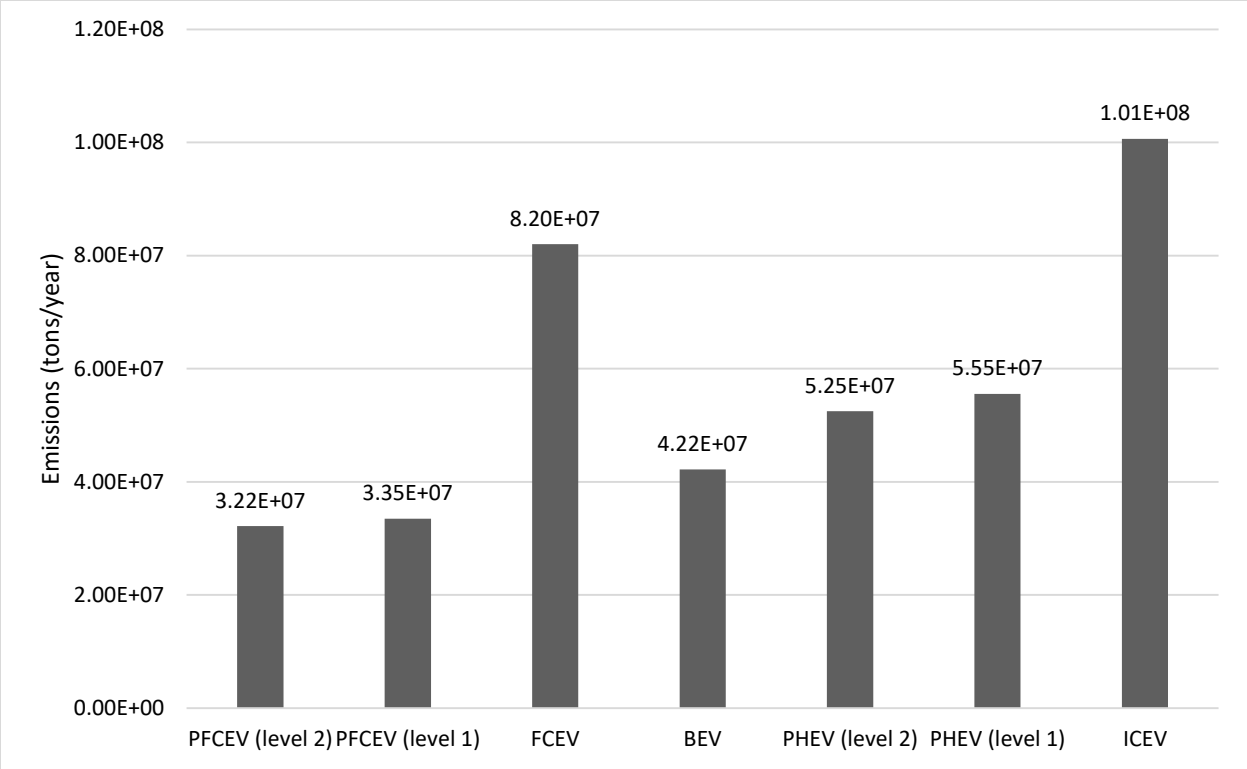


Figure 22: CO_2 Emissions by Vehicle Type, with Level 1 Charging

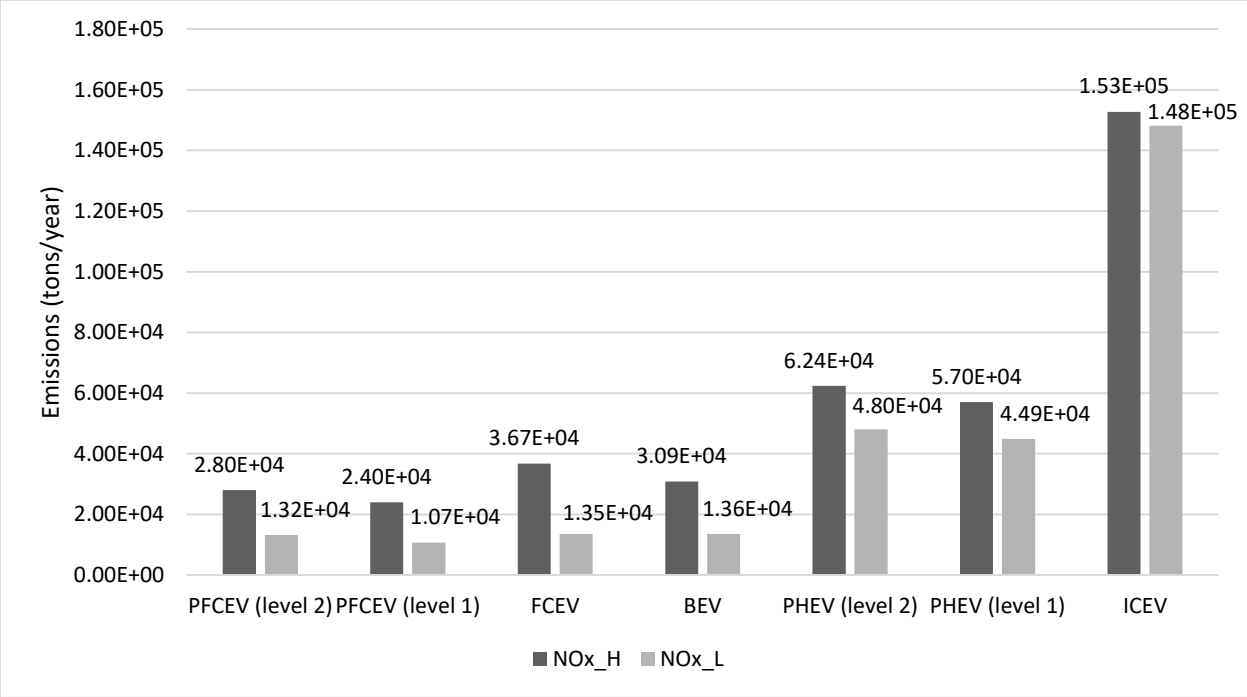


Figure 23: NO_x Emissions by Vehicle Type, with Level 1 Charging

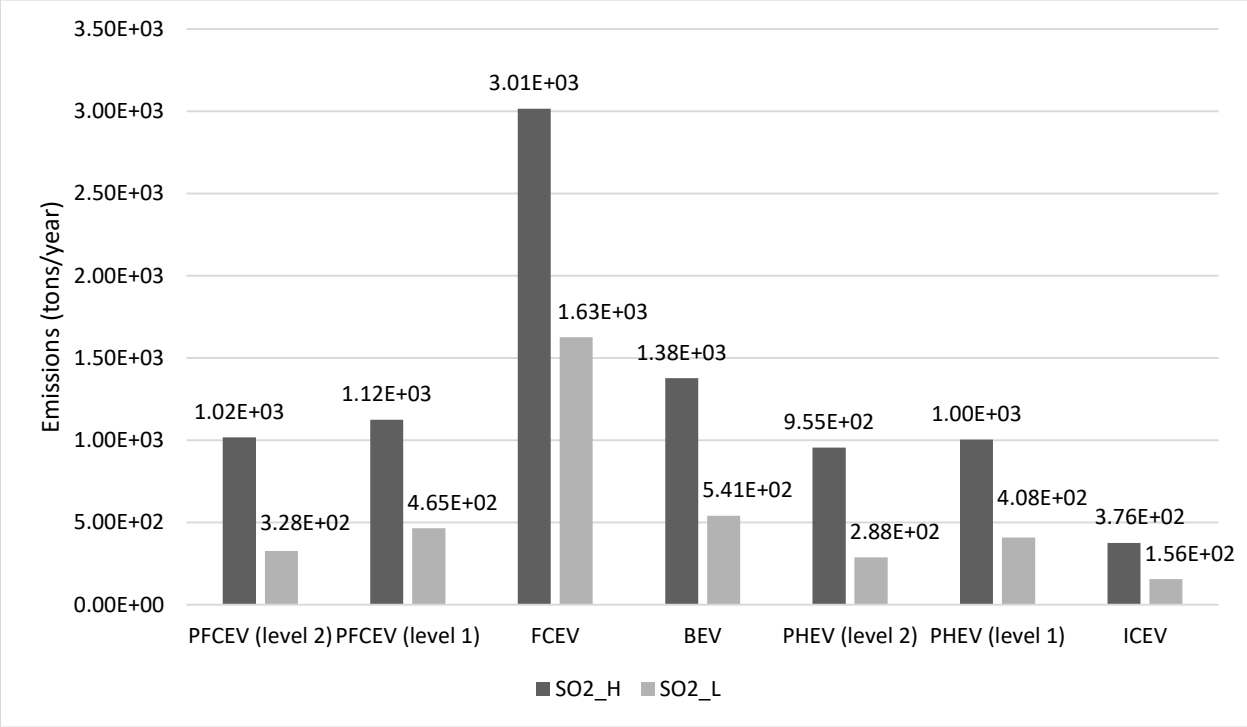


Figure 24: SO_2 Emissions by Vehicle Type, with Level 1 Charging

A key factor in making any change is economics. The economics of the PFCEV are similarly positive. When considering PFCEVs using level 1 charging, the PFCEV has the lowest infrastructure cost of all advanced alternative vehicles. Using level 2 charging with PFCEVs does lead to the most expensive infrastructure, but level 2 charging is not needed for PFCEVs. The same can be said for PHEVs, but these are not considered advanced alternative vehicles because they still rely on gasoline. The next most expensive paradigm is that of the BEV. The high cost of level 2 chargers, which are required for BEVs, cause the dramatically high cost. FCEVs, which only need hydrogen stations, have significantly cheaper infrastructure than BEVs, but not as low as PFCEVs.

An interesting result to consider at is the cost per reduction (or increase) in emissions. This is calculated using the infrastructure costs and dividing by the change in emissions of each of the vehicle types compared to the base case of the ICEV with 45 MPG. These results are displayed below in the series of figures.

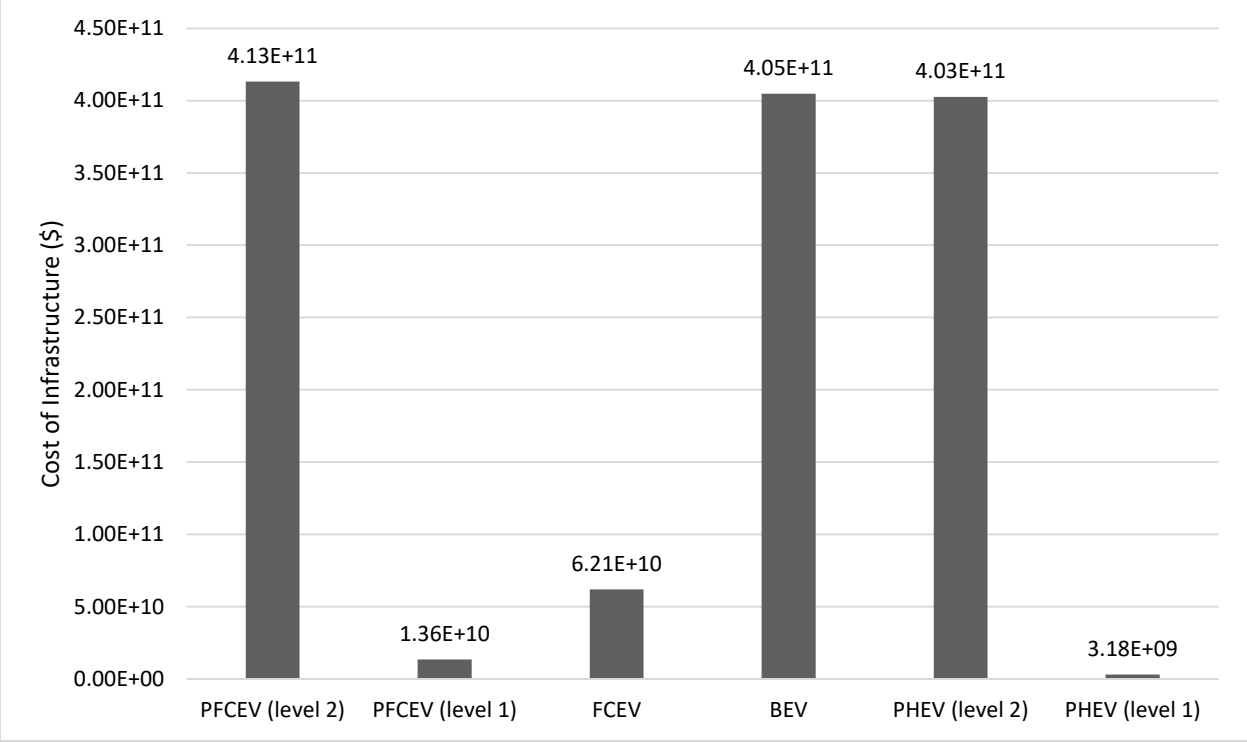


Figure 25: Alternative Vehicle Infrastructure Cost

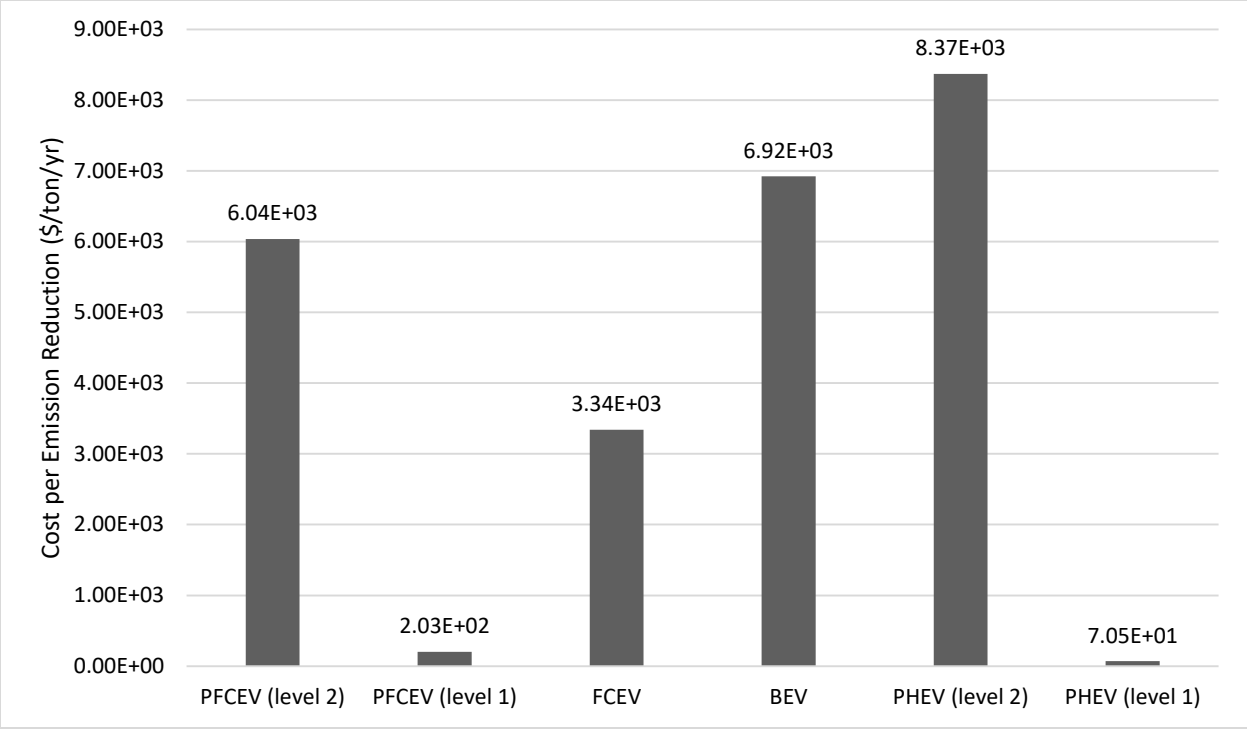


Figure 26: Cost per CO_2 Emissions Reduction

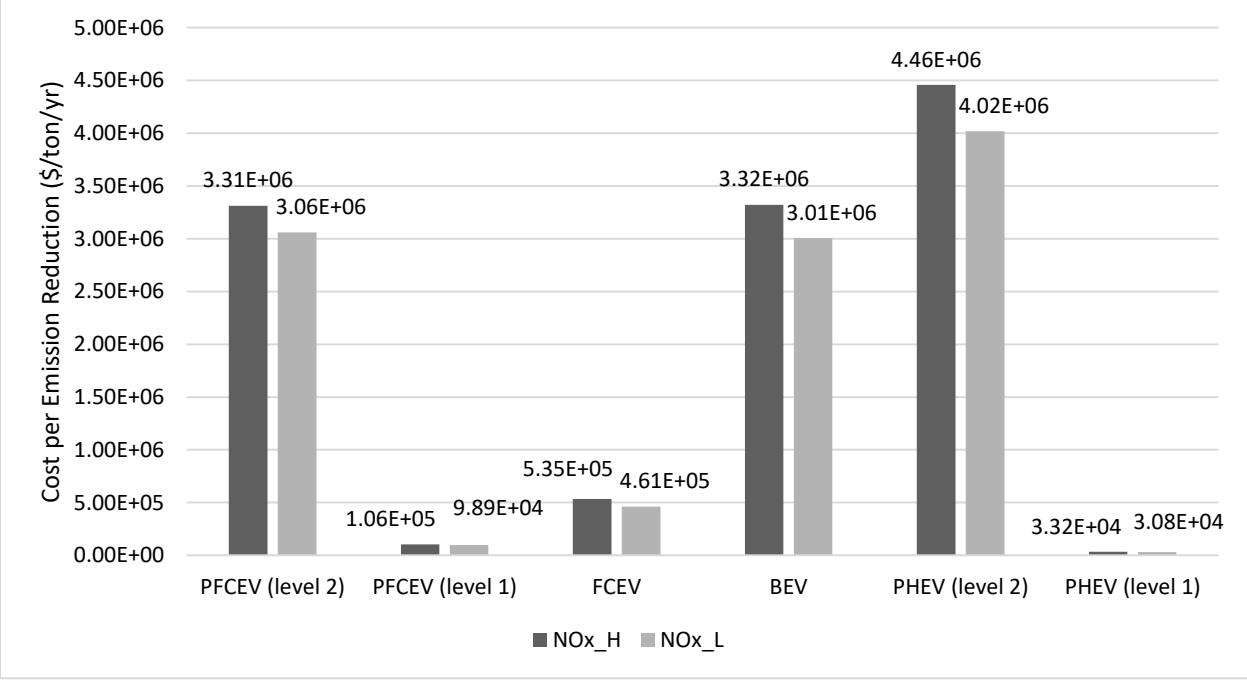


Figure 27: Cost per NO_x Emissions Reduction

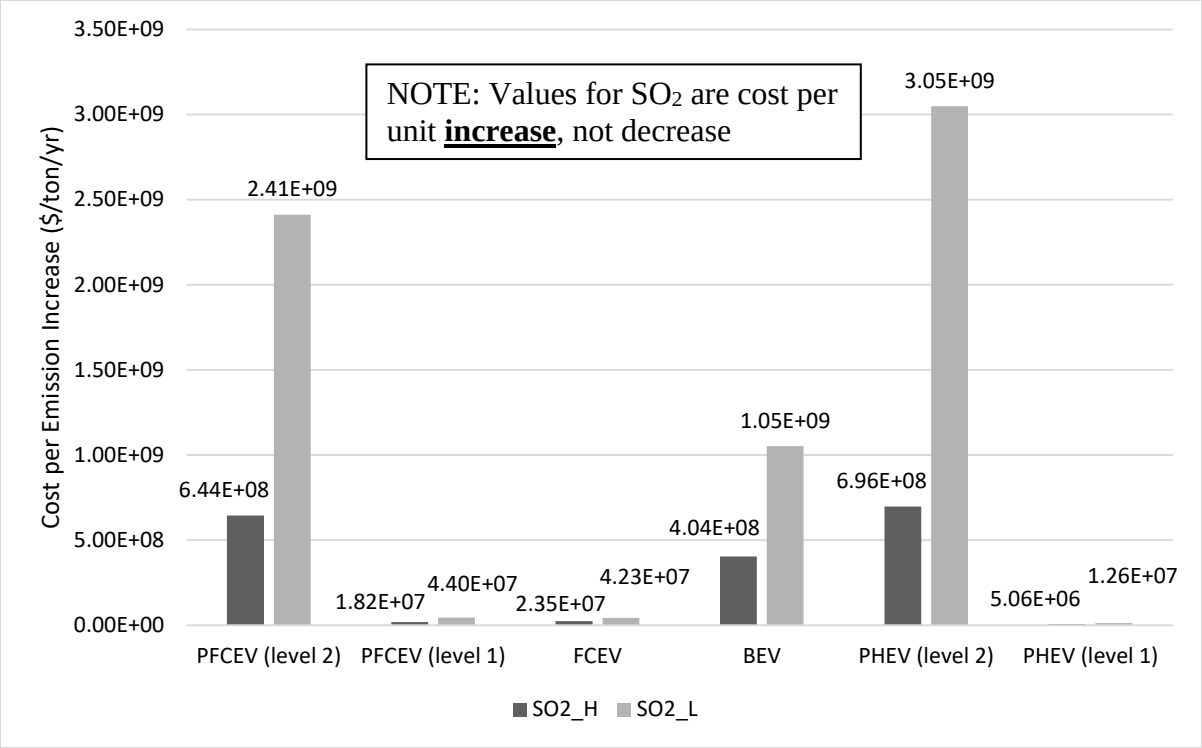


Figure 28: Cost per SO_2 Emissions Increase

Again, the PFCEV with level 1 charging is the most attractive. It is the lowest cost option among advanced alternative vehicles for all emissions reductions (excluding SO2, which all advanced alternatives increase). PHEVs, which use gasoline, are the lowest cost option for emissions reductions (again, besides SO2, for which the ICEV is the lowest emitting). However, note that when considering the cost per reduction in emissions, it is also important to consider the total amount of emissions that each vehicle type can decrease. While PHEVs may be the cheapest, the also offer the lowest emissions reductions, besides CO_2 emissions from FCEVs. Therefore, PHEVs, while the most effective per dollar at reducing emissions, are not as effective overall at emissions reductions as the PFCEV with level 1 charging.

The unintuitive result that ICEVs have the lowest SO_2 emissions will be briefly addressed here. Sulfur is used as an odorant in natural gas, the only fossil fuel that will likely be used for the electric grid in 2050. Considering the results of this thesis, it would be wise to consider

reducing the amount of sulfur in natural gas, or to find an alternative odorant that is less hazardous.

While it was not in the scope of this research, the economics of the PFCEV are encouraging as well. When considering the cost of the vehicle and the cost of the fuel over the lifetime of vehicle use, PFCEVs are economical and compare well to, or even better than, the other advanced alternative vehicle types in terms of vehicle and fuel costs [108] [52].

In closing, this thesis proves the PFCEV a vehicle worthy of attention, both by consumers and those in the position of advancing vehicle technology such as automotive companies and legislators. The PFCEV is the most effective vehicle for meeting drivers' demands, combating climate change, and improving air quality.

10.2 Conclusions

- **The PFCEV is the cleanest of all current advanced alternative vehicles that could be used for passenger vehicles**

  Analysis of PFCEVs, FCEVs, and BEVs as passenger vehicles in the projected California electric grid of 2050 leads to the conclusion that PFCEVs have the lowest CO2, NOx, and SO2 of these three advanced alternative vehicle types. Remarkably high efficiency of the PFCEV stemming from its lightweight powertrain composed of moderately sized fuel cell and battery which allows for BER lead to reduced fuel use for both hydrogen and electricity from the grid. Common short trips are met by the highly efficient battery and electric motor. For longer range, the lightweight fuel cell, especially light compared to a large battery, allow for efficient long-range driving. These factors combine to make the PFCEV unique in clean passenger transportation.

- **The PFCEV with level 1 electric charging requires the least infrastructure cost of any advanced alternative passenger vehicle.**

  The PFCEV keeps infrastructure cost comparatively low mainly due to its hydrogen fuel cell range extender and its BER. Electric charging with level 1 power is adequate for the PFCEV paradigm due to the fuel cell range extender, which negates the need for very costly level 2 charging infrastructure. Furthermore, the BER of the PFCEV allows for most trips to be fueled by electricity from the grid. This leaves the hydrogen fueling infrastructure to serve as a range extender, not as a primary fueling source. Keeping both electric charging and hydrogen fueling infrastructure to a minimum leaves the PFCEV with the cheapest required infrastructure for advanced alternative passenger vehicles.

- **The PFCEV is the most cost-effective advanced alternative passenger vehicle for reducing GHG and CAP emissions.**

  The required infrastructure costs and the emissions reductions provided by the vehicle types have been analyzed. As discussed above, the PFCEV has both the lowest infrastructure cost and the most GHG and CAP emissions reductions of all advanced alternative passenger vehicle types. Therefore, when targeting a future passenger vehicle paradigm, the PFCEV is the cheapest way to reduce GHG and CAP emissions.

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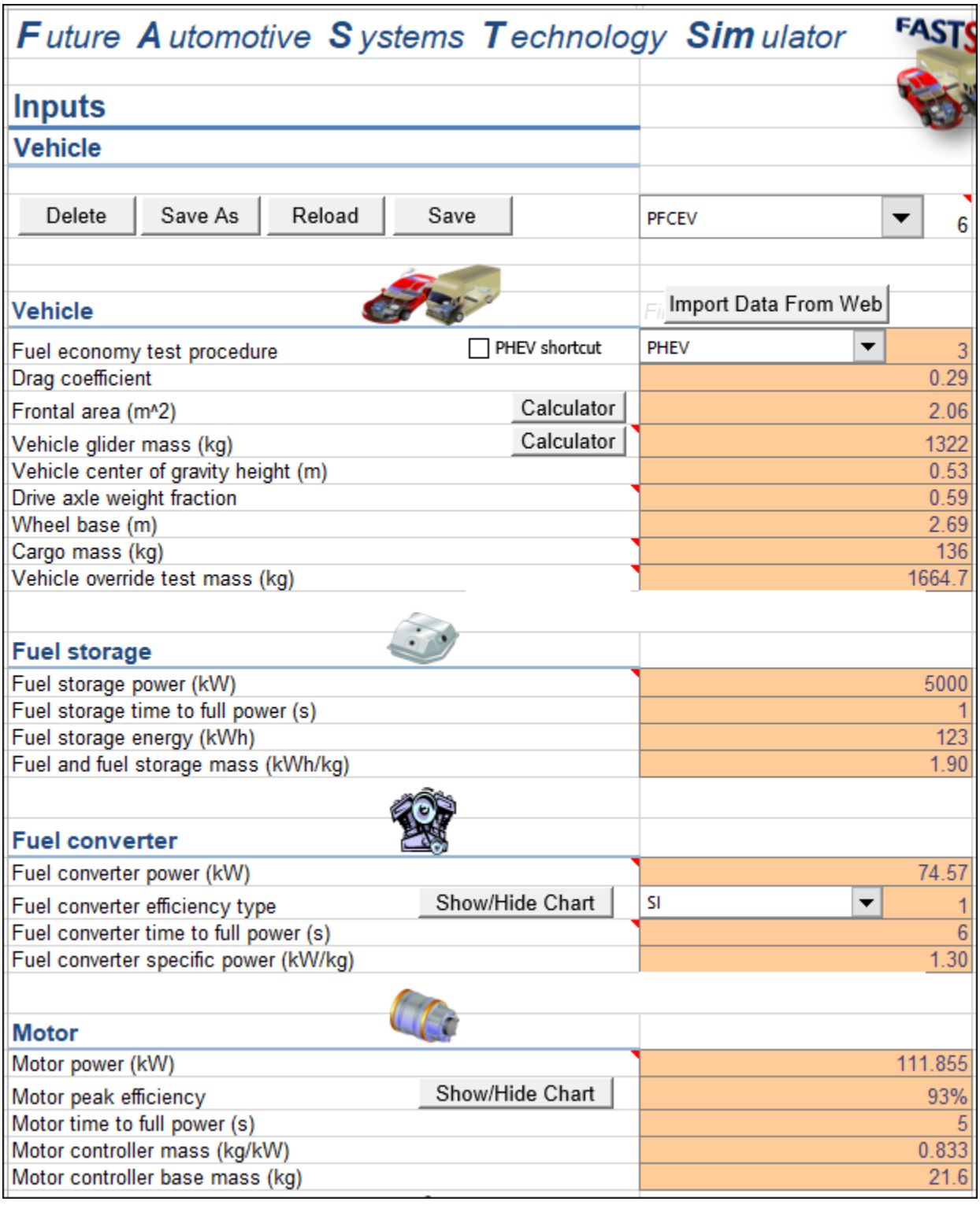
APPENDIX A: Detailed FASTSim PFCEV Inputs



Future Automotive Systems Technology Simulator

FASTS

Inputs

Vehicle

Delete / Save As / Reload / Save		PFCEV	6

Vehicle

Import Data From Web

Fuel economy test procedure	☐ PHEV shortcut	PHEV	3
Drag coefficient			0.29
Frontal area (m^2)	Calculator		2.06
Vehicle glider mass (kg)	Calculator		1322
Vehicle center of gravity height (m)			0.53
Drive axle weight fraction			0.59
Wheel base (m)			2.69
Cargo mass (kg)			136
Vehicle override test mass (kg)			1664.7

Fuel storage

Fuel storage power (kW)			5000
Fuel storage time to full power (s)			1
Fuel storage energy (kWh)			123
Fuel and fuel storage mass (kWh/kg)			1.90

Fuel converter

Fuel converter power (kW)			74.57
Fuel converter efficiency type	Show/Hide Chart	SI	1
Fuel converter time to full power (s)			6
Fuel converter specific power (kW/kg)			1.30

Motor

Motor power (kW)			111.855
Motor peak efficiency	Show/Hide Chart		93%
Motor time to full power (s)			5
Motor controller mass (kg/kW)			0.833
Motor controller base mass (kg)			21.6

		
Traction battery		
Battery power (kW)		111.9
Battery energy (kWh)		13.0
Battery mass (kg/kWh)		7.1
Battery base mass (kg)		92.3
Battery round trip efficiency		95.1%
Battery life coefficient A (product)		86
Battery life coefficient B (power)		-0.6844
		
Wheel		
Wheel inertia (one wheel) (kg*m^2)		0.815
Number of wheels		4
Rolling resistance coefficient		0.008
Tire radius (m)	Calculator	0.334
Wheel coefficient of friction		0.7
		
Energy management		
Strategy	Load HEV Defaults / Load PHEV Defaults	Kinetic Energy 1
Minimum state of charge	Show/Hide Chart	5%
Maximum state of charge		95%
Speed where the battery should be empty (mph)		0.1
Speed where the battery should be full (mph)		0
Attempted level of electric assist		5
Attempted level of engine charging the battery		0.2
Percent of battery reserved for passing		5%
Percent FC power done electrically		10%
Percent SOC buffer for high accessory loads during cycles with long		0%
Speed at which engine is commanded on (mph)		60
Power demand at which engine is commanded on (kW)		100
		
Misc.		
Alternator efficiency (conv. veh only)		100%
Charger efficiency		86%
Auxiliary loads (kW)		0.3
Transmission mass (kg)		0
Transmission efficiency		100.0%
Max battery to fuel energy error		0.50%
Max regen	Show/Hide Chart	100%

APPENDIX B: FASTSim Results for PFCEVs, BEVs, FCEVs, and PHEVs

PFCEV:

Adjusted fuel economy	
	Results
Charge depleting city range (miles)	41.7
Charge depleting highway range (miles)	43.1
Charge depleting city (mpgge)	20707.0
Charge depleting highway (mpgge)	3807.2
Charge depleting combined (mpgge)	6908.1
Charge sustaining city (mpgge)	80.9
Charge sustaining highway (mpgge)	83.3
Charge sustaining combined (mpgge)	82.0
City UF (percent driving electric)	63%
Highway UF (percent driving electric)	65%
City (mpgge)	217.3
Highway (mpgge)	225.9
Combined (mpgge)	221.1
Charge depleting city (kWh/mile) -includes charging efficiency	0.326
Charge depleting highway (kWh/mile) -includes charging efficiency	0.318
Charge depleting combined (kWh/mile) -includes charging efficiency	0.322
Utility factor (percent driving electric)	63%
Average PHEV elect. consumption (kWh/mile) (incl. charge eff)	0.203

Performance	
	Results
0-60 mph (s)	6.1
Charge depleting range for PHEVs (miles)	42.3
Range (miles)	341

BEV (2012 Nissan Leaf):

Adjusted fuel economy

	Results
Charge depleting city range (miles)	
Charge depleting highway range (miles)	
Charge depleting city (mpgge)	
Charge depleting highway (mpgge)	
Charge depleting combined (mpgge)	
Charge sustaining city (mpgge)	
Charge sustaining highway (mpgge)	
Charge sustaining combined (mpgge)	
City UF (percent driving electric)	
Highway UF (percent driving electric)	
City (mpgge)	
Highway (mpgge)	
Combined (mpgge)	
Charge depleting city (kWh/mile) -includes charging efficiency	**0.344**
Charge depleting highway (kWh/mile) -includes charging efficiency	**0.347**
Charge depleting combined (kWh/mile) -includes charging efficiency	**0.345**
Utility factor (percent driving electric)	
Average PHEV elect. consumption (kWh/mile) (incl. charge eff)	

Performance

	Results
0-60 mph (s)	**11.1**
Charge depleting range for PHEVs (miles)	
Range (miles)	**72**

FCEV (2016 Mirai):

Adjusted fuel economy	
	Results
Charge depleting city range (miles)	
Charge depleting highway range (miles)	
Charge depleting city (mpgge)	
Charge depleting highway (mpgge)	
Charge depleting combined (mpgge)	
Charge sustaining city (mpgge)	
Charge sustaining highway (mpgge)	
Charge sustaining combined (mpgge)	
City UF (percent driving electric)	
Highway UF (percent driving electric)	
City (mpgge)	**53.0**
Highway (mpgge)	**70.6**
Combined (mpgge)	**59.7**
Charge depleting city (kWh/mile) -includes charging efficiency	
Charge depleting highway (kWh/mile) -includes charging efficiency	
Charge depleting combined (kWh/mile) -includes charging efficiency	
Utility factor (percent driving electric)	
Average PHEV elect. consumption (kWh/mile) (incl. charge eff)	

Performance	
	Results
0-60 mph (s)	**9.6**
Charge depleting range for PHEVs (miles)	
Range (miles)	**295**

PHEV (2012 Chevrolet Volt):

175		
176	**Adjusted fuel economy** 	
177		Results
178	Charge depleting city range (miles)	36.5
179	Charge depleting highway range (miles)	35.9
180		
181	Charge depleting city (mpgge)	693.2
182	Charge depleting highway (mpgge)	875.6
183	Charge depleting combined (mpgge)	764.9
184		
185	Charge sustaining city (mpgge)	38.9
186	Charge sustaining highway (mpgge)	40.2
187	Charge sustaining combined (mpgge)	39.5
188		
189	City UF (percent driving electric)	58%
190	Highway UF (percent driving electric)	58%
191		
192	City (mpgge)	85.6
193	Highway (mpgge)	89.7
194	Combined (mpgge)	87.4
195		
196	Charge depleting city (kWh/mile) -includes charging efficiency	0.352
197	Charge depleting highway (kWh/mile) -includes charging efficiency	0.340
198	Charge depleting combined (kWh/mile) -includes charging efficiency	0.346
199		
200	Utility factor (percent driving electric)	58%
201	Average PHEV elect. consumption (kWh/mile) (incl. charge eff)	0.200
202		
203	**Performance** 	
204		Results
205	0-60 mph (s)	7.0
206	Charge depleting range for PHEVs (miles)	36.2
207	Range (miles)	401

APPENDIX C: Hydrogen Fueling Infrastructure Results

Explain columns

PFCEV

Name	Production	Capacity	Stat Cost	Trips	Truck Miles	Truck Fuel
Truckee - Location 1	NorCal	1023.061898	3.45E+06	2	349.82355	26.9095039
Saratoga - Location 1	NorCal	12441.03539	4.19E+07	2	115.753061	8.9040816
West Sacramento - S. River Rd. - Location 1	NorCal	85932.04266	2.90E+08	8	611.216494	47.0166534
Woodside - Location 1	NorCal	187.8205312	6.33E+05	2	139.298206	10.7152467
San Jose - Location 1	NorCal	62132.25647	2.09E+08	6	295.135503	22.702731
Los Altos - Homestead Road - Location 1	NorCal	12149.75644	4.09E+07	2	115.313943	8.87030333
Coalinga - Location 1	NorCal	2925.036862	9.86E+06	2	270.039343	20.7722571
San Ramon - Location 1	NorCal	24761.28871	8.34E+07	2	70.0479139	5.38830107
South San Francisco - Location 1	NorCal	73745.38283	2.49E+08	6	406.057597	31.2351997
Campbell - Winchester - Location 1	NorCal	43300.32737	1.46E+08	4	228.959696	17.6122843
Palo Alto - Location 1	NorCal	14331.40754	4.83E+07	2	115.871292	8.91317627
Foster City - Foster City Blvd. - Location 1	NorCal	13972.76782	4.71E+07	2	113.631802	8.74090783
Hayward - Location 1	NorCal	85934.45991	2.90E+08	8	322.573109	24.8133161
Rohnert Park - Location 1	NorCal	32038.58898	1.08E+08	4	369.707121	28.4390093
Mill Valley - Location 1	NorCal	46239.46487	1.56E+08	4	301.436189	23.1873992
Redwood City - Location 1	NorCal	13388.43728	4.51E+07	2	124.295225	9.56117119
Mountain View - Leong Dr. - Location 1	NorCal	10341.97376	3.49E+07	2	107.630249	8.27924989
402 N MAIN ST - Location 1	NorCal	246.0763202	8.29E+05	2	719.179413	55.3214933
1105 PARK AVE - Location 1	NorCal	14608.02182	4.92E+07	2	324.230435	24.9408027
7560 SUNRISE BLVD - Location 1	NorCal	63060.88437	2.13E+08	6	555.199778	42.7076752
1200 NORTHCREST DR - Location 1	NorCal	1190.255207	4.01E+06	2	809.472648	62.2671268
16150 ELGIN RD - Location 1	NorCal	15411.67775	5.19E+07	2	167.903523	12.9156556
10921 HWY 140 - Location 1	NorCal	409.4825996	1.38E+06	2	252.205975	19.4004596
105 S MAIN ST - Location 1	NorCal	912.8351773	3.08E+06	2	407.461287	31.3431759
17822 N FRIANT RD - Location 1	NorCal	57567.83886	1.94E+08	6	790.222473	60.7863441
290 N MAIN ST - Location 1	NorCal	81183.75269	2.74E+08	8	185.56428	14.2741754
61 ARTHUR RD - Location 1	NorCal	79850.87958	2.69E+08	8	298.958076	22.9967751
44275 STATE HIGHWAY 299 E - Location 1	NorCal	19.98262194	6.73E+04	2	605.196599	46.5535845
8695 PRUNEDALE NORTH RD - Location 1	NorCal	38357.04569	1.29E+08	4	402.582449	30.9678807
2762 LAKE TAHOE BLVD - Location 1	NorCal	2165.536078	7.30E+06	2	325.259103	25.019931
1530 MAIN ST - Location 1	NorCal	1049.490527	3.54E+06	2	509.214606	39.1703543

734 S STATE ST - Location 1	NorCal	3581.159807	1.21E+07	2	309.519853	23.8092195
248 BRIDGE ST - Location 1	NorCal	14452.83419	4.87E+07	2	235.450464	18.1115741
317 S WASHINGTON ST - Location 1	NorCal	2512.653559	8.47E+06	2	157.273018	12.0979244
9320 OLD HIGHWAY 99 - Location 1	NorCal	1650.419537	5.56E+06	2	635.822002	48.9093848
7990 HIGHWAY 29 - Location 1	NorCal	2447.146012	8.25E+06	2	260.344595	20.0265073
765 E CYPRESS AVE - Location 1	NorCal	11719.80777	3.95E+07	2	458.594198	35.2764768
900 Main St - Location 1	NorCal	242.9338918	8.19E+05	2	545.875578	41.9904291
1149 S LANDING RD - Location 1	NorCal	1387.583599	4.68E+06	2	432.584894	33.2757611
1324 5TH ST - Location 1	NorCal	7212.195594	2.43E+07	2	641.043987	49.3110759
600 REDWOOD DR - Location 1	NorCal	195.7168899	6.60E+05	2	511.06326	39.3125585
845 WALNUT AVE - Location 1	NorCal	3592.843195	1.21E+07	2	285.032851	21.9256039
60 MAIN ST - Location 1	NorCal	366.9389529	1.24E+06	2	416.125061	32.0096201
18725 HWY 49 - Location 1	NorCal	4658.771041	1.57E+07	2	156.583991	12.0449224
170 Co Rd 176A - Location 1	NorCal	23.44735075	7.90E+04	2	767.931432	59.0716486
Los Angeles - LAX (upgrade phase 2) - Location 2	SoCal	33247.21531	1.12E+08	4	187.405651	14.4158193
West LA - Location 2	SoCal	26144.84356	8.81E+07	4	152.113283	11.7010218
Redondo Beach - Beryl St. - Location 2	SoCal	11147.32177	3.76E+07	2	109.282404	8.40633878
South Pasadena - Location 2	SoCal	56339.39106	1.90E+08	6	272.115448	20.9319575
Chino - East End Ave. - Location 2	SoCal	35282.94492	1.19E+08	4	289.816769	22.2935976
Burbank - West Verdugo - Location 2	SoCal	96499.06263	3.25E+08	8	261.483502	20.1141155
Santa Barbara - Location 2	SoCal	17681.23626	5.96E+07	2	162.130686	12.4715913
Lawndale - Inglewood Ave. - Location 2	SoCal	12830.93824	4.32E+07	2	101.611391	7.81626086
Newport Beach - Jamboree - Location 2	SoCal	2911.500247	9.81E+06	2	166.490608	12.8069698
Los Angeles - Location 2	SoCal	2296.954047	7.74E+06	2	86.9826865	6.69097589
Santa Monica - Cloverfield Blvd. - Location 2	SoCal	13749.0108	4.63E+07	2	80.1436271	6.16489439
Ontario - Location 2	SoCal	54393.18038	1.83E+08	6	465.308956	35.7929966
Orange - Location 2	SoCal	45644.57899	1.54E+08	4	296.024452	22.7711117
Irvine - UCI (upgrade) - Location 2	SoCal	25091.8883	8.46E+07	4	327.089929	25.1607638
Costa Mesa - Location 2	SoCal	40347.97555	1.36E+08	4	318.97188	24.5362985
Torrance - W. 190th St. - Location 2	SoCal	24459.85731	8.24E+07	2	109.123027	8.39407897
Lake Forest - Location 2	SoCal	16716.91361	5.63E+07	2	178.355499	13.7196538
Diamond Bar - SCAQMD - Location 2	SoCal	47936.85969	1.62E+08	4	273.779568	21.0599667
Los Angeles - Harbor City - Location 2	SoCal	21938.01819	7.39E+07	2	119.214859	9.17037374
San Juan Capistrano - Junipero Serra - Location 2	SoCal	11832.45174	3.99E+07	2	189.972778	14.6132906

Laguna Niguel - Location 2	SoCal	8799.685987	2.97E+07	2	188.850166	14.5269358
San Diego - Carmel Valley - Location 2	SoCal	182989.4101	6.17E+08	16	2328.25834	179.096796
Long Beach - Location 2	SoCal	95817.71969	3.23E+08	8	496.271548	38.1747344
Anaheim - E. La Palma - Location 2	SoCal	63628.21357	2.14E+08	6	433.847318	33.3728706
Los Angeles - CSULA - Location 2	SoCal	96989.60377	3.27E+08	8	362.085559	27.8527353
Los Angeles - Woodland Hills - Location 2	SoCal	66769.59454	2.25E+08	6	200.647978	15.4344599
La Canada Flintridge - Location 2	SoCal	13785.10844	4.65E+07	2	76.9285909	5.91758391
Los Angeles - Hollywood Blvd. - Location 2	SoCal	52343.4307	1.76E+08	6	221.475815	17.0366011
Los Angeles - Beverly Blvd - Location 2	SoCal	30940.99512	1.04E+08	4	155.888709	11.9914392
Riverside - Location 2	SoCal	66941.54178	2.26E+08	6	565.707633	43.5159718
Los Angeles - Lincoln Blvd - Location 2	SoCal	10529.23026	3.55E+07	2	90.1744851	6.93649885
1145 TAVERN ROAD - Location 2	SoCal	40142.50908	1.35E+08	4	729.917828	56.1475253
1061 METTLER FRONTAGE RD W - Location 2	SoCal	41792.44516	1.41E+08	4	208.160013	16.0123087
3405 E. Highland - Location 2	SoCal	51851.35863	1.75E+08	6	587.087688	45.1605914
1901 N ROSE AVE - Location 2	SoCal	38857.49757	1.31E+08	4	191.311837	14.7162952
207 N CHINA LAKE BLVD - Location 2	SoCal	2217.18471	7.47E+06	2	269.03697	20.6951516
106 E TEHACHAPI BLVD - Location 2	SoCal	1796.179872	6.05E+06	2	169.189314	13.0145626
1088 N MOONEY BLVD - Location 2	SoCal	42614.95567	1.44E+08	4	547.983599	42.1525846
14595 7th St. - Location 2	SoCal	24369.93551	8.21E+07	2	196.928456	15.1483428
41923 SIERRA HWY - Location 2	SoCal	23974.23125	8.08E+07	2	72.8214855	5.60165273
49709 29 PALMS HWY - Location 2	SoCal	25163.76128	8.48E+07	4	598.832648	46.0640499
28015 SCOTT RD - Location 2	SoCal	45422.51405	1.53E+08	4	479.432458	36.8794199
5510 LAKE ISABELLA BLVD - Location 2	SoCal	390.708604	1.32E+06	2	226.88945	17.4530346
1302 S 4TH ST - Location 2	SoCal	13767.86537	4.64E+07	2	505.475476	38.8827289
491 W CHANSLOR WAY # B - Location 2	SoCal	978.3427243	3.30E+06	2	524.591822	40.3532171
31652 HIGHWAY 79 PO BOX 10 - Location 2	SoCal	367.3418284	1.24E+06	2	327.226484	25.171268
1493 S. Broadway - Location 2	SoCal	17599.21082	5.93E+07	2	302.027527	23.2328867
9990 EL CAMINO REAL - Location 2	SoCal	13681.81117	4.61E+07	2	355.88794	27.3759954

FCEV

Name	Production	Capacity	Stat Cost	Trips	Truck Miles	Truck Fuel
Truckee - Location 1	NorCal	1647.225117	5.55E+06	2	355.1936157	27.32258582
Saratoga - Location 1	NorCal	19216.33329	6.48E+07	2	129.9131369	9.993318225
West Sacramento - S. River Rd. - Location 1	NorCal	210.9340377	7.11E+05	2	154.587466	11.89134354
Woodside - Location 1	NorCal	84.85852091	2.86E+05	2	154.809764	11.90844338
San Jose - Location 1	NorCal	25526.4129	8.60E+07	4	223.4992966	17.19225358
Los Altos - Homestead Road - Location 1	NorCal	10109.31682	3.41E+07	2	135.4401791	10.41847531
Coalinga - Location 1	NorCal	29750	1.00E+08	4	542.3565136	41.71973181
San Ramon - Location 1	NorCal	11765.75515	3.97E+07	2	70.47732086	5.421332374
South San Francisco - Location 1	NorCal	12168.22699	4.10E+07	2	135.7412841	10.44163724
Campbell - Winchester - Location 1	NorCal	20604.61869	6.94E+07	2	128.3383651	9.872181931
Palo Alto - Location 1	NorCal	8746.73143	2.95E+07	2	130.5128526	10.0394502
Foster City - Foster City Blvd. - Location 1	NorCal	9810.614829	3.31E+07	2	113.6680925	8.743699421
Hayward - Location 1	NorCal	11544.15319	3.89E+07	2	86.77026291	6.674635609
Rohnert Park - Location 1	NorCal	278.3359486	9.38E+05	2	209.9557054	16.15043888
Mill Valley - Location 1	NorCal	1405.257106	4.74E+06	2	151.22776	11.63290462
Redwood City - Location 1	NorCal	7976.21606	2.69E+07	2	127.8673941	9.835953391
Mountain View - Leong Dr. - Location 1	NorCal	5430.460433	1.83E+07	2	121.1567623	9.319750944
25651 N HIGHWAY 99 - Location 1	NorCal	506.7265963	1.71E+06	2	102.9603695	7.92002842
1601 WEBSTER ST - Location 1	NorCal	18981.15396	6.40E+07	2	105.0029711	8.077151624
3255 MECARTNEY RD - Location 1	NorCal	4926.643271	1.66E+07	2	99.38510404	7.645008003
3177 DANVILLE BLVD - Location 1	NorCal	4893.669675	1.65E+07	2	83.04200286	6.387846374
402 N MAIN ST - Location 1	NorCal	1480.902416	4.99E+06	2	758.6509415	58.35776473
105 AMERICAN CANYON RD - Location 1	NorCal	5997.315352	2.02E+07	2	140.7896036	10.82996951
16201 CLOVERDALE RD - Location 1	NorCal	208.9944144	7.04E+05	2	475.8258113	36.60198549
3100 NORTH ST - Location 1	NorCal	2364.885751	7.97E+06	2	455.6002612	35.04617394
6644 HAPPY VALLEY RD - Location 1	NorCal	315.188792	1.06E+06	2	468.4175619	36.03212015
111 HOWELL MOUNTAIN RD - Location 1	NorCal	1983.26486	6.68E+06	2	213.7415731	16.44165947
2701 HILLCREST AVE - Location 1	NorCal	12111.0081	4.08E+07	2	42.10002483	3.238463448
2101 SOMERSVILLE RD - Location 1	NorCal	11944.6854	4.03E+07	2	48.16412849	3.704932961
7719 SOQUEL DR - Location 1	NorCal	5488.649133	1.85E+07	2	186.5583117	14.35063936
795 RIO DEL MAR BLVD - Location 1	NorCal	3373.489886	1.14E+07	2	189.4025585	14.56942758
3197 ALLIANCE RD - Location 1	NorCal	3299.299293	1.11E+07	2	672.4759181	51.72891678
1021 Shaffer Rd. - Location 1	NorCal	8773.401251	2.96E+07	2	143.4012607	11.03086621
2689 N BUHACH RD - Location 1	NorCal	3600.425816	1.21E+07	2	148.9857326	11.46044097
11911 DRY CREEK RD - Location 1	NorCal	2131.16114	7.18E+06	2	233.6886727	17.97605175
2280 Drive Inn Way - Location 1	NorCal	4244.380763	1.43E+07	2	230.600475	17.73849807
390 GRASS VALLEY HWY - Location 1	NorCal	7237.219569	2.44E+07	2	225.6878417	17.36060321
631 AUBURN FOLSOM RD - Location 1	NorCal	1589.521323	5.36E+06	2	227.128089	17.47139146

3575 Willow Pass Rd - Location 1	NorCal	9455.178853	3.19E+07	2	63.11203532	4.854771947
21919 STATE HIGHWAY 299 E - Location 1	NorCal	582.3719064	1.96E+06	2	489.6969981	37.66899985
2000 RALSTON AVE - Location 1	NorCal	10261.57725	3.46E+07	2	124.5622647	9.581712668
699 RALSTON AVE - Location 1	NorCal	14956.92044	5.04E+07	2	122.0813621	9.390874012
250 TIBURON BLVD - Location 1	NorCal	4053.327865	1.37E+07	2	154.5207864	11.88621434
9500 HIGHWAY 9 - Location 1	NorCal	2040.968654	6.88E+06	2	179.1318814	13.77937549
10 SOLANO SQ - Location 1	NorCal	7384.146037	2.49E+07	2	119.5425961	9.195584317
3009 ASHBY AVE - Location 1	NorCal	43463.07969	1.46E+08	4	215.8595199	16.60457845
17451 Hwy. 120 - Location 1	NorCal	367.558622	1.24E+06	2	177.5920369	13.66092591
454 B ST - Location 1	NorCal	737.0568674	2.48E+06	2	277.9540919	21.38108399
13980 HWY 128 - Location 1	NorCal	185.7189343	6.26E+05	2	342.6178759	26.35522122
13211 HWY 9 - Location 1	NorCal	1464.415618	4.94E+06	2	177.2648558	13.63575814
6481 LONE TREE WAY - Location 1	NorCal	11172.23041	3.77E+07	2	36.09988761	2.776914432
1480 BROADWAY - Location 1	NorCal	9108.956088	3.07E+07	2	126.9763041	9.767408007
1502 DISCOVERY BAY BLVD - Location 1	NorCal	1702.989288	5.74E+06	2	23.3702152	1.797708862
15031 BYRON HWY - Location 1	NorCal	96.49626092	3.25E+05	2	14.00031166	1.076947051
1108 LINCOLN AVE - Location 1	NorCal	2305.242334	7.77E+06	2	215.0370833	16.5413141
5450 PONY EXPRESS TRL - Location 1	NorCal	599.8285164	2.02E+06	2	259.3393163	19.94917818
337 E HAMILTON AVE - Location 1	NorCal	28877.11221	9.73E+07	4	248.3199771	19.1015367
3645 RIO RD - Location 1	NorCal	5813.051136	1.96E+07	2	263.6314243	20.27934033
27800 DORRIS DR - Location 1	NorCal	607.5870097	2.05E+06	2	270.4727657	20.80559736
38 W CARMEL VALLEY RD - Location 1	NorCal	1302.45707	4.39E+06	2	267.2035373	20.55411825
4101 MANZANITA AVE - Location 1	NorCal	13367.88403	4.50E+07	2	178.195656	13.70735816
18950 LAKE CHABOT RD - Location 1	NorCal	13259.26512	4.47E+07	2	79.8476536	6.1421272
2881 GROVE WAY - Location 1	NorCal	10350.31502	3.49E+07	2	75.64519059	5.818860814
11400 MERRITT ST - Location 1	NorCal	4014.050492	1.35E+07	2	225.0325656	17.31019735
2675 STATE HIGHWAY 140 - Location 1	NorCal	79.03965091	2.66E+05	2	205.5843935	15.81418412
314 MAIN ST - Location 1	NorCal	900.4701334	3.03E+06	2	454.7664162	34.98203202
1025 NORD AVE - Location 1	NorCal	12153.19491	4.10E+07	2	331.0301701	25.46385924
1111 FOREST AVE - Location 1	NorCal	7184.364833	2.42E+07	2	326.6189517	25.12453474
1198 EAST AVE - Location 1	NorCal	8770.491816	2.96E+07	2	329.8214705	25.37088234
1645 PARK AVE - Location 1	NorCal	8336.986	2.81E+07	2	324.4620304	24.95861773
3990 ESPLANADE - Location 1	NorCal	1028.000368	3.46E+06	2	336.8518256	25.91167889
2538 ESPLANADE - Location 1	NorCal	8603.199303	2.90E+07	2	331.0572518	25.46594244
1104 ROBERTSON BLVD - Location 1	NorCal	4515.92803	1.52E+07	2	192.8468897	14.83437613
7796 Sunrise Blvd. - Location 1	NorCal	17187.97218	5.79E+07	2	191.5069588	14.73130452
7147 Greenback Lane - Location 1	NorCal	15601.3603	5.26E+07	2	187.1011219	14.392394
15010 LAKESHORE DR. - Location 1	NorCal	1873.676142	6.31E+06	2	285.9317869	21.99475284
13430 E HIGHWAY 20 - Location 1	NorCal	1017.817345	3.43E+06	2	351.1950766	27.0150059
418 S CLOVERDALE BLVD - Location 1	NorCal	3291.055894	1.11E+07	2	283.3784863	21.7983451
1197 N WILLOW AVE - Location 1	NorCal	14501.10896	4.89E+07	2	269.4398962	20.72614586
2113 SHAW AVE - Location 1	NorCal	8316.13505	2.80E+07	2	274.5795278	21.12150214

1805 ASHLAN AVE - Location 1	NorCal	9628.290236	3.24E+07	2	274.8174146	21.13980112
2255 HERNDON AVE - Location 1	NorCal	8726.365385	2.94E+07	2	274.0278833	21.07906795
390 W SHAW AVE - Location 1	NorCal	16022.74347	5.40E+07	2	269.9093786	20.76225989
5020 N ACADEMY AVE - Location 1	NorCal	133.3491043	4.49E+05	2	290.8028189	22.36944761
301 E ELM AVE - Location 1	NorCal	5234.558476	1.76E+07	2	290.7970216	22.36900166
29580 YOSEMITE SPRINGS PKWY - Location 1	NorCal	305.0057695	1.03E+06	2	279.2210479	21.47854215
35335 Hwy. 41 - Location 1	NorCal	506.7265963	1.71E+06	2	290.4530429	22.34254176
655 MARKET ST - Location 1	NorCal	3409.372917	1.15E+07	2	288.6738609	22.20568161
800 OAK GROVE RD - Location 1	NorCal	11779.33251	3.97E+07	2	99.12871857	7.625286044
2799 CLAYTON RD - Location 1	NorCal	23140.19129	7.80E+07	2	103.8518949	7.9886073
2560 BATES AVENUE - Location 1	NorCal	3174.678494	1.07E+07	2	69.89016558	5.376166583
1024 ALBERTA WAY - Location 1	NorCal	5113.332017	1.72E+07	2	58.01283314	4.462525626
1500 KIRKER PASS RD - Location 1	NorCal	8355.897328	2.82E+07	2	56.36224092	4.335556994
2968 STATE HIGHWAY 49 - Location 1	NorCal	208.5095085	7.03E+05	2	238.1130653	18.31638964
522 MAIN ST - Location 1	NorCal	123.6509876	4.17E+05	2	140.42909	10.80223769
4720 Gold Hill Rd - Location 1	NorCal	3007.385981	1.01E+07	2	136.4017346	10.49244112
1425 SOLANO ST - Location 1	NorCal	3674.616408	1.24E+07	2	379.8043196	29.2157169
700 TAMALPAIS DR - Location 1	NorCal	6907.968508	2.33E+07	2	150.3548414	11.56575703
7716 OLD REDWOOD HWY - Location 1	NorCal	6949.185504	2.34E+07	2	205.0183954	15.7706458
315 HWY 101 SOUTH - Location 1	NorCal	1241.84384	4.19E+06	2	819.9550657	63.07346659
1500 NORTHCREST DR - Location 1	NorCal	2557.878273	8.62E+06	2	823.558657	63.35066592
900 US HIGHWAY 101 N - Location 1	NorCal	2750.870795	9.27E+06	2	822.439854	63.26460415
1245 POMONA ST - Location 1	NorCal	1477.02317	4.98E+06	2	134.8582092	10.3737084
10490 S DE ANZA BLVD - Location 1	NorCal	39109.11021	1.32E+08	4	267.5815079	20.58319292
198 DIABLO RD - Location 1	NorCal	7511.191365	2.53E+07	2	78.28664668	6.022049745
3500 CAMINO TASSAJARA - Location 1	NorCal	4732.196032	1.59E+07	2	76.71749626	5.901345866
811 CAMINO RAMON - Location 1	NorCal	4647.822417	1.57E+07	2	75.55290966	5.811762282
4810 CHILES RD - Location 1	NorCal	4020.354268	1.35E+07	2	173.3042229	13.33109407
705 RUSSELL BLVD - Location 1	NorCal	25207.82977	8.50E+07	4	362.4804602	27.88311232
4272 MAIN ST - Location 1	NorCal	2170.923418	7.32E+06	2	108.6076021	8.354430931
14830 HIGHWAY 4 - Location 1	NorCal	1544.425081	5.20E+06	2	19.27260715	1.482508243
1105 N 1ST ST - Location 1	NorCal	6711.09674	2.26E+07	2	193.0408202	14.84929386
2102 BLOSSOM ST - Location 1	NorCal	3101.457713	1.05E+07	2	179.1950701	13.78423616
11989 DUBLIN BLVD - Location 1	NorCal	10112.22626	3.41E+07	2	60.07680068	4.62129236
6400 DUBLIN BLVD - Location 1	NorCal	10142.77533	3.42E+07	2	56.97217099	4.382474692
4929 DUNSMUIR AVE - Location 1	NorCal	83.40380341	2.81E+05	2	578.4793218	44.49840937
9305 MIDWAY - Location 1	NorCal	861.1927608	2.90E+06	2	315.2256766	24.24812897
3160 CARLSON BLVD - Location 1	NorCal	26985.00965	9.09E+07	4	241.3113556	18.56241197
1021 SARATOGA WAY - Location 1	NorCal	4916.945155	1.66E+07	2	205.1007656	15.77698197
341 GREEN VALLEY RD - Location 1	NorCal	967.8720443	3.26E+06	2	204.4989057	15.73068505
10921 HWY 140 - Location 1	NorCal	189.598181	6.39E+05	2	280.0473492	21.54210378
5329 SAN PABLO DAM RD STE A - Location 1	NorCal	6484.160809	2.19E+07	2	134.7116893	10.36243763

8344 POWER INN RD - Location 1	NorCal	11596.52302	3.91E+07	2	138.5262099	10.6558623
9001 GRANTLINE RD - Location 1	NorCal	904.8342859	3.05E+06	2	135.6280061	10.43292354
9198 ELK GROVE FLORIN RD - Location 1	NorCal	7205.70069	2.43E+07	2	134.6438099	10.35721615
9615 WEST TARON DRIVE - Location 1	NorCal	6059.383299	2.04E+07	2	128.8091394	9.908395337
7401 Sheldon Rd - Location 1	NorCal	17307.25902	5.83E+07	2	140.2605235	10.78927104
8169 ELK GROVE BLVD - Location 1	NorCal	10232.96781	3.45E+07	2	136.910331	10.53156392
9100 HARBOUR POINT DR - Location 1	NorCal	5573.507654	1.88E+07	2	131.160323	10.08925561
8369 ELK GROVE FLORIN RD - Location 1	NorCal	12234.17419	4.12E+07	2	138.7725579	10.67481215
1512 WEISS WAY - Location 1	NorCal	3447.195572	1.16E+07	2	73.12823799	5.625249076
10 INDUSTRIAL PKWY - Location 1	NorCal	337.4944603	1.14E+06	2	727.0914132	55.93010871
4050 BROADWAY - Location 1	NorCal	4952.828186	1.67E+07	2	647.6497554	49.81921195
7769 MYRTLE AVE - Location 1	NorCal	387.924667	1.31E+06	2	663.5666271	51.0435867
803 4TH ST - Location 1	NorCal	8839.348444	2.98E+07	2	653.8340292	50.29492532
3973 WALNUT DR - Location 1	NorCal	1718.021369	5.79E+06	2	655.394263	50.41494331
11070 FAIR OAKS BLVD - Location 1	NorCal	9818.858228	3.31E+07	2	190.9489001	14.68837693
2985 PEABODY RD - Location 1	NorCal	2044.362995	6.89E+06	2	162.1818013	12.47552318
6325 HIGHWAY 9 - Location 1	NorCal	2116.613965	7.13E+06	2	173.0883565	13.31448896
1207 N ST - Location 1	NorCal	3296.874764	1.11E+07	2	204.0718945	15.69783804
1890 PRAIRIE CITY ROAD - Location 1	NorCal	8396.144512	2.83E+07	2	195.7166258	15.05512506
2495 Iron Point Road #11 - Location 1	NorCal	5420.27741	1.83E+07	2	200.0587769	15.38913668
19420 FORESTHILL RD - Location 1	NorCal	90.19248509	3.04E+05	2	250.1909352	19.24545656
24400 N HIGHWAY 1 - Location 1	NorCal	164.8679835	5.56E+05	2	460.8410094	35.44930842
700 S MAIN ST - Location 1	NorCal	4391.307231	1.48E+07	2	451.8733624	34.75948941
390 S FORTUNA BLVD - Location 1	NorCal	5345.601912	1.80E+07	2	617.4872576	47.49901981
327 W MERCED ST - Location 1	NorCal	2742.627396	9.24E+06	2	285.2886496	21.94528074
1830 FREEDOM BLVD - Location 1	NorCal	13871.70119	4.67E+07	2	210.104565	16.16188962
35900 FREMONT BLVD - Location 1	NorCal	16286.04733	5.49E+07	2	104.4917415	8.037826266
43411 GRIMMER BLVD - Location 1	NorCal	14680.52412	4.95E+07	2	93.383016	7.183308923
1848 WASHINGTON BLVD - Location 1	NorCal	11557.24564	3.89E+07	2	87.2882345	6.714479577
46840 WARM SPRINGS BLVD - Location 1	NorCal	11961.65711	4.03E+07	2	94.25779182	7.25059937
7264 N BLACKSTONE AVE - Location 1	NorCal	13908.06912	4.69E+07	2	261.5334937	20.11796105
1605 N CEDAR AVE - Location 1	NorCal	23539.7537	7.93E+07	2	268.8055239	20.67734799
384 W SHAW AVE - Location 1	NorCal	15135.8507	5.10E+07	2	260.9072845	20.06979111
1105 W SHIELDS AVE - Location 1	NorCal	21827.5512	7.36E+07	2	261.1024033	20.08480025
2615 S ELM AVE - Location 1	NorCal	7000.585522	2.36E+07	2	269.810747	20.75467285
603 G ST - Location 1	NorCal	19154.26534	6.45E+07	2	267.4931247	20.57639421
1014 E BULLARD AVE - Location 1	NorCal	18729.97274	6.31E+07	2	265.8962246	20.45355574
5480 W SHAW AVE - Location 1	NorCal	11110.64737	3.74E+07	2	251.8810988	19.37546914
5650 N FIGARDEN DR - Location 1	NorCal	9934.750723	3.35E+07	2	252.802709	19.44636223
10091 N MAPLE AVE - Location 1	NorCal	3900.097621	1.31E+07	2	270.0486983	20.77297679
9460 N SOMMERVILLE DR - Location 1	NorCal	7812.802794	2.63E+07	2	269.9459887	20.76507605

6735 N GOLDEN STATE BLVD - Location 1	NorCal	4458.224236	1.50E+07	2	246.9262558	18.99432737
2990 E CENTRAL AVE - Location 1	NorCal	2690.257566	9.07E+06	2	276.1424759	21.24172892
4602 E CHURCH AVE - Location 1	NorCal	11562.57961	3.90E+07	2	272.8658029	20.98967715
2593 S CLOVIS AVE - Location 1	NorCal	2340.64046	7.89E+06	2	281.6794169	21.66764745
5210 E TULARE AVE - Location 1	NorCal	17227.24956	5.81E+07	2	276.7977407	21.2921339
5687 E KINGS CANYON RD - Location 1	NorCal	5577.871806	1.88E+07	2	278.3604573	21.41234287
5993 E BELMONT AVE - Location 1	NorCal	2313.970639	7.80E+06	2	281.7074005	21.66980004
17822 N FRIANT RD - Location 1	NorCal	98.92079009	3.33E+05	2	263.663521	20.28180931
10450 TWIN CITIES RD - Location 1	NorCal	4736.075279	1.60E+07	2	113.0244766	8.694190511
700 C ST - Location 1	NorCal	5942.520993	2.00E+07	2	108.7905492	8.368503785
4710 MARSHALL RD - Location 1	NorCal	229.8453652	7.75E+05	2	264.2462354	20.3266335
1190 1ST ST - Location 1	NorCal	7545.134774	2.54E+07	2	177.3785375	13.64450289
401 LEAVESLEY RD - Location 1	NorCal	2954.531245	9.96E+06	2	173.6550849	13.35808345
7000 MONTEREY ST - Location 1	NorCal	8287.525605	2.79E+07	2	177.3258175	13.6404475
15195 ARNOLD DR - Location 1	NorCal	1896.466716	6.39E+06	2	191.4843579	14.729566
8555 AUBURN FOLSOM RD - Location 1	NorCal	2492.415986	8.40E+06	2	204.6717534	15.74398103
201 E MAIN ST - Location 1	NorCal	7859.353754	2.65E+07	2	282.898	21.76138461
1 KENT AVE - Location 1	NorCal	8061.074581	2.72E+07	2	151.8018299	11.67706384
348 EL CAMINO REAL - Location 1	NorCal	6412.879652	2.16E+07	2	299.1728096	23.01329305
505 VIRGINIA ST - Location 1	NorCal	3274.08419	1.10E+07	2	269.5225704	20.73250541
550 E GRIDLEY RD - Location 1	NorCal	264.2736794	8.91E+05	2	271.1877266	20.86059435
16383 MAIN ST - Location 1	NorCal	1053.700377	3.55E+06	2	249.7722909	19.21325315
12860 STATE HIGHWAY 33 - Location 1	NorCal	573.6436014	1.93E+06	2	123.6670663	9.512851254
780 SOUTH AVE - Location 1	NorCal	1728.689297	5.83E+06	2	112.060673	8.620051773
501 KELLY ST - Location 1	NorCal	5423.671751	1.83E+07	2	142.1610422	10.93546478
22810 FOOTHILL BLVD - Location 1	NorCal	17421.21189	5.87E+07	2	79.72587131	6.132759332
25757 SOTO RD - Location 1	NorCal	11031.12281	3.72E+07	2	83.04420561	6.388015816
438 W TENNYSON RD - Location 1	NorCal	14390.55043	4.85E+07	2	86.71677645	6.670521266
24350 HESPERIAN BLVD - Location 1	NorCal	8179.87651	2.76E+07	2	89.44574334	6.880441795
28250 HESPERIAN BLVD - Location 1	NorCal	8640.537052	2.91E+07	2	94.08676285	7.237443297
186 DRY CREEK RD - Location 1	NorCal	5609.390685	1.89E+07	2	252.3354512	19.41041932
3900 SAN PABLO AVE - Location 1	NorCal	7292.013929	2.46E+07	2	130.3244958	10.02496121
250 SAN BENITO ST - Location 1	NorCal	8389.840736	2.83E+07	2	205.4507678	15.80390521
591 TRES PINOS RD - Location 1	NorCal	7603.80838	2.56E+07	2	208.5652399	16.04347999
4232 CAMANCHE PKWY N - Location 1	NorCal	89.70757925	3.02E+05	2	134.3069941	10.33130723
5475 MAIN ST - Location 1	NorCal	1782.998751	6.01E+06	2	354.4131452	27.26254963
304 ARLINGTON AVE - Location 1	NorCal	14441.95045	4.87E+07	2	117.5460586	9.042004506
432 S MADERA AVE - Location 1	NorCal	6061.807828	2.04E+07	2	254.8095335	19.60073335
412 METZ RD - Location 1	NorCal	4768.079064	1.61E+07	2	325.0304665	25.00234358
50410 JOLON RD - Location 1	NorCal	1227.296665	4.14E+06	2	321.6754902	24.74426847
3317 STATE HIGHWAY 132 - Location 1	NorCal	86.79814425	2.93E+05	2	162.6018878	12.50783752
3546 MT DIABLO BLVD - Location 1	NorCal	5336.388701	1.80E+07	2	96.92520334	7.455784872

3632 MT DIABLO BLVD - Location 1	NorCal	1754.389307	5.91E+06	2	97.61305752	7.508696733
3740 LAKESHORE BLVD - Location 1	NorCal	677.8983556	2.28E+06	2	356.2455182	27.4035014
202 S. Main St. - Location 1	NorCal	2844.457621	9.59E+06	2	349.3571724	26.87362865
140 LATHROP RD - Location 1	NorCal	5347.056629	1.80E+07	2	41.92639013	3.225106933
16500 S HARLAN RD - Location 1	NorCal	2777.05571	9.36E+06	2	40.20287162	3.092528586
151 JOINER PKWY - Location 1	NorCal	5236.013193	1.76E+07	2	219.7430653	16.90331271
945 TWELVE BRIDGE DR - Location 1	NorCal	4182.797722	1.41E+07	2	214.7452425	16.51886481
18754 E HIGHWAY 26 - Location 1	NorCal	919.3814609	3.10E+06	2	85.69565509	6.591973468
10020 LIVE OAK BLVD - Location 1	NorCal	3706.135288	1.25E+07	2	255.9615209	19.68934776
1175 CATALINA DR - Location 1	NorCal	8232.731246	2.77E+07	2	46.80040656	3.600031274
533 EXCHANGE CT - Location 1	NorCal	1786.877998	6.02E+06	2	39.24631727	3.018947482
951 N VASCO RD - Location 1	NorCal	7727.459367	2.60E+07	2	36.43391703	2.802609002
13975 E. Hwy 88 - Location 1	NorCal	1069.217364	3.60E+06	2	104.7241825	8.055706347
2420 W TURNER RD - Location 1	NorCal	8470.820011	2.85E+07	2	96.93794461	7.45676497
401 W Kettleman Lane - Location 1	NorCal	15218.76959	5.13E+07	2	89.38071654	6.875439734
3430 Taylor Road - Location 1	NorCal	3385.612532	1.14E+07	2	210.1994848	16.16919114
330 S SAN ANTONIO RD - Location 1	NorCal	6550.592909	2.21E+07	2	127.7608628	9.827758678
401 MAIN ST - Location 1	NorCal	6066.171981	2.04E+07	2	128.2419626	9.864766357
929 Fremont Blvd - Location 1	NorCal	7957.304733	2.68E+07	2	127.5430336	9.811002584
140 W PACHECO BLVD - Location 1	NorCal	6408.515499	2.16E+07	2	144.0729136	11.08253181
403 Mercy Springs - Location 1	NorCal	9664.658173	3.26E+07	2	147.2891566	11.32993512
255 LOS GATOS SARATOGA RD - Location 1	NorCal	11243.99647	3.79E+07	2	135.1916823	10.39936018
7948 HWY 99 EAST - Location 1	NorCal	691.9606248	2.33E+06	2	401.5380201	30.88754001
101 S GATEWAY DR - Location 1	NorCal	13308.24061	4.48E+07	2	222.7791677	17.13685905
12893 HIGHWAY 145 - Location 1	NorCal	4959.131962	1.67E+07	2	225.7145137	17.3626549
22717 AVENUE 18 1/2 - Location 1	NorCal	230.8151769	7.78E+05	2	211.5151243	16.27039417
37019 AVENUE 12 - Location 1	NorCal	1556.062821	5.24E+06	2	245.3230156	18.8710012
6895 HIGHWAY 145 - Location 1	NorCal	121.7113643	4.10E+05	2	237.8490558	18.29608122
8104 ROAD 24 - Location 1	NorCal	190.5679927	6.42E+05	2	241.823836	18.60183354
1502 E YOSEMITE AVE - Location 1	NorCal	5826.143593	1.96E+07	2	223.7267689	17.20975145
16981 ROAD 26 - Location 1	NorCal	3690.618301	1.24E+07	2	218.7714269	16.8285713
13990 LAKERIDGE CIR - Location 1	NorCal	2052.121489	6.92E+06	2	344.0715252	26.4670404
14972 SKYWAY - Location 1	NorCal	1428.047681	4.81E+06	2	349.0773618	26.85210476
14800 S HIGHWAY 99 W. FRONTAGE RD - Location 1	NorCal	5796.564337	1.95E+07	2	49.79747992	3.830575379
505 N MAIN ST - Location 1	NorCal	17425.57604	5.87E+07	2	49.5760033	3.813538715
3076 DEL MONTE BLVD - Location 1	NorCal	3223.169077	1.09E+07	2	237.9676895	18.30520688
310 RESERVATION RD - Location 1	NorCal	4739.469619	1.60E+07	2	238.2374561	18.32595816
3939 Bootjack Lane - Location 1	NorCal	577.522848	1.95E+06	2	239.8300141	18.44846262
5099 HWY 140 - Location 1	NorCal	1382.466532	4.66E+06	2	229.8864924	17.68357634
5987 MEADOW LN - Location 1	NorCal	112.0132476	3.77E+05	2	254.1202755	19.5477135
1175 MUIR RD - Location 1	NorCal	8560.52759	2.88E+07	2	108.6967533	8.361288713
3700 ALHAMBRA AVE - Location 1	NorCal	5147.275426	1.73E+07	2	113.2013829	8.707798686

81 CENTER AVE - Location 1	NorCal	10119.49985	3.41E+07	2	104.2260783	8.017390636
11269 LOMA RICA RD - Location 1	NorCal	120.7415526	4.07E+05	2	272.392556	20.95327354
1201 B ST - Location 1	NorCal	7627.568766	2.57E+07	2	242.6960827	18.66892944
44275 STATE HIGHWAY 299 E - Location 1	NorCal	120.2566468	4.05E+05	2	617.6158578	47.50891214
117 SQUAW VALLEY RD - Location 1	NorCal	258.9397152	8.73E+05	2	608.7248264	46.82498665
16707 PLACER HILLS RD - Location 1	NorCal	278.8208544	9.40E+05	2	240.9689063	18.53606972
1380 EL CAMINO REAL - Location 1	NorCal	19076.68041	6.43E+07	2	127.3801906	9.798476199
3600 ALAMEDA DE LAS PULGAS - Location 1	NorCal	8835.954103	2.98E+07	2	130.3767087	10.02897759
1400 YOSEMITE PKWY - Location 1	NorCal	4147.399596	1.40E+07	2	163.4839449	12.57568807
1480 W 16TH ST - Location 1	NorCal	8617.746478	2.90E+07	2	154.2876623	11.86828171
1970 E CHILDS AVE - Location 1	NorCal	6088.962555	2.05E+07	2	160.9652543	12.38194264
3006 G ST - Location 1	NorCal	8771.946533	2.96E+07	2	159.5049776	12.26961366
5684 G ST - Location 1	NorCal	447.0831788	1.51E+06	2	167.2006147	12.86158575
369 S STATE HIGHWAY 59 - Location 1	NorCal	6110.298412	2.06E+07	2	157.7625479	12.13558061
1050 W OLIVE AVE - Location 1	NorCal	6965.187397	2.35E+07	2	156.4251251	12.03270193
1107 W OLIVE AVE - Location 1	NorCal	1874.645953	6.32E+06	2	156.2818369	12.02167976
2980 BEACHWOOD DR - Location 1	NorCal	2286.331006	7.70E+06	2	152.6303355	11.74079504
2986 US HIGHWAY 50 - Location 1	NorCal	886.4078642	2.99E+06	2	342.8742198	26.37493999
18696 PUTAH LN - Location 1	NorCal	799.1248141	2.69E+06	2	257.9065898	19.83896845
21026 HWY 29 - Location 1	NorCal	796.2153791	2.68E+06	2	250.5560823	19.27354479
251 SHORELINE HWY - Location 1	NorCal	3336.152136	1.12E+07	2	150.64047	11.58772846
340 MILLER AVE - Location 1	NorCal	5481.860451	1.85E+07	2	156.2935996	12.02258459
5 EL CAMINO REAL - Location 1	NorCal	12875.2197	4.34E+07	2	130.0827848	10.00636806
1885 N. Milpitas Blvd - Location 1	NorCal	11108.70775	3.74E+07	2	99.4797407	7.652287746
97 S ABBOTT AVE - Location 1	NorCal	24537.205	8.27E+07	2	103.8427312	7.987902401
3037 SISK RD - Location 1	NorCal	11425.35126	3.85E+07	2	69.84500429	5.372692638
937 PARADISE RD - Location 1	NorCal	8328.742601	2.81E+07	2	80.86501654	6.220385888
2501 OAKDALE RD - Location 1	NorCal	18493.33869	6.23E+07	2	82.95712353	6.381317194
4000 E. Briggsmore Ave. - Location 1	NorCal	7873.416023	2.65E+07	2	85.68734634	6.591334334
8026 HIGHWAY 49 - Location 1	NorCal	190.0830868	6.41E+05	2	149.1697953	11.47459964
1401 MUNRAS AVE - Location 1	NorCal	10039.49038	3.38E+07	2	257.140359	19.78002761
425 CANYON DEL REY BLVD - Location 1	NorCal	3692.557924	1.24E+07	2	254.8564688	19.60434375
1135 MORAGA WAY - Location 1	NorCal	2576.789601	8.68E+06	2	107.1176041	8.239815699
1455 MORAGA WAY - Location 1	NorCal	2298.453652	7.75E+06	2	106.2584445	8.173726502
425 MORAGA RD - Location 1	NorCal	3392.886119	1.14E+07	2	102.6096197	7.89304767
17005 CONDIT RD - Location 1	NorCal	4478.105375	1.51E+07	2	156.1888761	12.01452893
18605 MONTEREY ST - Location 1	NorCal	5548.29255	1.87E+07	2	154.4944069	11.88418515
6579 RAILROAD FLAT RD - Location 1	NorCal	292.3982178	9.85E+05	2	169.3824251	13.02941731
584 N RENGSTORFF AVE - Location 1	NorCal	26192.18861	8.83E+07	4	251.7656482	19.36658832
138 E HIGHWAY 4 - Location 1	NorCal	896.5908867	3.02E+06	2	176.573924	13.58260954
603 Lincoln Ave. - Location 1	NorCal	7656.663116	2.58E+07	2	167.8717456	12.9132112

2005 REDWOOD RD - Location 1	NorCal	12921.77066	4.35E+07	2	171.5449446	13.19576497
2896 1ST ST - Location 1	NorCal	6104.479542	2.06E+07	2	169.2225686	13.01712066
630 TRANCAS ST - Location 1	NorCal	4331.178907	1.46E+07	2	170.7881954	13.13755349
301 SACRAMENTO ST - Location 1	NorCal	3336.637042	1.12E+07	2	290.0277388	22.30982606
5502 THORNTON AVE - Location 1	NorCal	18226.64048	6.14E+07	2	106.4017581	8.184750622
6104 JARVIS AVE - Location 1	NorCal	6347.417364	2.14E+07	2	105.306139	8.10047223
9300 CHANTRY HILL RD - Location 1	NorCal	609.0417272	2.05E+06	2	217.6376505	16.74135773
1459 N ST - Location 1	NorCal	4519.322371	1.52E+07	2	102.7312435	7.902403348
7550 Watt Ave. - Location 1	NorCal	16217.67561	5.47E+07	2	183.7503423	14.13464171
7300 REDWOOD BLVD - Location 1	NorCal	6798.37979	2.29E+07	2	167.8909943	12.91469187
1390 S NOVATO BLVD - Location 1	NorCal	5164.732036	1.74E+07	2	165.7630244	12.75100188
2085 NOVATO BLVD - Location 1	NorCal	5964.341756	2.01E+07	2	170.7228574	13.13252749
1590 W F ST - Location 1	NorCal	4746.743207	1.60E+07	2	93.48664485	7.191280373
40049 HIGHWAY 49 - Location 1	NorCal	1210.324961	4.08E+06	2	305.2563967	23.48126129
40475 HIGHWAY 41 - Location 1	NorCal	1376.647662	4.64E+06	2	306.0369571	23.54130439
3609 INTERNATIONAL BLVD - Location 1	NorCal	43466.95894	1.46E+08	4	196.4579187	15.11214759
9750 GOLF LINKS RD - Location 1	NorCal	25539.50536	8.61E+07	4	178.3163834	13.71664487
2240 MOUNTAIN BLVD - Location 1	NorCal	17570.07798	5.92E+07	2	101.3586145	7.796816503
2225 TELEGRAPH AVE - Location 1	NorCal	63327.73208	2.13E+08	6	318.5068327	24.50052559
4150 REDWOOD RD - Location 1	NorCal	11392.37766	3.84E+07	2	97.06032144	7.466178572
5545 BRIDGEHEAD RD - Location 1	NorCal	1756.813836	5.92E+06	2	43.06632025	3.312793865
8696 GREENBACK LN - Location 1	NorCal	10208.72252	3.44E+07	2	193.852942	14.91176477
9301 GREENBACK LN - Location 1	NorCal	7551.43855	2.54E+07	2	196.9303658	15.14848968
67 MORAGA WAY - Location 1	NorCal	4776.322463	1.61E+07	2	104.7770675	8.059774427
1408 ORO DAM BLVD W - Location 1	NorCal	1860.583684	6.27E+06	2	296.4781353	22.80601041
2030 3RD ST - Location 1	NorCal	3018.538815	1.02E+07	2	301.9363642	23.22587417
2125 MONTE VISTA AVE - Location 1	NorCal	1756.32893	5.92E+06	2	296.8723088	22.83633145
2301 ORO DAM BLVD - Location 1	NorCal	6227.645623	2.10E+07	2	301.9051289	23.22347145
3296 FOOTHILL BLVD - Location 1	NorCal	1081.340009	3.64E+06	2	308.2578473	23.7121421
100 MILAGRA DR - Location 1	NorCal	3077.697327	1.04E+07	2	149.8975871	11.53058363
505 LINDA MAR BLVD - Location 1	NorCal	3262.931356	1.10E+07	2	157.2129977	12.09330752
679 HICKEY BLVD - Location 1	NorCal	20828.64518	7.02E+07	2	147.4211911	11.34009162
765 ODDSTAD BLVD - Location 1	NorCal	3677.525843	1.24E+07	2	160.0082878	12.30832983
2101 UNIVERSITY AVE - Location 1	NorCal	23088.79128	7.78E+07	2	122.0289374	9.386841341
2200 EL CAMINO REAL - Location 1	NorCal	18472.00283	6.23E+07	2	129.3037216	9.94644012
5531 PENTZ RD - Location 1	NorCal	1283.060836	4.32E+06	2	338.0236426	26.00181866
5734 CLARK RD - Location 1	NorCal	2237.840423	7.54E+06	2	332.6209075	25.58622365
7575 SKYWAY - Location 1	NorCal	3506.83899	1.18E+07	2	335.8471467	25.8343959
590 FRESNO ST - Location 1	NorCal	5878.513423	1.98E+07	2	305.041401	23.46472315
10143 GRAYSON RD - Location 1	NorCal	517.3945247	1.74E+06	2	67.32877476	5.17913652
10067 PLEASANT VALLEY RD - Location 1	NorCal	495.0888563	1.67E+06	2	299.2772726	23.02132867
1440 E WASHINGTON ST - Location 1	NorCal	7679.45369	2.59E+07	2	189.4097946	14.5699842

421 WASHINGTON ST - Location 1	NorCal	8685.148389	2.93E+07	2	189.9039248	14.60799422
5153 OLD REDWOOD HWY - Location 1	NorCal	4549.386533	1.53E+07	2	195.0915473	15.0070421
2601 Lakeville Hwy. - Location 1	NorCal	5509.500084	1.86E+07	2	188.7739734	14.52107488
2695 PINOLE VALLEY RD - Location 1	NorCal	9280.612753	3.13E+07	2	136.6873126	10.51440866
2150 RAILROAD AVE - Location 1	NorCal	15787.07923	5.32E+07	2	54.16028185	4.166175527
3943 MISSOURI FLAT RD - Location 1	NorCal	1860.098778	6.27E+06	2	232.9851756	17.92193658
2686 PLEASANT HILL RD - Location 1	NorCal	9878.501646	3.33E+07	2	102.4726847	7.882514208
1875 VALLEY AVE - Location 1	NorCal	4627.941278	1.56E+07	2	65.69597609	5.053536622
6750 SANTA RITA RD - Location 1	NorCal	11206.65872	3.78E+07	2	53.6490764	4.126852031
11401 STATE RTE 1 - Location 1	NorCal	454.3567663	1.53E+06	2	189.1582381	14.5506337
6529 PONY EXPRESS TRL - Location 1	NorCal	969.8116676	3.27E+06	2	264.3606889	20.33543761
104 LA MESA DR - Location 1	NorCal	757.9078182	2.55E+06	2	134.481042	10.34469554
10010 MAIN ST - Location 1	NorCal	240.0283877	8.09E+05	2	375.1898584	28.86075834
29478 AUBERRY RD - Location 1	NorCal	95.52644926	3.22E+05	2	297.6105639	22.8931203
10246 MILLS STATION RD - Location 1	NorCal	10323.6452	3.48E+07	2	176.632375	13.58710577
2401 SUNRISE BLVD - Location 1	NorCal	10302.79425	3.47E+07	2	181.8255676	13.98658212
2896 ZINFANDEL DR - Location 1	NorCal	11099.97944	3.74E+07	2	179.0723536	13.77479643
3096 SUNRISE BLVD. - Location 1	NorCal	5408.63967	1.82E+07	2	180.0718988	13.85168452
1 SUTTER ST - Location 1	NorCal	2448.774461	8.25E+06	2	410.1224429	31.54788022
11625 HWY 99 E - Location 1	NorCal	80.00946258	2.70E+05	2	428.0428718	32.92637475
15 ANTELOPE BLVD - Location 1	NorCal	4899.003639	1.65E+07	2	414.4166511	31.87820393
2155 NORTH MAIN ST - Location 1	NorCal	2050.181865	6.91E+06	2	416.0671458	32.00516506
1720 PLEASANT ST - Location 1	NorCal	3614.972991	1.22E+07	2	479.5229241	36.88637878
1860 EUREKA WAY - Location 1	NorCal	7344.868664	2.48E+07	2	477.596269	36.73817454
7036 WESTSIDE RD - Location 1	NorCal	2718.86701	9.16E+06	2	467.2412129	35.94163176
1670 Hartnell Ave. - Location 1	NorCal	5559.445384	1.87E+07	2	473.7529032	36.44253101
19483 KNIGHTON RD - Location 1	NorCal	904.34938	3.05E+06	2	461.4827487	35.49867298
2951 BECHELL LANE - Location 1	NorCal	6221.826753	2.10E+07	2	472.7080772	36.36215978
11113 BLACK MARBLE WAY - Location 1	NorCal	3878.276859	1.31E+07	2	477.0792234	36.6984018
1120 CHURN CREEK RD - Location 1	NorCal	4841.78475	1.63E+07	2	474.6275898	36.5098146
14361 HOLIDAY RD - Location 1	NorCal	405.3812771	1.37E+06	2	490.240503	37.71080792
1495 Lake Blvd - Location 1	NorCal	2466.715977	8.31E+06	2	482.5638528	37.12029637
19973 COLLEGE VIEW DR - Location 1	NorCal	1965.80825	6.62E+06	2	481.5239194	37.04030149
3139 JEFFERSON AVE - Location 1	NorCal	11552.39658	3.89E+07	2	131.7088808	10.13145237
590 CANYON RD - Location 1	NorCal	1733.538356	5.84E+06	2	131.5160504	10.11661926
1101 BROADWAY ST - Location 1	NorCal	17932.30264	6.04E+07	2	127.4508382	9.803910628
8551 EAST RD - Location 1	NorCal	669.6549565	2.26E+06	2	358.7554445	27.59657265
1720 E DINUBA AVE - Location 1	NorCal	2537.997134	8.55E+06	2	315.5943634	24.27648949
22012 E MANNING AVE - Location 1	NorCal	109.1038126	3.68E+05	2	318.6971278	24.51516368
12890 SAN PABLO AVE - Location 1	NorCal	17958.97246	6.05E+07	2	126.8742228	9.759555601
582 WILDWOOD AVE - Location 1	NorCal	886.4078642	2.99E+06	2	601.59932	46.27687077
6007 DRY CREEK RD - Location 1	NorCal	2958.895398	9.97E+06	2	176.8762084	13.60586218

6401 RIO LINDA BLVD - Location 1	NorCal	4381.124208	1.48E+07	2	175.3218738	13.48629799
3800 ROCKLIN RD - Location 1	NorCal	7813.2877	2.63E+07	2	204.6504632	15.74234332
718 4TH ST - Location 1	NorCal	3879.24667	1.31E+07	2	130.9625135	10.0740395
1484 EAST COTATI - Location 1	NorCal	10987.96619	3.70E+07	2	207.2411683	15.94162833
4990 COMMERCE BLVD - Location 1	NorCal	3160.616225	1.07E+07	2	209.7360684	16.13354372
1813 TAYLOR RD - Location 1	NorCal	16289.44167	5.49E+07	2	196.3103478	15.10079599
9035 WOODCREEK OAKS BLVD - Location 1	NorCal	4391.792137	1.48E+07	2	209.0392956	16.07994581
1261 PLEASANT GROVE BLVD - Location 1	NorCal	7641.146129	2.58E+07	2	200.6131842	15.4317834
3998 FOOTHILLS BLVD - Location 1	NorCal	10022.51868	3.38E+07	2	197.4958587	15.19198913
809 20TH ST - Location 1	NorCal	44154.55541	1.49E+08	4	313.6489747	24.12684421
2600 RIO LINDA BLVD - Location 1	NorCal	16735.07014	5.64E+07	2	162.5201227	12.5015479
6441 FOLSOM BLVD - Location 1	NorCal	24059.57276	8.11E+07	2	162.7040096	12.51569305
3701 FRANKLIN BLVD - Location 1	NorCal	25728.13373	8.67E+07	4	303.8990874	23.37685287
4300 WATT AVE - Location 1	NorCal	11575.18716	3.90E+07	2	175.5356644	13.50274341
4050 FLORIN RD - Location 1	NorCal	15188.22053	5.12E+07	2	146.7827692	11.29098225
7595 FRANKLIN BLVD - Location 1	NorCal	14871.09211	5.01E+07	2	144.8933997	11.14564613
2600 ARDEN WAY - Location 1	NorCal	24082.36333	8.12E+07	2	167.1765724	12.85973634
5500 FLORIN PERKINS RD - Location 1	NorCal	6911.847755	2.33E+07	2	168.1691997	12.93609228
3300 BRADSHAW RD - Location 1	NorCal	11243.51157	3.79E+07	2	171.219525	13.17073269
9700 JACKSON RD - Location 1	NorCal	5778.622821	1.95E+07	2	172.0439931	13.23415332
8121 FLORIN RD - Location 1	NorCal	13633.12752	4.59E+07	2	144.8508855	11.14237581
7596 BRADSHAW RD - Location 1	NorCal	2856.095361	9.63E+06	2	149.0505522	11.46542709
6431 RIVERSIDE BLVD - Location 1	NorCal	13039.11787	4.39E+07	2	145.4856545	11.19120419
1481 MEADOWVIEW RD - Location 1	NorCal	12291.39307	4.14E+07	2	139.5425533	10.73404256
1599 W EL CAMINO AVE - Location 1	NorCal	13735.44265	4.63E+07	2	159.7882918	12.29140706
2828 EL CENTRO RD - Location 1	NorCal	6861.417548	2.31E+07	2	163.7662967	12.59740744
2221 Del Paso Road - Location 1	NorCal	11529.60601	3.89E+07	2	166.8141176	12.8318552
4200 NORWOOD AVE - Location 1	NorCal	10133.07721	3.41E+07	2	168.5178318	12.96291014
4700 MADISON AVE - Location 1	NorCal	16637.60406	5.61E+07	2	179.447025	13.80361731
5764 ANTELOPE RD - Location 1	NorCal	11900.07407	4.01E+07	2	190.3218813	14.64014471
3480 FAIR OAKS BLVD - Location 1	NorCal	11800.18347	3.98E+07	2	169.5266374	13.04051057
4530 KIERNAN AVE - Location 1	NorCal	7203.761067	2.43E+07	2	64.96941297	4.997647152
1020 TERVEN AVE - Location 1	NorCal	10379.40937	3.50E+07	2	234.4071318	18.03131783
1512 CONSTITUTION BLVD - Location 1	NorCal	6515.679689	2.20E+07	2	232.8195963	17.90919971
975 N SANBORN RD - Location 1	NorCal	16425.70021	5.54E+07	2	235.0642428	18.08186483
2047 N MAIN ST - Location 1	NorCal	14580.63352	4.91E+07	2	224.521114	17.27085492
306 N MAIN ST - Location 1	NorCal	24468.83328	8.25E+07	2	230.3057413	17.71582625
307 SAN JUAN GRADE RD - Location 1	NorCal	1929.925218	6.50E+06	2	224.8222053	17.29401579
1040 EL CAMINO REAL N - Location 1	NorCal	574.1285072	1.93E+06	2	214.1663632	16.47433563
2347 SAN MIGUEL CANYON RD - Location 1	NorCal	1888.223317	6.36E+06	2	213.9478128	16.45752406
2 CORRAL DE TIERRA RD - Location 1	NorCal	501.877538	1.69E+06	2	247.8376186	19.0644322

22760 PORTOLA DR - Location 1	NorCal	609.5266331	2.05E+06	2	242.5148564	18.65498895
1098 EL CAMINO REAL - Location 1	NorCal	11394.31728	3.84E+07	2	125.9451302	9.688086939
300 FIFTH ST - Location 1	NorCal	86188.13271	2.90E+08	8	500.4091012	38.49300778
2559 VAN NESS AVE - Location 1	NorCal	77169.85401	2.60E+08	8	524.5897831	40.35306024
1298 VALENCIA ST - Location 1	NorCal	56716.04104	1.91E+08	6	389.5609429	29.96622638
2099 SAN JOSE AVE - Location 1	NorCal	46688.6733	1.57E+08	4	272.6643669	20.97418207
3501 GEARY BLVD - Location 1	NorCal	67989.13186	2.29E+08	6	399.1539709	30.70415161
3701 NORIEGA ST - Location 1	NorCal	36126.45443	1.22E+08	4	299.8005076	23.06157751
3800 3RD ST - Location 1	NorCal	22021.51354	7.42E+07	2	131.0633996	10.08179997
447 E WILLIAM ST - Location 1	NorCal	52602.09994	1.77E+08	6	364.0509501	28.00391924
3010 ALMADEN EXPY - Location 1	NorCal	26689.21709	8.99E+07	4	259.4058393	19.95429533
3197 SILVER CREEK RD - Location 1	NorCal	19625.59381	6.61E+07	2	124.5312415	9.579326273
102 POUGHKEEPSIE RD - Location 1	NorCal	16702.58145	5.63E+07	2	132.7194214	10.20918626
4144 MONTEREY HWY - Location 1	NorCal	25870.21114	8.72E+07	4	257.3861123	19.79893171
6095 CAHALAN AVE - Location 1	NorCal	19209.0597	6.47E+07	2	135.9043573	10.45418133
6499 CAMDEN AVE - Location 1	NorCal	12414.07425	4.18E+07	2	139.8240023	10.75569248
1777 BLOSSOM HILL RD - Location 1	NorCal	19738.57687	6.65E+07	2	136.3950807	10.49192928
1510 MOUNT PLEASANT DR - Location 1	NorCal	7860.808472	2.65E+07	2	120.2104648	9.246958828
401 S SARATOGA AVE - Location 1	NorCal	25812.50734	8.70E+07	4	249.1372775	19.16440596
1601 N CAPITOL AVE - Location 1	NorCal	25038.59763	8.44E+07	4	216.8369309	16.67976391
3295 SIERRA RD - Location 1	NorCal	12084.33828	4.07E+07	2	113.2145684	8.708812951
7022 SANTA TERESA BLVD - Location 1	NorCal	9926.992229	3.35E+07	2	136.8983518	10.53064245
2701 MCKEE RD - Location 1	NorCal	22521.93636	7.59E+07	2	113.3068443	8.715911102
3295 S WHITE RD - Location 1	NorCal	22497.69106	7.58E+07	2	127.0241142	9.771085705
1088 MARINA BLVD - Location 1	NorCal	26691.15672	8.99E+07	4	174.3984651	13.41526654
15199 WASHINGTON AVE - Location 1	NorCal	26112.66406	8.80E+07	4	168.3220433	12.94784949
13235 MONTEREY HWY - Location 1	NorCal	937.3229767	3.16E+06	2	164.8418867	12.68014513
230 S EL CAMINO REAL - Location 1	NorCal	22869.61384	7.71E+07	2	120.2318356	9.248602739
700 POLHEMUS RD - Location 1	NorCal	6608.781609	2.23E+07	2	123.9360448	9.533541906
1522 RUMRILL BLVD - Location 1	NorCal	14913.76382	5.03E+07	2	131.1969426	10.09207251
16400 SAN PABLO AVE - Location 1	NorCal	8922.752248	3.01E+07	2	137.8286755	10.6022058
1320 2ND ST - Location 1	NorCal	10529.24527	3.55E+07	2	147.3732104	11.3364008
831 E FRANCISCO BLVD - Location 1	NorCal	7824.440534	2.64E+07	2	144.913394	11.14718416
100 MARINWOOD AVE - Location 1	NorCal	3375.429509	1.14E+07	2	155.987515	11.99903961
1005 NORTHGATE DR - Location 1	NorCal	5596.783134	1.89E+07	2	152.4799334	11.72922565
170 MERRYDALE RD - Location 1	NorCal	3946.163675	1.33E+07	2	150.375083	11.56731407
13015 E KINGS CANYON RD - Location 1	NorCal	118.8019293	4.00E+05	2	295.2015973	22.70781517
1305 JENSEN AVE - Location 1	NorCal	10948.20392	3.69E+07	2	297.6725479	22.8978883
3499 EL CAMINO REAL - Location 1	NorCal	42201.35472	1.42E+08	4	242.5516494	18.65781918
3471 LAFAYETTE ST - Location 1	NorCal	30952.02428	1.04E+08	4	228.3470233	17.56515564
5390 GREAT AMERICA PARKWAY - Location 1	NorCal	10320.25086	3.48E+07	2	111.276423	8.559724847

1319 OCEAN ST - Location 1	NorCal	12564.39506	4.23E+07	2	174.8129602	13.44715079
1725 MISSION ST - Location 1	NorCal	11683.32116	3.94E+07	2	178.314681	13.71651392
1200 17TH AVE - Location 1	NorCal	8953.301315	3.02E+07	2	180.5605913	13.88927626
1500 SOQUEL DR - Location 1	NorCal	5180.733928	1.75E+07	2	177.7949014	13.67653088
28991 WEST GONZAGA RD - Location 1	NorCal	108.6189068	3.66E+05	2	130.2715148	10.02088576
440 HEARN AVE - Location 1	NorCal	10944.80957	3.69E+07	2	216.7044253	16.66957117
701 MENDOCINO AVE - Location 1	NorCal	16486.79835	5.56E+07	2	221.6469555	17.0497658
2225 CLEVELAND AVE - Location 1	NorCal	15976.67741	5.38E+07	2	223.3347849	17.17959884
4840 OLD REDWOOD HWY - Location 1	NorCal	3491.322003	1.18E+07	2	230.5307316	17.7331332
4925 SONOMA HWY - Location 1	NorCal	12789.39137	4.31E+07	2	227.2093995	17.47764612
2799 YULUPA AVE - Location 1	NorCal	5951.249298	2.01E+07	2	224.5768169	17.27513976
3453 CLEVELAND AVE - Location 1	NorCal	9342.6807	3.15E+07	2	225.803929	17.369533
365 TODD RD - Location 1	NorCal	1705.898723	5.75E+06	2	214.0440044	16.46492342
14395 BIG BASIN WAY - Location 1	NorCal	5296.141517	1.78E+07	2	135.0008951	10.38468424
1 HACIENDA DR - Location 1	NorCal	3195.529445	1.08E+07	2	163.0632549	12.5433273
90 MOUNT HERMON RD - Location 1	NorCal	2205.836638	7.43E+06	2	166.5605002	12.81234617
2000 DEL MONTE BLVD - Location 1	NorCal	13969.16726	4.71E+07	2	247.975533	19.075041
1080 GRAVENSTEIN HWY S - Location 1	NorCal	1442.10995	4.86E+06	2	219.2470947	16.86516113
4115 GRAVENSTEIN HWY NORTH - Location 1	NorCal	827.7342583	2.79E+06	2	229.7992011	17.67686162
7101 WILTON AVE - Location 1	NorCal	5101.209372	1.72E+07	2	221.578091	17.04446854
10610 E MOUNTAIN VIEW AVE - Location 1	NorCal	624.5587139	2.10E+06	2	299.9304823	23.07157557
2921 WHITSON ST - Location 1	NorCal	11028.21338	3.72E+07	2	294.9976354	22.6921258
4833 SHASTA DAM BLVD - Location 1	NorCal	2262.57062	7.62E+06	2	488.1241182	37.5480091
41801 TOLLHOUSE RD - Location 1	NorCal	176.9906293	5.96E+05	2	332.8088752	25.6006827
2643 CAMERON PARK DR - Location 1	NorCal	3382.703097	1.14E+07	2	217.887204	16.76055415
4021 MOTHER LODE DR - Location 1	NorCal	1878.5252	6.33E+06	2	218.8407913	16.83390703
7175 MURIETA DR - Location 1	NorCal	1297.123105	4.37E+06	2	198.5795153	15.27534733
100 FRONT ST - Location 1	NorCal	6231.039964	2.10E+07	2	281.170519	21.62850146
23003 ARNOLD DR - Location 1	NorCal	314.7038861	1.06E+06	2	176.382188	13.56786061
540 WEST NAPA STREET - Location 1	NorCal	12131.85906	4.09E+07	2	180.777748	13.90598061
13778 MONO WAY - Location 1	NorCal	2009.449775	6.77E+06	2	162.7229365	12.51714896
15 PESCE WAY - Location 1	NorCal	2998.657676	1.01E+07	2	161.3971936	12.41516874
8752 HIGHWAY 49 - Location 1	NorCal	88.25286175	2.97E+05	2	162.9640882	12.5356991
4860 SOQUEL DR - Location 1	NorCal	8650.235169	2.92E+07	2	176.5735343	13.58257957
2304 LAKE TAHOE BLVD - Location 1	NorCal	6418.698522	2.16E+07	2	352.7985583	27.13835064
4029 LAKE TAHOE BLVD - Location 1	NorCal	5309.71888	1.79E+07	2	360.8192345	27.75532573
1 WESTBOROUGH BLVD - Location 1	NorCal	19397.20316	6.54E+07	2	138.5390557	10.65685044
2132 Mariposa Road - Location 1	NorCal	6323.656978	2.13E+07	2	63.82177167	4.909367052
508 W CHARTER WAY - Location 1	NorCal	15166.39976	5.11E+07	2	57.74825798	4.442173691
4405 PACIFIC AVE - Location 1	NorCal	20877.13577	7.04E+07	2	66.0380338	5.079848754
4627 DA VINCI DR - Location 1	NorCal	5830.02284	1.96E+07	2	67.07790944	5.159839187
2908 BENJAMIN HOLT DR - Location 1	NorCal	11462.68901	3.86E+07	2	69.74557918	5.365044552

9321 THORNTON RD - Location 1	NorCal	18403.1462	6.20E+07	2	75.92157128	5.840120868
3434 E HAMMER LN - Location 1	NorCal	13749.02001	4.63E+07	2	76.23488249	5.86422173
13521 E MARIPOSA RD - Location 1	NorCal	88.73776758	2.99E+05	2	71.74087642	5.518528955
4100 E FREMONT ST - Location 1	NorCal	3848.212697	1.30E+07	2	67.48860989	5.19143153
4943 S HIGHWAY 99 - Location 1	NorCal	3649.401305	1.23E+07	2	67.74910107	5.211469313
5611 E WATERLOO RD - Location 1	NorCal	1209.355149	4.08E+06	2	71.28837048	5.483720807
4155 Suisun Vly Rd. - Location 1	NorCal	1328.157079	4.48E+06	2	144.4728821	11.11329862
698 N FAIR OAK AVE - Location 1	NorCal	26356.08678	8.88E+07	4	234.776754	18.05975031
1530 MAIN ST - Location 1	NorCal	5107.028242	1.72E+07	2	594.4240459	45.72492661
7505 COLUSA HWY - Location 1	NorCal	1140.498521	3.84E+06	2	249.6987535	19.20759642
121 HANFORD ST - Location 1	NorCal	1580.308112	5.33E+06	2	160.5534856	12.35026812
4219 MORADA LN - Location 1	NorCal	8190.544439	2.76E+07	2	77.45142194	5.957801688
10476 W LINNE RD - Location 1	NorCal	5313.113221	1.79E+07	2	27.9871455	2.152857347
1153 LINCOLN BLVD - Location 1	NorCal	13713.62189	4.62E+07	2	21.56346763	1.658728279
15 E GRANT LINE RD - Location 1	NorCal	7887.478292	2.66E+07	2	21.28173585	1.637056604
25775 PATTERSON PASS RD - Location 1	NorCal	346.2227653	1.17E+06	2	17.43286693	1.340989764
755 S TRACY BLVD - Location 1	NorCal	8585.257787	2.89E+07	2	23.98619521	1.845091939
10041 DONNER PASS RD - Location 1	NorCal	2017.208269	6.80E+06	2	359.38494	27.64499538
2406 W MONTE VISTA AVE - Location 1	NorCal	7819.591476	2.64E+07	2	100.1891694	7.706859181
2901 GEER RD - Location 1	NorCal	9966.269602	3.36E+07	2	103.4727988	7.959446061
24269 HWY 108 - Location 1	NorCal	251.1812219	8.46E+05	2	185.1896867	14.24536051
1099 S STATE ST - Location 1	NorCal	7437.485679	2.51E+07	2	338.6047194	26.04651688
915 N STATE ST - Location 1	NorCal	4443.677061	1.50E+07	2	342.465191	26.34347623
31889 ALVARADO BLVD - Location 1	NorCal	15939.82457	5.37E+07	2	98.69692029	7.592070791
33365 MISSION BLVD - Location 1	NorCal	16093.05481	5.42E+07	2	90.9829071	6.998685161
1501 E MONTE VISTA AVE - Location 1	NorCal	10408.98863	3.51E+07	2	169.3636813	13.02797548
199 South Orchard - Location 1	NorCal	6266.43809	2.11E+07	2	167.5413777	12.88779829
1991 ALAMO DR - Location 1	NorCal	18625.71798	6.28E+07	2	168.2094111	12.93918547
4819 MIDWAY RD - Location 1	NorCal	82.91889758	2.79E+05	2	177.665115	13.66654731
2817 REDWOOD PKWY - Location 1	NorCal	7919.482078	2.67E+07	2	133.2427413	10.24944164
701 MINI DR - Location 1	NorCal	9049.797576	3.05E+07	2	138.6480672	10.66523594
2601 SPRINGS RD - Location 1	NorCal	8995.488123	3.03E+07	2	128.487014	9.88361646
425 Laurel Rd - Location 1	NorCal	8502.823796	2.87E+07	2	128.677936	9.898302768
500 TENNESSEE ST - Location 1	NorCal	12198.77606	4.11E+07	2	133.0609843	10.23546033
10 VISTA DEL LAGO DR - Location 1	NorCal	1947.381829	6.56E+06	2	122.2151663	9.401166637
1599 NEWELL AVE - Location 1	NorCal	14504.5033	4.89E+07	2	89.40458456	6.877275736
2411 OAK GROVE RD - Location 1	NorCal	7781.768821	2.62E+07	2	98.49586341	7.576604877
200 LEE RD - Location 1	NorCal	9394.565624	3.17E+07	2	222.1516693	17.08858994
3 HECKER PASS RD - Location 1	NorCal	2097.702637	7.07E+06	2	202.6795523	15.59073479
12 S WEED BLVD - Location 1	NorCal	1527.938282	5.15E+06	2	610.8721562	46.99016586
6301 HEMBREE LANE - Location 1	NorCal	1504.177896	5.07E+06	2	235.0213665	18.07856666
9120 OLD REDWOOD HWY - Location 1	NorCal	8673.025743	2.92E+07	2	238.8713547	18.37471959

999 E GRANT AVE - Location 1	NorCal	3281.357777	1.11E+07	2	193.4338693	14.87952841
5 W MAIN ST - Location 1	NorCal	16022.25856	5.40E+07	2	193.1299047	14.85614651
1592 E MAIN ST - Location 1	NorCal	10904.56239	3.67E+07	2	189.1592359	14.55071046
200 S MAIN ST - Location 1	NorCal	3995.139165	1.35E+07	2	667.2901834	51.33001411
1263 Franklin Ave. - Location 1	NorCal	8671.571026	2.92E+07	2	234.9002364	18.06924895
1285 BOGUE RD - Location 1	NorCal	8336.986	2.81E+07	2	230.886826	17.76052507
3281 INDUSTRIAL DR - Location 1	NorCal	2342.095177	7.89E+06	2	241.7969386	18.59976451
525 COLUSA AVE - Location 1	NorCal	6625.753313	2.23E+07	2	238.6210871	18.35546824
1281 O'BANION RD - Location 1	NorCal	160.503831	5.41E+05	2	220.7802262	16.98309432
1299 NORTHGATE DR - Location 1	NorCal	3079.63695	1.04E+07	2	239.455665	18.41966654
2255 BUTTE HOUSE RD - Location 1	NorCal	4598.846928	1.55E+07	2	240.2099202	18.47768617
7966 WALERGA RD - Location 1	NorCal	9177.32781	3.09E+07	2	189.3013468	14.56164206
724 G ST - Location 1	NorCal	6754.253359	2.28E+07	2	668.9306794	51.4562061
54432 ROAD 432 - Location 1	NorCal	201.235921	6.78E+05	2	324.0202633	24.92463564
2371 BALFOUR ROAD - Location 1	NorCal	5940.096464	2.00E+07	2	29.05046393	2.234651071
8315 BRENTWOOD BLVD - Location 1	NorCal	10826.49255	3.65E+07	2	28.03403263	2.156464049
1036 Feather Dr. - Location 1	NorCal	186.2038402	6.28E+05	2	147.476994	11.34438416
2700 BAYSHORE BLVD - Location 1	NorCal	16275.86431	5.48E+07	2	135.1137974	10.39336903
8999 ELK GROVE BLVD - Location 1	NorCal	9345.590135	3.15E+07	2	133.0369016	10.23360782
2600 HARRIS ST - Location 1	NorCal	5931.853065	2.00E+07	2	654.2950014	50.33038472
1942 SIR FRANCIS DRAKE BLVD - Location 1	NorCal	7426.81775	2.50E+07	2	154.1971655	11.86132042
3345 N TEXAS ST - Location 1	NorCal	11892.80048	4.01E+07	2	156.4976103	12.03827771
7010 N WEST AVE - Location 1	NorCal	7452.032854	2.51E+07	2	256.9251321	19.7634717
6341 HWY 193 - Location 1	NorCal	477.1473405	1.61E+06	2	262.6023954	20.20018426
7620 FOLSOM AUBURN RD - Location 1	NorCal	2470.595223	8.33E+06	2	203.3543993	15.6426461
2468 3RD ST - Location 1	NorCal	3158.676601	1.06E+07	2	97.81809003	7.524468464
306 SUTTER ST - Location 1	NorCal	2959.865209	9.97E+06	2	158.2922646	12.17632804
463-770 MAIN - Location 1	NorCal	124.1358935	4.18E+05	2	575.0123863	44.23172202
474 S LANDING RD - Location 1	NorCal	220.1472485	7.42E+05	2	435.5556433	33.50428025
1980 CENTRAL AVE - Location 1	NorCal	4187.161875	1.41E+07	2	679.6306696	52.27928227
3459 MCHENRY AVE - Location 1	NorCal	20302.52236	6.84E+07	2	76.06603528	5.851233483
9400 CABRILLO HWY - Location 1	NorCal	3152.372825	1.06E+07	2	153.7327499	11.82559614
205 W LAKE ST - Location 1	NorCal	2379.432926	8.02E+06	2	593.8187406	45.67836466
257 SOUTH KELLY ROAD - Location 1	NorCal	1007.149417	3.39E+06	2	146.8295143	11.29457802
3444 East Hwy 20 - Location 1	NorCal	835.9776575	2.82E+06	2	368.4734507	28.34411159
115 S DEL PUERTO AVE - Location 1	NorCal	9292.250493	3.13E+07	2	75.89119888	5.837784529
17562 PENN VALLEY DR - Location 1	NorCal	498.4831971	1.68E+06	2	296.6182539	22.81678876
3145 PENRYN RD - Location 1	NorCal	341.8586128	1.15E+06	2	212.3408132	16.3339087
1999 STAGE RD - Location 1	NorCal	188.6283693	6.36E+05	2	177.4026265	13.64635588
2505 TARMAC ROAD - Location 1	NorCal	1803.849702	6.08E+06	2	478.0407258	36.77236352
1153 MAIN ST - Location 1	NorCal	4053.327865	1.37E+07	2	198.3145403	15.25496464

100 MONTEREY SALINAS HWY - Location 1	NorCal	1567.215655	5.28E+06	2	235.8439177	18.14183982
1744 W SAN CARLOS ST - Location 1	NorCal	39222.57818	1.32E+08	4	241.4125437	18.57019567
2790 Story Road - Location 1	NorCal	25896.39605	8.73E+07	4	233.6168312	17.97052548
5875 SONOMA HWY - Location 1	NorCal	1695.715701	5.71E+06	2	231.2977236	17.79213258
3705 GRAVENSTEIN HWY 50 - Location 1	NorCal	460.1756363	1.55E+06	2	213.8217158	16.44782429
2725 CASCADE BLVD - Location 1	NorCal	1273.847625	4.29E+06	2	484.8956123	37.29966249
115 SUNSET CENTER - Location 1	NorCal	11392.86256	3.84E+07	2	153.8641537	11.83570413
300 River Rd - Location 1	NorCal	1334.94576	4.50E+06	2	383.7174903	29.51673003
HWY 101 & PATRICKS POINT - Location 1	NorCal	226.4510244	7.63E+05	2	699.8503503	53.83464233
2401 N. STATE ST - Location 1	NorCal	339.9189895	1.15E+06	2	344.631108	26.51008523
8125 S EL DORADO ST - Location 1	NorCal	2039.513937	6.87E+06	2	49.50996371	3.808458747
1250 W WOOD ST - Location 1	NorCal	3548.055986	1.20E+07	2	322.5708461	24.81314201
2895 N MAIN ST - Location 1	NorCal	14365.82023	4.84E+07	2	95.8164873	7.370499023
781 S MAIN ST - Location 1	NorCal	2762.023629	9.31E+06	2	383.9809239	29.53699414
250 E WEBB ST - Location 1	NorCal	433.0209096	1.46E+06	2	661.6513757	50.89625967
82 E VISTA DR - Location 1	NorCal	87.28305008	2.94E+05	2	607.1376645	46.70289727
13600 MOUNTAIN HOUSE RD - Location 1	NorCal	216.2680019	7.29E+05	2	312.3241837	24.02493721
9320 OLD HIGHWAY 99 - Location 1	NorCal	95.04154342	3.20E+05	2	648.6988157	49.8999089
6001 STANFORD RANCH RD - Location 1	NorCal	7329.836584	2.47E+07	2	204.4438914	15.72645318
12505 Yosemite Blvd. - Location 1	NorCal	3777.416445	1.27E+07	2	105.2148066	8.093446662
4010 LAKE CT - Location 1	NorCal	3629.03526	1.22E+07	2	160.5242613	12.3480201
570 E ST - Location 1	NorCal	2254.327221	7.60E+06	2	270.8105108	20.83157776
45 15TH ST - Location 1	NorCal	18735.3067	6.31E+07	2	154.9732619	11.92102015
7001 Hwy 116 - Location 1	NorCal	1310.215563	4.42E+06	2	235.4588887	18.11222221
12 MAHER RD - Location 1	NorCal	504.786973	1.70E+06	2	210.7428907	16.21099159
2008 1ST ST - Location 1	NorCal	13518.20483	4.56E+07	2	43.63580571	3.356600439
341 E MAIN ST - Location 1	NorCal	6899.240203	2.33E+07	2	60.32820277	4.640630982
4805 YOSEMITE BLVD - Location 1	NorCal	7638.7216	2.57E+07	2	89.36715164	6.87439628
14161 RIVER RD - Location 1	NorCal	383.5605145	1.29E+06	2	114.3368782	8.795144476
22277 Parrotts Ferry Rd. - Location 1	NorCal	389.3793845	1.31E+06	2	166.8832897	12.83717613
3250 W GRANTLINE RD - Location 1	NorCal	3489.38238	1.18E+07	2	15.73737554	1.210567349
3998 DOUGLAS BLVD - Location 1	NorCal	8040.22363	2.71E+07	2	198.58972	15.27613231
198 SOSCOL AVE - Location 1	NorCal	7563.07629	2.55E+07	2	163.1509447	12.55007267
26632 Hwy 88 - Location 1	NorCal	444.6586496	1.50E+06	2	193.8763848	14.91356806
100 D ST - Location 1	NorCal	1774.755352	5.98E+06	2	241.7848926	18.59883789
2800 INDEPENDENCE DR - Location 1	NorCal	2795.967038	9.42E+06	2	48.07287918	3.697913783
Citizens Dock - Crecent City Harbor - Location 1	NorCal	220.1472485	7.42E+05	2	824.8145357	63.44727198
2811 DEL PASO RD - Location 1	NorCal	7369.598862	2.48E+07	2	165.3431477	12.71870367
10858 TRINITY PARKWAY - Location 1	NorCal	2348.398953	7.91E+06	2	78.12910689	6.009931299
25045 BLUE RAVINE RD - Location 1	NorCal	4920.824401	1.66E+07	2	201.7824673	15.52172826

2580 MERRYCHASE DR - Location 1	NorCal	3791.478714	1.28E+07	2	213.520848	16.42468061
1091 LEISURE TOWN RD - Location 1	NorCal	2592.791493	8.74E+06	2	174.0337727	13.38721329
401 9th St. - Location 1	NorCal	21829.97573	7.36E+07	2	79.4972988	6.115176831
9772 N STEPHENS ST - Location 1	NorCal	3633.399413	1.22E+07	2	117.7140679	9.0549283
950 I ST - Location 1	NorCal	10762.48498	3.63E+07	2	312.445413	24.03426254
10021 COMBIE RD - Location 1	NorCal	695.8398715	2.34E+06	2	245.9643679	18.92033599
1297 Hwy. 4 - Location 1	NorCal	729.7832799	2.46E+06	2	199.2581717	15.32755167
39 PRESTON AVE - Location 1	NorCal	1892.587469	6.38E+06	2	142.4587674	10.95836672
9002 VILLAGE RD - Location 1	NorCal	123.6509876	4.17E+05	2	276.8185874	21.29373749
28013 ARNOLD DR - Location 1	NorCal	234.6944236	7.91E+05	2	166.7964407	12.83049544
11300 HWY 3 - Location 1	NorCal	401.5020304	1.35E+06	2	704.9030565	54.22331204
2901 BRIDGEWAY BLVD - Location 1	NorCal	3682.374902	1.24E+07	2	148.7736889	11.44412992
14290 TUOLUMNE RD - Location 1	NorCal	752.573854	2.54E+06	2	164.4382109	12.64909314
900 Main St - Location 1	NorCal	1461.991089	4.93E+06	2	565.3762088	43.4904776
1801 CLEVELAND AVE - Location 1	NorCal	2913.799155	9.82E+06	2	219.8284515	16.90988088
3790 HOPYARD RD - Location 1	NorCal	6671.334461	2.25E+07	2	60.2587792	4.635290708
4212 1ST ST - Location 1	NorCal	12701.1385	4.28E+07	2	59.66551021	4.589654632
3670 MAIN ST - Location 1	NorCal	1056.609812	3.56E+06	2	418.9452524	32.22655788
44901 Main St - Location 1	NorCal	658.9870281	2.22E+06	2	420.3500125	32.33461635
23970 FORESTHILL RD - Location 1	NorCal	549.8832155	1.85E+06	2	262.1396129	20.1645856
5309 SKY WAY - Location 1	NorCal	1015.877722	3.42E+06	2	336.2506767	25.86543667
101 N ALTA ST - Location 1	NorCal	2982.655784	1.01E+07	2	266.3010824	20.48469865
10 RONAN AVE - Location 1	NorCal	3495.686156	1.18E+07	2	175.7907228	13.52236329
10 WALKER ST - Location 1	NorCal	3638.733377	1.23E+07	2	355.491753	27.34551946
1005 W EL CAMINO REAL - Location 1	NorCal	24598.78804	8.29E+07	2	124.7189381	9.593764468
10291 FAIRWAY DR - Location 1	NorCal	4366.577033	1.47E+07	2	204.4141067	15.72416205
105 LOPES RD - Location 1	NorCal	4640.063924	1.56E+07	2	141.2078337	10.86214106
11060 BOLLINGER CANYON RD - Location 1	NorCal	6920.57606	2.33E+07	2	72.73481365	5.594985665
12105 ALCOSTA BLVD - Location 1	NorCal	7320.138467	2.47E+07	2	67.25464689	5.173434376
14090 LAKESHORE DR - Location 1	NorCal	1292.274047	4.35E+06	2	288.4138201	22.18567847
1501 E F ST - Location 1	NorCal	6179.15504	2.08E+07	2	93.16774693	7.166749764
15865 MONTEREY ST - Location 1	NorCal	4799.597943	1.62E+07	2	160.7321172	12.36400901
177 CALIFORNIA DR - Location 1	NorCal	9661.748738	3.26E+07	2	124.2108814	9.554683187
17776 COUNTY RD 89 - Location 1	NorCal	121.2264584	4.09E+05	2	215.4302972	16.57156132
1825 CUTTING BLVD - Location 1	NorCal	13320.84816	4.49E+07	2	125.8470483	9.680542173
1915 MOFFAT BLVD - Location 1	NorCal	2762.023629	9.31E+06	2	51.05837061	3.92756697
20661 SOULSBYVILLE RD - Location 1	NorCal	1268.998567	4.28E+06	2	172.519466	13.27072815
20749 LAKESHORE DR - Location 1	NorCal	86.31323842	2.91E+05	2	522.4422886	40.18786836
2101 SAN BRUNO AVE - Location 1	NorCal	16140.09068	5.44E+07	2	138.3477516	10.64213474
2120 SOUTH AVE - Location 1	NorCal	328.7661553	1.11E+06	2	375.8152569	28.90886592
2147 MOWRY AVE STE B3 - Location 1	NorCal	20282.15631	6.84E+07	2	93.46797447	7.18984419
2213 FRANCISCO DR - Location 1	NorCal	3707.105099	1.25E+07	2	207.2645119	15.94342399

22288 KASSON RD - Location 1	NorCal	2406.102747	8.11E+06	2	36.97300295	2.84407715
2301 WALTERS RD - Location 1	NorCal	6363.904163	2.14E+07	2	159.3899827	12.2607679
2575 COUNTRY CLUB BLVD - Location 1	NorCal	10012.33566	3.37E+07	2	63.87876478	4.913751137
275 AVIATION BLVD - Location 1	NorCal	2119.5234	7.14E+06	2	232.9012577	17.91548136
2770 PATTERSON RD - Location 1	NorCal	9088.590043	3.06E+07	2	82.41311999	6.339470768
295 hwy 299 - Location 1	NorCal	115.4075884	3.89E+05	2	684.5332613	52.65640471
3000 E SERVICE RD - Location 1	NorCal	4668.673368	1.57E+07	2	91.21107866	7.01623682
3011 MAIN ST - Location 1	NorCal	2694.136813	9.08E+06	2	417.6563939	32.12741491
3111 DEPOT RD - Location 1	NorCal	5799.473772	1.95E+07	2	94.46028271	7.266175593
3481 W MAIN ST - Location 1	NorCal	8368.019974	2.82E+07	2	38.29046887	2.945420682
385 S STATE HIGHWAY 65 - Location 1	NorCal	6038.532348	2.03E+07	2	217.251288	16.71163754
4186 EAST AVE - Location 1	NorCal	5984.707801	2.02E+07	2	43.61174543	3.354749648
7080 C E DIXON ST - Location 1	NorCal	1465.38543	4.94E+06	2	54.36886771	4.182220593
6 WHARF RD - Location 1	NorCal	264.2736794	8.91E+05	2	186.8890804	14.37608311
6001 West Oaks Blvd - Location 1	NorCal	6366.813598	2.15E+07	2	207.4098814	15.95460626
630 NOYES CT - Location 1	NorCal	2281.481948	7.69E+06	2	118.9024695	9.146343804
633 E VICTOR RD - Location 1	NorCal	9256.367461	3.12E+07	2	90.36131354	6.950870273
639 PLEASANT VALLEY RD - Location 1	NorCal	988.2380893	3.33E+06	2	236.3227172	18.17867056
6737 N HWY 3 - Location 1	NorCal	164.3830777	5.54E+05	2	713.7456269	54.90350976
686 S MAIN ST - Location 1	NorCal	1863.493119	6.28E+06	2	162.9165389	12.53204145
718-710 HWY 395 - Location 1	NorCal	76.61512174	2.58E+05	2	584.8510293	44.98854072
8850 SONOMA HWY - Location 1	NorCal	1103.645678	3.72E+06	2	201.7703579	15.52079676
9192 DESCHUTES RD - Location 1	NorCal	993.5720534	3.35E+06	2	470.4181185	36.18600911
109 CONVAIR AVE - Location 1	NorCal	439.8095913	1.48E+06	2	335.6551696	25.81962843
110 LOCH LOMOND DR - Location 1	NorCal	2473.504658	8.34E+06	2	151.0617337	11.62013336
1003 AMESTI RD - Location 1	NorCal	916.9569317	3.09E+06	2	213.4684577	16.42065059
101 S MAYFAIR AVE - Location 1	NorCal	36754.89239	1.24E+08	4	281.5166803	21.65512925
105 PORTOLA RD - Location 1	NorCal	1226.326854	4.13E+06	2	154.3398269	11.87229438
12399 FOLSOM BLVD - Location 1	NorCal	2860.459514	9.64E+06	2	187.4902759	14.42232891
1249 WOODLAND AVE - Location 1	NorCal	11658.10606	3.93E+07	2	74.8229396	5.755610738
12685 COLFAX HWY - Location 1	NorCal	960.1135509	3.24E+06	2	277.5122848	21.34709883
14900 W HIGHWAY 12 - Location 1	NorCal	116.8623059	3.94E+05	2	96.75301715	7.44253978
1580 LYTTON SPRINGS RD - Location 1	NorCal	84.85852091	2.86E+05	2	260.0497997	20.00383075
15090 DIGGER BAY RD - Location 1	NorCal	506.2416905	1.71E+06	2	492.7960317	37.90738705
1780 N BEALE RD - Location 1	NorCal	4306.933616	1.45E+07	2	231.8027258	17.83097891
17875 LAKE ARTHUR RD - Location 1	NorCal	213.8434727	7.21E+05	2	243.9836657	18.76797429
18372 STATE HIGHWAY 108 - Location 1	NorCal	855.3738908	2.88E+06	2	153.0351063	11.77193125
2001 CROWS LANDING RD - Location 1	NorCal	13294.17834	4.48E+07	2	83.27044546	6.405418882
20080 Hwy 88 - Location 1	NorCal	652.6832523	2.20E+06	2	177.2729812	13.63638317
20170 W Paoli Ln - Location 1	NorCal	225.4812127	7.60E+05	2	248.0102244	19.07770957
20645 GAS POINT RD - Location 1	NorCal	1668.560974	5.62E+06	2	444.5833605	34.19872004

210 N GOLDEN STATE BLVD - Location 1	NorCal	16255.49827	5.48E+07	2	106.4075779	8.185198297
42 MI NE OF NORTH FORK ON MAMMOTH POOL ROAD - Location 1	NorCal	281.2453836	9.48E+05	2	303.1850417	23.32192629
2459 W TAHOE - Location 1	NorCal	1279.666495	4.31E+06	2	297.9912359	22.92240276
28524 TOLLHOUSE RD - Location 1	NorCal	88.73776758	2.99E+05	2	307.6137073	23.66259287
28742 AVENUE 13 1/2 - Location 1	NorCal	1666.136445	5.61E+06	2	228.4388277	17.57221752
2950 WOODSIDE RD - Location 1	NorCal	1859.128967	6.27E+06	2	142.6956562	10.97658894
3000 BAUMAN RD - Location 1	NorCal	97.95097843	3.30E+05	2	74.79566818	5.753512937
31268 HWY 44 - Location 1	NorCal	136.7434451	4.61E+05	2	502.068974	38.6206903
3408 MANTHEY RD - Location 1	NorCal	8304.49731	2.80E+07	2	55.38996681	4.260766678
3480 West Center St. - Location 1	NorCal	3290.570988	1.11E+07	2	455.4206408	35.03235699
3610 W MOUNT WHITNEY AVE - Location 1	NorCal	1477.02317	4.98E+06	2	317.4565554	24.41973503
3740 HIGHLAND SPRINGS RD - Location 1	NorCal	453.8718604	1.53E+06	2	346.2445842	26.63419879
400 Fallen Leaf Lake Rd - Location 1	NorCal	78.55474507	2.65E+05	2	348.4656374	26.80504903
4130 AVIATION DR - Location 1	NorCal	135.7736335	4.58E+05	2	216.9026647	16.68482036
419 HWY 12 - Location 1	NorCal	1857.674249	6.26E+06	2	69.26133633	5.327795102
4301 EASTSIDE RD - Location 1	NorCal	3229.957759	1.09E+07	2	474.0976156	36.46904736
4385 W CLINTON AVE - Location 1	NorCal	10613.13398	3.58E+07	2	257.7519563	19.82707356
4649 GOLF COURSE RD - Location 1	NorCal	13286.90475	4.48E+07	2	41.05297516	3.157921166
4782 SLY PARK RD - Location 1	NorCal	319.0680386	1.08E+06	2	272.4843582	20.96033525
5380 LINDHURST AVE - Location 1	NorCal	4781.656427	1.61E+07	2	228.3427894	17.56482995
60 MAIN ST - Location 1	NorCal	2133.100763	7.19E+06	2	498.2838372	38.32952594
6110 S ELM AVE - Location 1	NorCal	1010.058852	3.40E+06	2	278.6524035	21.43480027
6190 SODA BAY RD - Location 1	NorCal	222.0868719	7.48E+05	2	361.1387781	27.77990601
6235 BETHEL IS RD - Location 1	NorCal	104.7396601	3.53E+05	2	40.61384787	3.124142144
6711 MOUNT AUKUM RD - Location 1	NorCal	86.31323842	2.91E+05	2	194.2396358	14.94151045
700 E BIDWELL ST - Location 1	NorCal	14511.29198	4.89E+07	2	197.6835778	15.20642906
7272 N WEST LANE - Location 1	NorCal	209.964226	7.08E+05	2	82.53474112	6.34882624
7746 No Hwy 1 - Location 1	NorCal	93.58682592	3.15E+05	2	414.398794	31.87683031
801 BIDWELL CANYON RD - Location 1	NorCal	771.9700874	2.60E+06	2	313.9418172	24.14937055
8500 Hwy 128 - Location 1	NorCal	75.16040424	2.53E+05	2	353.891336	27.22241046
9050 ELKMONT DR - Location 1	NorCal	1416.894846	4.77E+06	2	127.1727175	9.782516732
970 W CHANDLER AVE - Location 1	NorCal	2946.287846	9.93E+06	2	266.5119927	20.50092252
5015 FEATHER RIVER BLVD. - Location 1	NorCal	79.52455674	2.68E+05	2	292.6861965	22.51432281
18725 HWY 49 - Location 1	NorCal	426.2322279	1.44E+06	2	164.0721279	12.62093292
900 HWY 1 - Location 1	NorCal	176.0208177	5.93E+05	2	242.0677756	18.62059812
9435 KONECTI BAY RD - Location 1	NorCal	810.7625541	2.73E+06	2	293.3046194	22.5618938
2236 POPLAR ST - Location 1	NorCal	18160.20838	6.12E+07	2	108.2480122	8.326770171
880 N WRIGHT RD - Location 1	NorCal	9100.227783	3.07E+07	2	225.0307962	17.31006125
3180 JEFFERSON - Location 1	NorCal	4395.186478	1.48E+07	2	160.2922035	12.3301695
6798 Ave of the Giants - Location 1	NorCal	198.326486	6.68E+05	2	545.3867477	41.95282675

3374 MIRA LOMA DR - Location 1	NorCal	1293.243859	4.36E+06	2	219.4788197	16.88298613
2901 S NORFOLK - Location 1	NorCal	15500.98479	5.22E+07	2	117.9353988	9.07195375
5885 FLIGHTLINE CIRCLE - Location 1	NorCal	287.5491594	9.69E+05	2	173.7713844	13.36702957
3 River Rd - Location 1	NorCal	580.9171889	1.96E+06	2	374.8866192	28.83743225
4451 ORWOOD RD - Location 1	NorCal	164.8679835	5.56E+05	2	27.1538153	2.088755023
170 Co Rd 176A - Location 1	NorCal	141.1075976	4.76E+05	2	780.3513801	60.02702924
2440 DANIELS ST - Location 1	NorCal	3875.367424	1.31E+07	2	43.76271291	3.366362532
471-920 JOHNSTONVILLE DR - Location 1	NorCal	107.6490951	3.63E+05	2	584.7872687	44.98363606
13083 JOHN BAUER AVE - Location 1	NorCal	299.1868995	1.01E+06	2	281.7367845	21.67206035
3415 HWY 36 - Location 1	NorCal	262.8189619	8.86E+05	2	617.4822532	47.49863486
161 MAIN ST - Location 1	NorCal	6571.44386	2.21E+07	2	236.9083145	18.2237165
6388 GREELEY HILL RD - Location 1	NorCal	74.19059257	2.50E+05	2	198.9844288	15.30649453
5800 Nave Dr. - Location 1	NorCal	4861.180984	1.64E+07	2	160.5003173	12.34617825
6795 WASHINGTON ST - Location 1	NorCal	1572.549619	5.30E+06	2	185.1887701	14.24529001
1201 FOREST AVE - Location 1	NorCal	11095.61529	3.74E+07	2	259.4551945	19.95809188
76 BEAR CANYON ROAD - Location 1	NorCal	979.5097843	3.30E+06	2	521.1405629	40.0877356
1009 OLIVER RD - Location 1	NorCal	15746.83205	5.31E+07	2	149.1970024	11.47669249
1001 WILLOW PASS COURT - Location 1	NorCal	628.4379606	2.12E+06	2	66.38657581	5.106659678
1998 TICE VALLEY BLVD. - Location 1	NorCal	2621.400937	8.83E+06	2	90.82172195	6.986286304
4955 CROWS LANDING RD - Location 1	NorCal	1017.817345	3.43E+06	2	87.97562957	6.767356121
1129 PUTNAM WAY - Location 1	NorCal	1039.153202	3.50E+06	2	250.0390701	19.23377462
387 BLOHM AVE - Location 1	NorCal	704.0832707	2.37E+06	2	207.0804571	15.92926593
9190 SKYWAY DR #B - Location 1	NorCal	1524.543941	5.14E+06	2	339.576668	26.12128215
917 COTTING LANE - Location 1	NorCal	2246.568728	7.57E+06	2	174.706564	13.43896646
4217 ARBOGA ROAD - Location 1	NorCal	3954.89198	1.33E+07	2	225.5037389	17.34644146
10032 ALTA SIERRA DR - Location 1	NorCal	1459.081654	4.92E+06	2	260.1661797	20.01278305
240 S AUBURN ST - Location 1	NorCal	1259.785356	4.25E+06	2	256.9018461	19.76168047
1821 MITCHELL RD - Location 1	NorCal	11450.08145	3.86E+07	2	88.15121422	6.780862632
326 E SAINT CHARLES ST - Location 1	NorCal	1297.123105	4.37E+06	2	145.4158457	11.18583429
3371 N STATE ST - Location 1	NorCal	1281.606119	4.32E+06	2	346.8251157	26.67885506
5000 AIRPORT RD - Location 1	NorCal	1269.483473	4.28E+06	2	465.1596924	35.7815148
504 L ST - Location 1	NorCal	14008.44463	4.72E+07	2	180.295038	13.86884908
5040 EL CAMINO AVE - Location 1	NorCal	16853.87207	5.68E+07	2	174.1598781	13.3969137
9135 E HIGHWAY 140 - Location 1	NorCal	163.8981718	5.52E+05	2	173.6706417	13.35928013
2680 REYNOLDS RANCH PKWY - Location 1	NorCal	1317.004245	4.44E+06	2	86.8324109	6.679416223
2800 W A ST - Location 1	NorCal	1775.725163	5.98E+06	2	186.3016821	14.33089862
5955 W ATHENS - Location 1	NorCal	1758.268553	5.93E+06	2	254.1451817	19.54962936
Los Angeles - LAX (upgrade phase 2) - Location 2	SoCal	20900.89615	7.04E+07	2	96.02736379	7.386720292
West LA - Location 2	SoCal	41855.13195	1.41E+08	4	154.2115269	11.86242514
Redondo Beach - Beryl St. - Location 2	SoCal	30901.10916	1.04E+08	4	220.777074	16.98285184
South Pasadena - Location 2	SoCal	33951.65176	1.14E+08	4	184.067759	14.15905838

Chino - East End Ave. - Location 2	SoCal	15752.16601	5.31E+07	2	152.381899	11.72168454
Burbank - West Verdugo - Location 2	SoCal	10663.07929	3.59E+07	2	67.32907278	5.179159445
Santa Barbara - Location 2	SoCal	1922.651631	6.48E+06	2	164.2329188	12.63330145
Lawndale - Inglewood Ave. - Location 2	SoCal	37338.71901	1.26E+08	4	204.3427045	15.71866957
Newport Beach - Jamboree - Location 2	SoCal	0	0.00E+00	0	0	0
Los Angeles - Location 2	SoCal	2296.514029	7.74E+06	2	95.41681184	7.339754757
Santa Monica - Cloverfield Blvd. - Location 2	SoCal	31886.43782	1.07E+08	4	167.535206	12.88732354
Ontario - Location 2	SoCal	14413.82591	4.86E+07	2	160.3941591	12.33801224
Orange - Location 2	SoCal	13669.49545	4.61E+07	2	151.4920646	11.65323574
Irvine - UCI (upgrade) - Location 2	SoCal	11561.12489	3.90E+07	2	166.9867914	12.8451378
Costa Mesa - Location 2	SoCal	18865.26146	6.36E+07	2	164.4973753	12.65364426
Torrance - W. 190th St. - Location 2	SoCal	24456.22573	8.24E+07	2	110.5194838	8.50149875
Lake Forest - Location 2	SoCal	5644.303905	1.90E+07	2	182.4880245	14.03754035
Diamond Bar - SCAQMD - Location 2	SoCal	501.3926321	1.69E+06	2	143.7222367	11.05555667
Los Angeles - Harbor City - Location 2	SoCal	22237.78154	7.49E+07	2	125.3989493	9.646073026
San Juan Capistrano - Junipero Serra - Location 2	SoCal	5506.590649	1.86E+07	2	191.3970487	14.7228499
Laguna Niguel - Location 2	SoCal	1084.73435	3.66E+06	2	192.8095341	14.83150262
San Diego - Carmel Valley - Location 2	SoCal	7295.893175	2.46E+07	2	292.2275317	22.4790409
Long Beach - Location 2	SoCal	24171.586	8.15E+07	2	125.5455324	9.657348648
Anaheim - E. La Palma - Location 2	SoCal	7706.608416	2.60E+07	2	145.883768	11.22182831
Los Angeles - CSULA - Location 2	SoCal	39002.43093	1.31E+08	4	186.0260709	14.30969776
Los Angeles - Woodland Hills - Location 2	SoCal	11914.62124	4.02E+07	2	76.36427243	5.874174802
La Canada Flintridge - Location 2	SoCal	3569.391843	1.20E+07	2	77.79968018	5.984590783
Los Angeles - Hollywood Blvd. - Location 2	SoCal	24963.92214	8.41E+07	2	74.39129613	5.722407394
Los Angeles - Beverly Blvd - Location 2	SoCal	32557.06259	1.10E+08	4	159.3975378	12.26134906
Riverside - Location 2	SoCal	7656.17821	2.58E+07	2	200.2027451	15.40021116
Los Angeles - Lincoln Blvd - Location 2	SoCal	19368.10881	6.53E+07	2	92.32562525	7.101971173
33488 CROWN VALLEY RD - Location 2	SoCal	694.385154	2.34E+06	2	80.70568078	6.208129291
11424 Chamberlaine - Location 2	SoCal	1613.281709	5.44E+06	2	239.279435	18.40611038
11500 BARTLETT AVE - Location 2	SoCal	1586.611888	5.35E+06	2	238.2925765	18.3301982
5134 KANAN RD - Location 2	SoCal	8223.033129	2.77E+07	2	95.39385751	7.33798904
5226 PALO COMADO CANYON RD - Location 2	SoCal	2284.876289	7.70E+06	2	92.38003744	7.106156726
23022 ALISO CREEK RD - Location 2	SoCal	8928.571118	3.01E+07	2	182.2059117	14.01583936
1666 ALPINE BLVD - Location 2	SoCal	2633.523583	8.87E+06	2	366.7079271	28.20830209
2235 ALPINE BLVD - Location 2	SoCal	1241.358935	4.18E+06	2	368.1776098	28.3213546
1200 S HARBOR BLVD - Location 2	SoCal	45496.28986	1.53E+08	4	276.0787733	21.23682871
5650 E LA PALMA AVE - Location 2	SoCal	14378.91269	4.85E+07	2	152.1630654	11.70485118
400 S ANAHEIM HILLS RD - Location 2	SoCal	4171.644888	1.41E+07	2	155.1966152	11.93820117
741 S WIER CANYON RD - Location 2	SoCal	7062.653469	2.38E+07	2	159.4251973	12.26347672
56245 HWY 371 - Location 2	SoCal	298.2170878	1.00E+06	2	322.7139079	24.82414676

17928 WIKA RD - Location 2	SoCal	3581.029583	1.21E+07	2	241.4590235	18.57377104
21270 BEAR VALLEY RD - Location 2	SoCal	7571.804595	2.55E+07	2	241.7311835	18.59470643
22488 US HIGHWAY 18 - Location 2	SoCal	4674.492238	1.58E+07	2	254.6723498	19.59018076
679 W DUARTE RD - Location 2	SoCal	27822.44203	9.38E+07	4	204.7013991	15.74626147
1490 E GRAND AVE - Location 2	SoCal	6235.889023	2.10E+07	2	338.7414545	26.05703496
610 E GRAND AVE - Location 2	SoCal	5666.609574	1.91E+07	2	336.6709853	25.8977681
610 MESA VIEW DR - Location 2	SoCal	1123.041911	3.78E+06	2	341.4643388	26.2664876
12215 SOUTH ST - Location 2	SoCal	34491.83686	1.16E+08	4	250.0714059	19.236262
5145 EL CAMINO REAL - Location 2	SoCal	6295.047534	2.12E+07	2	369.9258001	28.45583077
340 N. Citrus - Location 2	SoCal	17501.22135	5.90E+07	2	118.5606642	9.120051095
101 19th Street - Location 2	SoCal	28955.66696	9.76E+07	4	318.834292	24.52571477
3220 MING AVE - Location 2	SoCal	16477.10023	5.55E+07	2	150.1414426	11.54934174
11101 HIGHWAY 178 - Location 2	SoCal	2098.672449	7.07E+06	2	174.6136331	13.43181793
3711 MOUNT VERNON AVE - Location 2	SoCal	16724.88711	5.64E+07	2	166.5235266	12.80950205
4800 FAIRFAX RD - Location 2	SoCal	8589.137034	2.89E+07	2	170.4479887	13.11138375
2301 PANAMA LN - Location 2	SoCal	12178.41002	4.10E+07	2	138.1160602	10.62431233
6529 E BRUNDAGE LN - Location 2	SoCal	16052.80763	5.41E+07	2	164.4258667	12.64814359
1125 COFFEE RD - Location 2	SoCal	2965.199174	9.99E+06	2	160.0671733	12.31285948
2612 Buck Owens Blvd - Location 2	SoCal	8039.738724	2.71E+07	2	156.6966561	12.05358893
35300 MERLE HAGGARD DR - Location 2	SoCal	3857.910814	1.30E+07	2	165.4253798	12.72502921
3801 FRUITVALE AVE - Location 2	SoCal	4833.541351	1.63E+07	2	160.6276675	12.35597443
500 Norris Road - Location 2	SoCal	13889.1578	4.68E+07	2	162.1664721	12.47434401
4050 Gosford Road - Location 2	SoCal	10134.04702	3.42E+07	2	153.0680967	11.77446898
5401 Stockdale Hwy - Location 2	SoCal	12420.37803	4.19E+07	2	154.6250986	11.89423835
8803 CAMINO MEDIA - Location 2	SoCal	6653.392945	2.24E+07	2	157.2542449	12.09648038
13001 Stockdale Hwy - Location 2	SoCal	3605.75978	1.22E+07	2	164.6697789	12.66690607
4101 CALLOWAY DR - Location 2	SoCal	7620.780084	2.57E+07	2	165.0784542	12.69834263
9600 BRIMHALL RD - Location 2	SoCal	3453.984254	1.16E+07	2	162.0611468	12.46624206
3221 TAFT HWY - Location 2	SoCal	4607.575233	1.55E+07	2	141.2845154	10.86803965
5634 Stine Rd. - Location 2	SoCal	15121.78843	5.10E+07	2	147.6577101	11.35828539
13003 ROSEDALE HWY - Location 2	SoCal	8598.835151	2.90E+07	2	167.3269135	12.87130104
22520 SIDDING RD - Location 2	SoCal	141.5925035	4.77E+05	2	167.6788435	12.89837257
31110 7TH STANDARD RD - Location 2	SoCal	1278.696684	4.31E+06	2	175.7161575	13.5166275
827 W RAMSEY ST - Location 2	SoCal	8325.833166	2.81E+07	2	250.9364757	19.30280583
29291 WEST HIGHWAY 58 - Location 2	SoCal	640.5606064	2.16E+06	2	301.7278579	23.20983522
491 ARMORY RD - Location 2	SoCal	10496.75658	3.54E+07	2	297.2189198	22.86299383
10501 BEAUMONT AVE - Location 2	SoCal	3549.995609	1.20E+07	2	245.9834765	18.92180589
401 E 6TH STREET - Location 2	SoCal	5833.902086	1.97E+07	2	240.5280613	18.50215856
501 HIGHLAND SPRINGS AVE - Location 2	SoCal	4939.250823	1.66E+07	2	243.7665097	18.75126998
9800 ALONDRA BLVD - Location 2	SoCal	50700.78417	1.71E+08	6	362.9569452	27.91976502
427 N CRESCENT DR - Location 2	SoCal	37555.47192	1.27E+08	4	166.1717275	12.78244058

3100 W LINE ST - Location 2	SoCal	902.8946625	3.04E+06	2	518.0488566	39.84991205
18762 VALLEY BLVD - Location 2	SoCal	19560.13152	6.59E+07	2	184.1462694	14.16509764
27243 HWY 189 - Location 2	SoCal	450.4775196	1.52E+06	2	224.8259787	17.29430606
17970 W HOBSON WAY - Location 2	SoCal	603.7077631	2.03E+06	2	513.7036822	39.51566786
761 E HOBSONWAY - Location 2	SoCal	5098.784842	1.72E+07	2	530.1153168	40.77810129
4498 BONITA RD - Location 2	SoCal	5278.684907	1.78E+07	2	342.1637177	26.32028597
5555 MISSION RD - Location 2	SoCal	819.0059533	2.76E+06	2	274.3105626	21.10081251
104 West Main - Location 2	SoCal	11357.94934	3.83E+07	2	563.856283	43.37356023
3300 E IMPERIAL HWY - Location 2	SoCal	9628.290236	3.24E+07	2	153.1234154	11.77872426
89 E HWY 246 - Location 2	SoCal	2297.483841	7.74E+06	2	242.3805126	18.64465482
8991 ORANGETHORPE AVE - Location 2	SoCal	44667.58579	1.51E+08	4	257.7043366	19.8234105
349 S GLENOAKS BLVD - Location 2	SoCal	22589.82317	7.61E+07	2	67.0003186	5.153870661
2417 N SAN FERNANDO BLVD - Location 2	SoCal	16831.5664	5.67E+07	2	62.02445157	4.771111659
48320 SEMINOLE DR - Location 2	SoCal	172.6264768	5.82E+05	2	259.0398507	19.92614236
22295 MULHOLLAND HWY - Location 2	SoCal	4952.343281	1.67E+07	2	79.71027542	6.131559647
24115 CALABASAS RD - Location 2	SoCal	3758.505118	1.27E+07	2	81.92148943	6.301653033
4807 LAS VIRGENES RD - Location 2	SoCal	3938.890088	1.33E+07	2	87.57965654	6.736896657
444 S IMPERIAL AVE - Location 2	SoCal	20354.89219	6.86E+07	2	557.2897203	42.86844002
7990 CALIFORNIA CITY BLVD - Location 2	SoCal	1117.223041	3.77E+06	2	197.8420359	15.21861815
8601 CALIFORNIA CITY BLVD - Location 2	SoCal	2020.602609	6.81E+06	2	199.122474	15.31711339
499 SANDALWOOD DR - Location 2	SoCal	2441.015967	8.23E+06	2	227.0485342	17.46527186
2157 LAS POSAS RD - Location 2	SoCal	7325.472431	2.47E+07	2	116.1319666	8.933228204
4418 E. Central Ave. - Location 2	SoCal	1028.000368	3.46E+06	2	97.81896677	7.524535906
4870 SANTA ROSA RD - Location 2	SoCal	6656.787286	2.24E+07	2	126.1707772	9.705444396
4007 ADOLFO RD - Location 2	SoCal	9066.76928	3.06E+07	2	114.754074	8.827236461
2194 MAIN ST - Location 2	SoCal	1693.776077	5.71E+06	2	404.1713044	31.09010034
19301 Soledad Canyon - Location 2	SoCal	8462.091706	2.85E+07	2	31.61700532	2.432077332
18755 VIA PRINCESSA - Location 2	SoCal	9311.646726	3.14E+07	2	46.18885901	3.552989155
17100 SIERRA HWY - Location 2	SoCal	1872.70633	6.31E+06	2	37.59721653	2.892093579
27777 BOUQUET CANYON RD - Location 2	SoCal	9461.482629	3.19E+07	2	28.28351286	2.175654835
28522 SAND CANYON RD - Location 2	SoCal	6610.236326	2.23E+07	2	50.47841115	3.882954704
2590 El Camino Real - Location 2	SoCal	9632.169482	3.25E+07	2	258.8275225	19.90980942
5802 VAN ALLEN WAY - Location 2	SoCal	4952.828186	1.67E+07	2	268.9582597	20.6890969
970 TAMARACK AVE - Location 2	SoCal	7613.021591	2.57E+07	2	259.4024698	19.95403614
7170 AVENIDA ENCINAS - Location 2	SoCal	4192.495839	1.41E+07	2	268.1377607	20.62598159
7602 EL CAMINO REAL - Location 2	SoCal	6052.594617	2.04E+07	2	273.813249	21.06255762
899 PALOMAR AIRPORT RD - Location 2	SoCal	7150.421425	2.41E+07	2	264.0762199	20.31355538
1116 CASITAS PASS RD - Location 2	SoCal	4909.186661	1.65E+07	2	133.745204	10.28809262
4401 VIA REAL - Location 2	SoCal	1415.440129	4.77E+06	2	136.2283152	10.47910117
21313 AVALON BLVD - Location 2	SoCal	28090.59495	9.47E+07	4	233.1747641	17.93652031

31785 THE OLD RD - Location 2	SoCal	4827.722481	1.63E+07	2	5.798413842	0.446031834
28051 DATE PALM DRIVE - Location 2	SoCal	6330.44566	2.13E+07	2	304.6741571	23.43647362
34021 DATE PALM DR - Location 2	SoCal	7820.076382	2.64E+07	2	310.8525458	23.91173429
198 N OCEAN AVE - Location 2	SoCal	865.5569133	2.92E+06	2	396.8226504	30.52481927
231 N HWY #173 - Location 2	SoCal	355.4359762	1.20E+06	2	233.2554677	17.94272828
21930 LASSEN ST - Location 2	SoCal	18556.86135	6.25E+07	2	64.94248913	4.995576087
4200 Chino Hill Pkwy - Location 2	SoCal	11504.87581	3.88E+07	2	150.0153997	11.53964613
6510 BUTTERFIELD RANCH RD - Location 2	SoCal	2585.033	8.71E+06	2	159.1629163	12.24330125
15450 FAIRFIELD RANCH RD - Location 2	SoCal	5279.169813	1.78E+07	2	153.2361067	11.78739283
407 E ST - Location 2	SoCal	18826.9539	6.34E+07	2	339.3319801	26.10246001
770 PLAZA CT - Location 2	SoCal	8510.582289	2.87E+07	2	342.7442191	26.36493993
1495 MELROSE AVE - Location 2	SoCal	9175.873093	3.09E+07	2	345.3465573	26.56511979
4555 Main Street - Location 2	SoCal	4466.467635	1.51E+07	2	346.5052151	26.65424731
902 3RD AVE - Location 2	SoCal	24791.29566	8.35E+07	2	345.5830005	26.58330773
903 OTAY LAKES RD - Location 2	SoCal	10842.49444	3.65E+07	2	347.0389936	26.6953072
2210 OTAY LAKES RD - Location 2	SoCal	10002.15263	3.37E+07	2	351.3982126	27.03063174
2115 OLYMPIC PKWY - Location 2	SoCal	10947.71901	3.69E+07	2	352.2174447	27.09364959
699 E FOOTHILL BLVD - Location 2	SoCal	7809.408453	2.63E+07	2	143.6765114	11.05203934
701 E. FOOTHILL BLVD - Location 2	SoCal	8296.25391	2.80E+07	2	143.7062163	11.05432433
1101 N RANCHO AVE - Location 2	SoCal	13150.16131	4.43E+07	2	192.1559125	14.78122404
791 E VALLEY BLVD - Location 2	SoCal	13453.22745	4.53E+07	2	193.389816	14.87613969
1238 S WILMINGTON AVE - Location 2	SoCal	37939.03244	1.28E+08	4	242.3788311	18.64452547
4502 E ROSECRANS AVE - Location 2	SoCal	45759.10882	1.54E+08	4	230.9574056	17.76595428
4710 GREEN RIVER RD - Location 2	SoCal	2366.825375	7.98E+06	2	168.4337673	12.95644364
2240 COMPTON AVE - Location 2	SoCal	11584.40037	3.90E+07	2	187.5692816	14.42840628
1580 W 6TH ST - Location 2	SoCal	16271.50016	5.48E+07	2	176.0414769	13.54165207
23760 TEMESCAL CANYON RD - Location 2	SoCal	1841.187451	6.20E+06	2	198.6704218	15.28234014
2201 E PACIFIC COAST HWY - Location 2	SoCal	6061.807828	2.04E+07	2	175.2152146	13.47809343
1201 BAKER ST - Location 2	SoCal	24760.26169	8.34E+07	2	161.3111105	12.40854696
195 E 17TH ST - Location 2	SoCal	21695.65682	7.31E+07	2	166.5817128	12.81397791
607 S BARRANCA AVE - Location 2	SoCal	16868.90415	5.68E+07	2	127.2260728	9.786620982
11181 WASHINGTON BLVD - Location 2	SoCal	42006.90748	1.42E+08	4	167.068292	12.85140708
40312 ROAD 128 - Location 2	SoCal	2445.865026	8.24E+06	2	327.2923201	25.17633232
5972 LINCOLN AVE - Location 2	SoCal	42662.50016	1.44E+08	4	260.1061865	20.00816819
32611 NIGUEL RD - Location 2	SoCal	2225.717777	7.50E+06	2	201.6937722	15.51490555
34306 PACIFIC COAST HWY - Location 2	SoCal	11200.35495	3.77E+07	2	202.3645021	15.56650016
1757 CECIL AVE - Location 2	SoCal	11008.81714	3.71E+07	2	219.9423712	16.91864394
465 11TH AVE - Location 2	SoCal	8640.052147	2.91E+07	2	217.0947864	16.69959896
12775 PALM DRIVE - Location 2	SoCal	7731.338614	2.61E+07	2	307.6485638	23.66527414

301 South Diamond Bar Boulevard - Location 2	SoCal	9461.967535	3.19E+07	2	140.3897198	10.79920922
180 E EL MONTE WAY - Location 2	SoCal	10600.52643	3.57E+07	2	325.6104752	25.04695963
8001 E. FIRESTONE BLVD - Location 2	SoCal	39369.50465	1.33E+08	4	221.2577905	17.01983004
24156 LAKE DR - Location 2	SoCal	3275.054001	1.10E+07	2	216.514412	16.65495477
1484 E WASHINGTON AVE - Location 2	SoCal	18812.89163	6.34E+07	2	346.6601593	26.6661661
1498 JAMACHA RD - Location 2	SoCal	3814.269289	1.29E+07	2	343.9021346	26.45401035
2411 Jamacha Rd. - Location 2	SoCal	6734.37222	2.27E+07	2	347.0145879	26.69342984
1699 E MAIN ST - Location 2	SoCal	5945.915334	2.00E+07	2	347.0286262	26.69450971
1791 N 2ND ST - Location 2	SoCal	10597.13209	3.57E+07	2	346.5526042	26.65789263
2646 MARMOL CT - Location 2	SoCal	3440.891797	1.16E+07	2	279.1041163	21.46954741
4801 N PECK RD - Location 2	SoCal	31892.25669	1.07E+08	4	225.80555	17.36965769
770 N SEPULVEDA BLVD - Location 2	SoCal	11800.66837	3.98E+07	2	99.93018225	7.686937096
102 LEUCADIA BLVD - Location 2	SoCal	7444.27436	2.51E+07	2	273.7133583	21.05487371
1355 ENCINITAS BLVD - Location 2	SoCal	10030.27717	3.38E+07	2	278.3125594	21.40865841
1580 LEUCADIA BLVD - Location 2	SoCal	7583.442335	2.56E+07	2	275.7802276	21.21386366
16801 VENTURA BLVD - Location 2	SoCal	7331.776207	2.47E+07	2	64.08599562	4.929691971
100 LA TERRAZA BLVD - Location 2	SoCal	16420.85116	5.53E+07	2	290.314099	22.33185377
1158 E WASHINGTON AVE - Location 2	SoCal	20996.90751	7.08E+07	2	293.4530124	22.57330864
215 E VIA RANCHO PKWY - Location 2	SoCal	6689.760883	2.25E+07	2	297.930439	22.91772607
26915 MESA ROCK RD - Location 2	SoCal	576.0681305	1.94E+06	2	298.6082317	22.96986397
450 W EL NORTE PKWY - Location 2	SoCal	11410.31917	3.85E+07	2	291.6603321	22.43541016
2375 E VALLEY PKWY - Location 2	SoCal	12029.05902	4.05E+07	2	296.9017449	22.83859576
1400 AUTO PKWY - Location 2	SoCal	2546.240533	8.58E+06	2	293.3598282	22.56614063
4730 HIGHWAY 76 - Location 2	SoCal	575.0983189	1.94E+06	2	281.8626393	21.68174149
936 E MISSION RD - Location 2	SoCal	8197.818026	2.76E+07	2	280.8694743	21.60534418
660 Ventura Street - Location 2	SoCal	5776.683198	1.95E+07	2	52.40936852	4.031489886
14534 FOOTHILL BLVD - Location 2	SoCal	14867.21286	5.01E+07	2	169.0348764	13.0026828
15160 SUMMIT AVE - Location 2	SoCal	10461.35846	3.53E+07	2	167.8804722	12.91388248
16096 SLOVER AVE - Location 2	SoCal	18098.62534	6.10E+07	2	177.8430181	13.68023216
16900 Foothill Blvd. - Location 2	SoCal	30464.20901	1.03E+08	4	350.6521307	26.97324082
17475 BROOKHURST - Location 2	SoCal	27560.10797	9.29E+07	4	307.430374	23.64849031
351 N PLACENTIA AVE - Location 2	SoCal	41906.04706	1.41E+08	4	288.0574387	22.15826452
13152 GARDEN GROVE BLVD - Location 2	SoCal	40193.35966	1.35E+08	4	297.2093216	22.86225551
13202 BROOKHURST ST - Location 2	SoCal	29528.82565	9.95E+07	4	301.330935	23.17930269
15312 S VERMONT AVE - Location 2	SoCal	36143.91104	1.22E+08	4	225.4047137	17.33882413
1297 N VERDUGO RD - Location 2	SoCal	6772.194875	2.28E+07	2	77.22402261	5.940309431
144 N VERDUGO RD - Location 2	SoCal	26860.87376	9.05E+07	4	154.4454811	11.88042163
180 N FAIRVIEW AVE - Location 2	SoCal	7238.189381	2.44E+07	2	173.4511484	13.34239603
49 GLEN ANNIE RD - Location 2	SoCal	15357.45266	5.18E+07	2	178.0234632	13.69411256
11454 BALBOA - Location 2	SoCal	25198.61656	8.49E+07	4	98.14312754	7.549471349
22483 BARTON RD - Location 2	SoCal	10678.59627	3.60E+07	2	200.8186481	15.44758831
751 GUADALUPE ST - Location 2	SoCal	2425.014075	8.17E+06	2	324.2648892	24.94345301

1160 S 7TH AVE - Location 2	SoCal	5907.607773	1.99E+07	2	118.7838924	9.137222489
10915 HANFORD ARMONA RD - Location 2	SoCal	5169.096188	1.74E+07	2	326.4826055	25.11404657
14020 GRANGEVILLE BLVD - Location 2	SoCal	2789.663262	9.40E+06	2	343.5322355	26.42555658
2497 N 10TH AVE - Location 2	SoCal	9781.035573	3.30E+07	2	326.4762593	25.11355841
395 N 11TH AVE - Location 2	SoCal	10138.41117	3.42E+07	2	326.2985624	25.09988942
3101 EL SEGUNDO BLVD - Location 2	SoCal	41152.9883	1.39E+08	4	204.6799355	15.74461042
70 E MAIN ST - Location 2	SoCal	2488.051833	8.38E+06	2	544.8942122	41.9149394
15075 VISTA RD - Location 2	SoCal	1776.210069	5.99E+06	2	267.3745464	20.5672728
1101 S STATE ST - Location 2	SoCal	9143.869308	3.08E+07	2	264.6911735	20.3608595
1701 W FLORIDA AVE - Location 2	SoCal	15809.8698	5.33E+07	2	260.0755047	20.00580805
25760 NEW CHICAGO AVE - Location 2	SoCal	10335.28294	3.48E+07	2	269.8298449	20.75614192
1111 S SANDERSON AVE - Location 2	SoCal	5295.656611	1.78E+07	2	260.8105049	20.06234653
11254 I AVE - Location 2	SoCal	1639.466624	5.53E+06	2	235.6430519	18.12638861
13187 MAIN ST - Location 2	SoCal	3514.597483	1.18E+07	2	218.2832311	16.79101778
14519 MAIN ST - Location 2	SoCal	5460.524594	1.84E+07	2	221.7021011	17.05400777
15853 MAIN ST - Location 2	SoCal	6558.351402	2.21E+07	2	225.112814	17.31637031
17465 MAIN ST - Location 2	SoCal	5221.466018	1.76E+07	2	229.1581101	17.62754693
8197 I St. - Location 2	SoCal	4686.614884	1.58E+07	2	231.9238095	17.84029304
7955 WEBSTER ST #13 - Location 2	SoCal	8001.431163	2.70E+07	2	202.8280429	15.60215715
8972 ADAMS AVE - Location 2	SoCal	17631.17612	5.94E+07	2	158.0890796	12.16069843
16501 GOLDENWEST ST - Location 2	SoCal	23084.42712	7.78E+07	2	149.0362261	11.46432508
18502 BEACH BLVD - Location 2	SoCal	17028.92307	5.74E+07	2	154.1877415	11.8605955
706 PACIFIC COAST HWY - Location 2	SoCal	8218.184071	2.77E+07	2	160.3743126	12.33648559
16921 ALGONQUIN ST - Location 2	SoCal	7704.183887	2.60E+07	2	149.3879778	11.49138291
5002 EDINGER AVE - Location 2	SoCal	8207.031237	2.77E+07	2	146.5670651	11.27438962
2581 E SLAUSON AVE - Location 2	SoCal	37865.81166	1.28E+08	4	196.0652329	15.08194099
144 SOUTH J ST - Location 2	SoCal	4095.999578	1.38E+07	2	544.1222835	41.85556027
1300 IMPERIAL BEACH BLVD - Location 2	SoCal	11488.38901	3.87E+07	2	349.1933715	26.86102858
45-242 COMMERCE STREET - Location 2	SoCal	2585.517906	8.71E+06	2	340.3374655	26.17980504
62450 CHIRIACO RD - Location 2	SoCal	14088.939	4.75E+07	2	338.2751326	26.02116404
40010 WASHINGTON STREET - Location 2	SoCal	3895.733469	1.31E+07	2	327.1011724	25.16162865
1235 CENTINELA AVE - Location 2	SoCal	46942.27905	1.58E+08	4	185.5112687	14.27009759
14493 CULVER DR - Location 2	SoCal	18560.25569	6.25E+07	2	161.2043336	12.40033336
3765 ALTON PKY - Location 2	SoCal	19890.3524	6.70E+07	2	166.2239209	12.78645545
18692 MACARTHUR BLVD - Location 2	SoCal	26661.09255	8.98E+07	4	328.860957	25.29699669
4601 Campus Drive - Location 2	SoCal	13306.78589	4.48E+07	2	170.9740549	13.15185038
5793 Alton Pkwy - Location 2	SoCal	7574.229124	2.55E+07	2	167.4358825	12.87968327
8693 IRVINE CENTER DR - Location 2	SoCal	11902.01369	4.01E+07	2	170.4679482	13.11291909
5333 UNIVERSITY DR - Location 2	SoCal	3992.714635	1.35E+07	2	171.8760493	13.22123456
32435 ROAD 160 - Location 2	SoCal	75.64531007	2.55E+05	2	314.5293446	24.19456497
13886 CAMPO RD - Location 2	SoCal	912.1078734	3.07E+06	2	356.0870503	27.39131156

61794 29 PALMS HWY - Location 2	SoCal	1359.675958	4.58E+06	2	338.1116006	26.00858466
1913 MAIN ST - Location 2	SoCal	1003.27017	3.38E+06	2	371.3404497	28.56464998
1748 DRAPER ST - Location 2	SoCal	5787.836032	1.95E+07	2	329.6550253	25.35807887
1001 FOOTHILL BLVD - Location 2	SoCal	5581.266147	1.88E+07	2	76.61470788	5.893439067
3402 FOOTHILL BLVD - Location 2	SoCal	10974.87374	3.70E+07	2	71.41623157	5.493556275
1990 W WHITTIER BLVD - Location 2	SoCal	15111.6054	5.09E+07	2	137.2079761	10.5544597
2204 TORREY PINES RD - Location 2	SoCal	5032.837649	1.70E+07	2	307.0492158	23.61917044
3233 LA JOLLA VILLAGE DR - Location 2	SoCal	15672.64145	5.28E+07	2	302.20676	23.24667385
801 PEARL ST - Location 2	SoCal	9994.879046	3.37E+07	2	310.1629424	23.85868788
3775 MASSACHUSETTS AVE - Location 2	SoCal	16006.74157	5.39E+07	2	334.8764957	25.75973044
4610 AVOCADO BLVD - Location 2	SoCal	5913.426643	1.99E+07	2	342.159499	26.31996146
8200 UNIVERSITY AVE - Location 2	SoCal	20351.98275	6.86E+07	2	332.0310253	25.5408481
14152 IMPERIAL HWY - Location 2	SoCal	29095.80475	9.81E+07	4	239.9881478	18.46062675
14910 BEACH BLVD - Location 2	SoCal	24691.88996	8.32E+07	2	130.3496141	10.02689339
1818 HACIENDA BLVD - Location 2	SoCal	31861.22272	1.07E+08	4	244.6595232	18.81996332
447 S AZUSA - Location 2	SoCal	20800.03574	7.01E+07	2	128.742935	9.903302689
1090 FOOTHILL BLVD - Location 2	SoCal	17142.39104	5.78E+07	2	130.6283363	10.04833356
27702 CROWN VALLEY PKWY STE H - Location 2	SoCal	13425.58782	4.52E+07	2	188.8662116	14.52817012
604 S COAST HWY - Location 2	SoCal	8417.965275	2.84E+07	2	187.1791831	14.3983987
25172 CABOT RD - Location 2	SoCal	14871.57702	5.01E+07	2	181.1125993	13.93173841
28922 GOLDEN LANTERN - Location 2	SoCal	9534.218504	3.21E+07	2	189.5146561	14.57805047
30061 ALICIA PKY - Location 2	SoCal	4304.509087	1.45E+07	2	193.735601	14.90273854
16851 LAKESHORE DR - Location 2	SoCal	8284.131265	2.79E+07	2	224.6382315	17.27986396
17595 GRAND AVE - Location 2	SoCal	2941.923694	9.91E+06	2	233.6235935	17.97104565
29355 CENTRAL AVE - Location 2	SoCal	4976.588572	1.68E+07	2	220.1193775	16.93225981
23891 BRIDGER RD - Location 2	SoCal	14501.10896	4.89E+07	2	175.6377605	13.51059696
24571 TRABUCO RD - Location 2	SoCal	12494.08371	4.21E+07	2	175.3397036	13.48766951
29080 PORTOLA PKWY - Location 2	SoCal	14951.10157	5.04E+07	2	182.7580385	14.05831066
17518 ELIZABETH LAKE RD - Location 2	SoCal	546.0039689	1.84E+06	2	43.88095232	3.375457871
11610 RIVERSIDE DR - Location 2	SoCal	1896.951622	6.39E+06	2	337.5251764	25.96347511
12320 WILLOW RD - Location 2	SoCal	5786.381315	1.95E+07	2	340.933505	26.22565423
5304 PARAMOUNT BLVD - Location 2	SoCal	28369.90071	9.56E+07	4	247.0106078	19.00081598
4870 BELLFLOWER BLVD - Location 2	SoCal	24419.37288	8.23E+07	2	128.2694637	9.866881824
12816 MAIN ST - Location 2	SoCal	424.7775104	1.43E+06	2	146.9150981	11.30116139
8116 LAMONT ST - Location 2	SoCal	740.4512082	2.50E+06	2	151.6897206	11.66844005
2802 E AVENUE I - Location 2	SoCal	4685.645072	1.58E+07	2	130.2766299	10.02127922
844 E AVENUE J - Location 2	SoCal	13156.46508	4.43E+07	2	124.4266248	9.571278831
2343 WEST AVE. J - Location 2	SoCal	8340.380341	2.81E+07	2	120.5470814	9.272852416
41940 NORTH 50TH ST WEST - Location 2	SoCal	5062.901811	1.71E+07	2	120.3188314	9.255294727
1790 W BUSH ST - Location 2	SoCal	2593.276399	8.74E+06	2	329.5960574	25.35354287
690 N ELMWOOD AVE - Location 2	SoCal	5778.622821	1.95E+07	2	306.467987	23.57446053

37202 90TH ST E - Location 2	SoCal	871.8606892	2.94E+06	2	125.1988025	9.630677119
38350 90TH ST E - Location 2	SoCal	553.7624622	1.87E+06	2	122.2403637	9.403104897
8314 PEARBLOSSOM HWY - Location 2	SoCal	1044.487166	3.52E+06	2	110.3911048	8.49162345
1880 MOUNTAIN VIEW AVE - Location 2	SoCal	8259.401067	2.78E+07	2	201.5047359	15.5003643
24913 Redlands Boulevard - Location 2	SoCal	14823.57134	5.00E+07	2	199.733391	15.364107
3705 CONSTELLATION ROAD - Location 2	SoCal	2617.521691	8.82E+06	2	273.0998782	21.00768294
940 N H ST - Location 2	SoCal	16272.95488	5.48E+07	2	265.830883	20.44852946
260 N PICO AVE - Location 2	SoCal	27968.88359	9.43E+07	4	266.5901416	20.50693397
6401 E PACIFIC COAST HWY - Location 2	SoCal	19895.20145	6.70E+07	2	140.7604635	10.82772796
2440 E ANAHEIM ST #795 - Location 2	SoCal	52858.13022	1.78E+08	6	405.8162069	31.2166313
5588 LONG BEACH BLVD - Location 2	SoCal	24955.19383	8.41E+07	2	119.8043724	9.215720956
465 W PACIFIC COAST HWY - Location 2	SoCal	34107.79144	1.15E+08	4	260.3687199	20.02836307
5871 E SPRING ST - Location 2	SoCal	27523.25513	9.28E+07	4	272.3108488	20.94698837
10961 LOS ALAMITOS - Location 2	SoCal	25828.50924	8.70E+07	4	262.5844517	20.19880398
605 BELL ST - Location 2	SoCal	686.6266607	2.31E+06	2	270.2358818	20.78737553
3625 BEVERLY BLVD - Location 2	SoCal	83869.79792	2.83E+08	8	317.2220197	24.40169382
4368 AVALON BLVD - Location 2	SoCal	64807.17978	2.18E+08	6	294.3613763	22.64318279
504 W OLYMPIC BLVD - Location 2	SoCal	94483.41681	3.18E+08	8	362.3219973	27.87092287
3774 S WESTERN AVE - Location 2	SoCal	60232.57814	2.03E+08	6	289.9430064	22.30330818
3309 W OLYMPIC BLVD - Location 2	SoCal	78242.46572	2.64E+08	8	324.5168087	24.96283144
3915 E OLYMPIC BLVD - Location 2	SoCal	63584.24727	2.14E+08	6	283.6940188	21.82261683
10389 SANTA MONICA BLVD - Location 2	SoCal	30064.1617	1.01E+08	4	159.2209044	12.24776188
6228 Franklin Ave - Location 2	SoCal	22321.67025	7.52E+07	2	72.80800439	5.600615722
2829 N BROADWAY - Location 2	SoCal	41553.03562	1.40E+08	4	171.0785007	13.15988467
3053 Los Feliz Boulevard - Location 2	SoCal	27781.70994	9.36E+07	4	152.424757	11.72498131
4380 EAGLE ROCK BLVD - Location 2	SoCal	21425.07936	7.22E+07	2	84.11899458	6.470691891
5137 N FIGUEROA ST - Location 2	SoCal	24042.60105	8.10E+07	2	88.43629516	6.802791936
1803 W. MANCHESTER AVE - Location 2	SoCal	55469.83305	1.87E+08	6	295.8683366	22.75910282
11699 SAN VICENTE BLVD - Location 2	SoCal	14958.37516	5.04E+07	2	76.0955308	5.853502369
13060 SAN VICENTE BLVD - Location 2	SoCal	6020.105927	2.03E+07	2	78.65769644	6.050592034
670 N SEPULVEDA BLVD - Location 2	SoCal	14751.32037	4.97E+07	2	71.71251604	5.516347387
1150 E IMPERIAL HWY - Location 2	SoCal	55302.54053	1.86E+08	6	328.1715526	25.24396558
11280 NATIONAL BLVD - Location 2	SoCal	19511.64094	6.58E+07	2	81.785328	6.291179077
2199 10TH ST - Location 2	SoCal	5210.79809	1.76E+07	2	381.8154231	29.37041716
4346 E IMPERIAL HWY - Location 2	SoCal	27176.54745	9.16E+07	4	221.4558101	17.03506231
21216 PACIFIC COAST HWY - Location 2	SoCal	303.0661461	1.02E+06	2	105.0292162	8.079170474
23387 PACIFIC COAST HWY - Location 2	SoCal	1269.968379	4.28E+06	2	110.7710418	8.520849367
30811 PACIFIC COAST HWY - Location 2	SoCal	421.3831696	1.42E+06	2	125.8953478	9.684257527
26925 NEWPORT RD - Location 2	SoCal	4184.25244	1.41E+07	2	248.5465756	19.11896736

2097 Mentone Blvd. - Location 2	SoCal	6366.328692	2.15E+07	2	216.6105535	16.66235027
10597 JURUPA AVE - Location 2	SoCal	5462.464218	1.84E+07	2	180.26013	13.86616384
26811 TRABUCO RD - Location 2	SoCal	13974.98613	4.71E+07	2	182.3621346	14.0278565
705 W HUNTINGTON DR - Location 2	SoCal	17118.14574	5.77E+07	2	102.7327174	7.902516721
854 E HUNTINGTON DR - Location 2	SoCal	11698.35324	3.94E+07	2	106.6230714	8.201774721
4910 HOLT BLVD - Location 2	SoCal	21466.78126	7.23E+07	2	150.9946224	11.61497095
500 N GARFIELD AVE - Location 2	SoCal	41580.67525	1.40E+08	4	206.094394	15.85341492
7825 TELEGRAPH RD - Location 2	SoCal	24254.98981	8.17E+07	2	105.351983	8.103998692
2114 VERDUGO BLVD - Location 2	SoCal	6677.638237	2.25E+07	2	74.21183147	5.708602421
550 W LOS ANGELES AVE - Location 2	SoCal	10908.44164	3.68E+07	2	96.41591268	7.416608667
15980 Perris - Location 2	SoCal	13444.98405	4.53E+07	2	221.1418493	17.01091149
23021 SUNNYMEAD BLVD - Location 2	SoCal	11376.86067	3.83E+07	2	210.9106436	16.22389566
24991 SUNNYMEAD - Location 2	SoCal	9640.897787	3.25E+07	2	214.1954451	16.4765727
25020 ALESSANDRO BLVD - Location 2	SoCal	14897.27703	5.02E+07	2	217.2461542	16.71124263
12301 Heacock - Location 2	SoCal	10289.21689	3.47E+07	2	212.0887164	16.31451664
23801 WASHINGTON AVE - Location 2	SoCal	4903.852697	1.65E+07	2	242.1795001	18.62919231
41240 KALMIA ST - Location 2	SoCal	6972.94589	2.35E+07	2	243.8664	18.75895385
39440 MURRIETA HOT SPRINGS RD - Location 2	SoCal	5949.309675	2.00E+07	2	249.7244008	19.2095693
39614 Los Alamos - Location 2	SoCal	5625.392578	1.90E+07	2	252.5891955	19.42993812
45 N. REINO RD - Location 2	SoCal	8545.010603	2.88E+07	2	119.0156058	9.155046603
518 Rancho Conejo - Location 2	SoCal	7685.27256	2.59E+07	2	115.3625305	8.874040805
23502 NEWHALL AVE - Location 2	SoCal	3563.572973	1.20E+07	2	31.20284005	2.400218465
1240 BISON AVE - Location 2	SoCal	4224.98453	1.42E+07	2	170.0668436	13.08206489
1550 JAMBOREE RD - Location 2	SoCal	3178.072835	1.07E+07	2	171.7621805	13.21247543
2690 SAN MIGUEL DR - Location 2	SoCal	3567.937125	1.20E+07	2	173.3921775	13.33785981
1501 6TH ST - Location 2	SoCal	8374.808655	2.82E+07	2	184.996123	14.230471
1850 2ND ST - Location 2	SoCal	10644.16796	3.59E+07	2	189.9011967	14.60778436
8705 SEPULVEDA BLVD - Location 2	SoCal	52264.12058	1.76E+08	6	150.8600189	11.60461684
6800 LANKERSHIM BLVD - Location 2	SoCal	40728.21079	1.37E+08	4	117.4495452	9.034580401
11240 TAMPA AVE - Location 2	SoCal	15944.67363	5.37E+07	2	55.49258235	4.268660181
12042 FIRESTONE BLVD - Location 2	SoCal	39091.1687	1.32E+08	4	231.796696	17.83051508
19560 LAKEVIEW AVE - Location 2	SoCal	1456.172219	4.91E+06	2	237.784498	18.29111523
905 NORTH VENTURA AVE - Location 2	SoCal	3262.931356	1.10E+07	2	121.6887001	9.360669239
3361 MISSION AVE - Location 2	SoCal	5933.792688	2.00E+07	2	255.8476136	19.68058566
802 N COAST HWY - Location 2	SoCal	13135.61413	4.43E+07	2	251.0117622	19.30859709
3401 COLLEGE BLVD - Location 2	SoCal	11364.25312	3.83E+07	2	262.1693968	20.16687668
4181 OCEANSIDE BLVD - Location 2	SoCal	13321.33307	4.49E+07	2	265.5928256	20.43021735
785 COLLEGE BLVD - Location 2	SoCal	12785.51212	4.31E+07	2	262.5680295	20.19754073
360 E OJAI AVE - Location 2	SoCal	3825.907029	1.29E+07	2	103.6028974	7.969453644
3015 S ARCHIBALD - Location 2	SoCal	11019.00017	3.71E+07	2	168.7906344	12.98389495
2430 S EUCLID AVE - Location 2	SoCal	18820.65013	6.34E+07	2	160.7095158	12.36227045
4525 JURUPA ST - Location 2	SoCal	10280.48858	3.46E+07	2	170.5786068	13.12143129

660 Douglas - Location 2	SoCal	10950.14354	3.69E+07	2	257.8329747	19.83330575
700 W CHAPMAN AVE - Location 2	SoCal	28025.13266	9.44E+07	4	295.9230657	22.76331275
5344 E CHAPMAN AVE - Location 2	SoCal	12547.42336	4.23E+07	2	155.7961354	11.98431811
1132 S OXNARD BLVD - Location 2	SoCal	27402.99848	9.23E+07	4	217.09558	16.69966
1860 N VENTURA RD - Location 2	SoCal	12244.35721	4.13E+07	2	106.3731777	8.182552133
1901 N ROSE AVE - Location 2	SoCal	14287.75039	4.81E+07	2	96.80540857	7.44656989
500 S VICTORIA AVE - Location 2	SoCal	6779.953368	2.28E+07	2	102.1761357	7.859702746
5040 Saviers Rd. - Location 2	SoCal	16538.68327	5.57E+07	2	113.2139946	8.708768818
3402 E VINEYARD AVE - Location 2	SoCal	6394.938136	2.16E+07	2	92.93270661	7.148669739
15281 W. SUNSET BLVD - Location 2	SoCal	6398.817383	2.16E+07	2	84.49662899	6.499740692
11152 HWY 76 - Location 2	SoCal	462.1152596	1.56E+06	2	291.1520244	22.39630957
75000 GERALD FORD DR - Location 2	SoCal	326.3416261	1.10E+06	2	319.6760461	24.59046508
77920 AVENUE OF THE STATES - Location 2	SoCal	4524.171429	1.52E+07	2	329.4626151	25.34327809
72-300 Highway 111 - Location 2	SoCal	4956.707433	1.67E+07	2	325.5322598	25.04094306
73801 HIGHWAY 111 - Location 2	SoCal	8581.863446	2.89E+07	2	330.368873	25.41299023
73001 COUNTRY CLUB DR - Location 2	SoCal	1895.98181	6.39E+06	2	321.5616221	24.73550939
145 S GENE AUTRY TRL - Location 2	SoCal	6589.385375	2.22E+07	2	312.664045	24.05108038
1708 N PALM CANYON DR - Location 2	SoCal	9624.410989	3.24E+07	2	294.6064831	22.66203716
60490 OVERTURE DR - Location 2	SoCal	85.82833258	2.89E+05	2	286.2428153	22.0186781
2520 E AVENUE S - Location 2	SoCal	8513.006818	2.87E+07	2	100.3614828	7.720114063
2850 E PALMDALE BLVD - Location 2	SoCal	9904.686561	3.34E+07	2	109.9347773	8.456521334
1022 W RANCHO VISTA BLVD - Location 2	SoCal	6072.960662	2.05E+07	2	106.6466645	8.203589577
3113 RANCHO VISTA BLVD - Location 2	SoCal	6904.089262	2.33E+07	2	111.0207963	8.54006125
37204 47TH St. - Location 2	SoCal	14145.67298	4.77E+07	2	116.3349048	8.94883883
17051 E AVENUE O - Location 2	SoCal	1037.213578	3.50E+06	2	143.7412018	11.05701552
9508 E PALMDALE BLVD - Location 2	SoCal	803.0040608	2.71E+06	2	123.2491169	9.480701303
16408 Orange - Location 2	SoCal	14526.32406	4.90E+07	2	106.5004505	8.192342348
200 N FAIR OAKS - Location 2	SoCal	25408.09588	8.56E+07	4	173.8304612	13.37157394
1400 E COLORADO BLVD - Location 2	SoCal	27945.60811	9.42E+07	4	181.8312649	13.98702038
3275 E FOOTHILL BLVD - Location 2	SoCal	14476.37876	4.88E+07	2	94.84577017	7.295828474
1924 CRESTON RD - Location 2	SoCal	5400.881177	1.82E+07	2	348.6748932	26.82114563
13012 PEARBLOSSOM HWY - Location 2	SoCal	320.5227561	1.08E+06	2	120.9632886	9.304868356
19248 HARVILL AVE - Location 2	SoCal	1819.851594	6.13E+06	2	222.0571088	17.08131606
33 W NUEVO RD - Location 2	SoCal	12274.42137	4.14E+07	2	228.0606322	17.54312555
3995 N PERRIS BLVD - Location 2	SoCal	4759.350759	1.60E+07	2	224.0754336	17.23657181
4074 PHELAN RD - Location 2	SoCal	1302.45707	4.39E+06	2	218.2023858	16.78479891
8845 Whittier Boulevard - Location 2	SoCal	28764.61406	9.69E+07	4	216.1677336	16.6282872
28820 OLD HIGHWAY 80 - Location 2	SoCal	371.4378687	1.25E+06	2	396.9060941	30.53123801
2699 SHELL BEACH RD - Location 2	SoCal	718.1455398	2.42E+06	2	349.4124476	26.87788059
890 N 4TH ST - Location 2	SoCal	3275.054001	1.10E+07	2	341.0213626	26.23241251
16 VILLAGE LOOP RD - Location 2	SoCal	5763.105835	1.94E+07	2	140.4144353	10.80111041

295 E MISSION BLVD - Location 2	SoCal	30271.21649	1.02E+08	4	288.9427897	22.22636844
2510 N TOWNE AVE - Location 2	SoCal	24859.66738	8.38E+07	2	139.8180152	10.75523194
3190 W TEMPLE AVE - Location 2	SoCal	13654.46337	4.60E+07	2	137.2379057	10.55676198
1391 E SPRINGVILLE AVE - Location 2	SoCal	2326.093285	7.84E+06	2	257.8010032	19.8308464
730 S PLANO ST - Location 2	SoCal	6356.145669	2.14E+07	2	254.4848145	19.57575496
12295 SCRIPPS POWAY PKWY - Location 2	SoCal	3752.686248	1.26E+07	2	318.8403863	24.52618356
13341 POWAY RD - Location 2	SoCal	10739.2095	3.62E+07	2	318.9621133	24.53554718
14147 TWIN PEAKS RD - Location 2	SoCal	3918.039137	1.32E+07	2	315.6579177	24.28137829
1910 MAIN ST - Location 2	SoCal	3242.565311	1.09E+07	2	328.9645378	25.30496444
802 MAIN ST - Location 2	SoCal	3593.637134	1.21E+07	2	327.337124	25.17977877
6760 CARNELIAN - Location 2	SoCal	13492.01992	4.55E+07	2	150.5742639	11.58263568
8514 VINEYARD AVE - Location 2	SoCal	17412.96849	5.87E+07	2	155.2758097	11.94429305
6411 HAVEN AVE - Location 2	SoCal	14985.52989	5.05E+07	2	154.8071655	11.9082435
69-800 HIGHWAY 111 - Location 2	SoCal	2321.729132	7.82E+06	2	315.4713754	24.26702887
28103 HAWTHORNE BLVD - Location 2	SoCal	8231.761434	2.77E+07	2	122.5117669	9.423982068
28632 OSO PKWY - Location 2	SoCal	7221.217677	2.43E+07	2	187.5062721	14.4235594
1075 PARKFORD DRIVE - Location 2	SoCal	5930.398347	2.00E+07	2	213.372973	16.41330561
902 ORANGE ST - Location 2	SoCal	15693.0075	5.29E+07	2	208.8848906	16.06806851
1500 S PACIFIC COAST HWY - Location 2	SoCal	13393.09913	4.51E+07	2	116.4060872	8.954314402
1916 N RIVERSIDE AVE - Location 2	SoCal	12256.96476	4.13E+07	2	178.4702319	13.72847938
207 N CHINA LAKE BLVD - Location 2	SoCal	7327.412054	2.47E+07	2	288.9615287	22.2278099
3565 W INYOKERN RD - Location 2	SoCal	406.3510887	1.37E+06	2	276.6698415	21.2822955
843 E RIDGECREST BLVD - Location 2	SoCal	1839.732733	6.20E+06	2	291.2506217	22.40389397
851 W UPJOHN AVE - Location 2	SoCal	3769.657952	1.27E+07	2	282.9669342	21.76668724
16970 VAN BUREN BLVD - Location 2	SoCal	1325.247644	4.47E+06	2	205.4121523	15.80093479
7494 INDIANA AVE - Location 2	SoCal	18202.39519	6.13E+07	2	199.9749856	15.3826912
8970 ARLINGTON AVE - Location 2	SoCal	15970.85854	5.38E+07	2	191.4237284	14.72490218
2720 14TH ST - Location 2	SoCal	15114.02993	5.09E+07	2	200.5165928	15.4243533
5310 LA SIERRA AVE - Location 2	SoCal	12523.17806	4.22E+07	2	192.8934519	14.83795784
3261 IOWA AVE - Location 2	SoCal	24270.02189	8.18E+07	2	198.4741431	15.26724178
5225 CANYON CREST DR BLDG 81 - Location 2	SoCal	4418.946863	1.49E+07	2	202.724829	15.59421762
6287 DAY ST - Location 2	SoCal	10151.98854	3.42E+07	2	209.0440813	16.08031395
18965 Van Buren - Location 2	SoCal	1014.90791	3.42E+06	2	204.1722108	15.70555468
19220 VAN BUREN BLVD - Location 2	SoCal	7087.383667	2.39E+07	2	221.6508576	17.05006597
381 E ALESSANDRO BLVD - Location 2	SoCal	4494.592173	1.51E+07	2	214.6583068	16.51217745
8902 Trautwein - Location 2	SoCal	3928.707065	1.32E+07	2	218.4817208	16.80628622
10112 MISSION BLVD - Location 2	SoCal	8588.652128	2.89E+07	2	178.4881365	13.72985665
5599 MISSION BLVD - Location 2	SoCal	7770.615987	2.62E+07	2	190.5368541	14.65668108
6060 CAMINO REAL - Location 2	SoCal	6003.134222	2.02E+07	2	187.5412613	14.42625087
6824 VALLEY WAY - Location 2	SoCal	6712.551457	2.26E+07	2	186.8246312	14.37112548
9267 JURUPA RD - Location 2	SoCal	5874.634176	1.98E+07	2	181.4686255	13.95912504

2072 W ROSAMOND BLVD - Location 2	SoCal	2559.817897	8.63E+06	2	143.8542002	11.06570771
3033 W 25TH STREET - Location 2	SoCal	1869.311989	6.30E+06	2	143.8493071	11.06533131
2356 FULLERTON RD - Location 2	SoCal	11117.92096	3.75E+07	2	132.0713905	10.15933773
3909 HALLMARK PKWY - Location 2	SoCal	12085.3081	4.07E+07	2	187.9817066	14.46013128
2696 FOOTHILL BLVD - Location 2	SoCal	20624.01492	6.95E+07	2	184.8357019	14.21813091
795 S EL CAMINO REAL - Location 2	SoCal	11002.02846	3.71E+07	2	209.013099	16.07793069
606 CAMINO DE LOS MARES - Location 2	SoCal	6441.974002	2.17E+07	2	201.6226462	15.50943432
901 S PICO - Location 2	SoCal	7133.449721	2.40E+07	2	208.5740785	16.04415988
1606 MARKET ST - Location 2	SoCal	38037.95323	1.28E+08	4	659.3577077	50.71982367
3535 INDIA ST - Location 2	SoCal	22947.19877	7.73E+07	2	322.0767669	24.77513591
1704 ROSECRANS ST - Location 2	SoCal	19825.37501	6.68E+07	2	323.3850579	24.87577368
1885 GARNET AVE - Location 2	SoCal	19315.25408	6.51E+07	2	313.6944667	24.13034359
1083 MORENA BLVD - Location 2	SoCal	14172.82771	4.78E+07	2	317.593877	24.43029823
6130 BALBOA AVE - Location 2	SoCal	13914.85781	4.69E+07	2	312.3369627	24.02592021
8110 BALBOA AVE - Location 2	SoCal	18694.57461	6.30E+07	2	311.8325267	23.98711744
1025 EUCLID AVE - Location 2	SoCal	21137.5302	7.12E+07	2	328.8666061	25.29743124
5111 COLLEGE AVE - Location 2	SoCal	18611.17081	6.27E+07	2	328.0426301	25.23404847
3766 CLAIREMONT MESA BLVD - Location 2	SoCal	14366.79004	4.84E+07	2	310.8516789	23.91166761
7448 JACKSON DR - Location 2	SoCal	7687.697089	2.59E+07	2	331.4729386	25.49791835
8787 LAKE MURRAY BLVD - Location 2	SoCal	12376.2516	4.17E+07	2	337.6601469	25.97385745
6110 MISSION GORGE RD - Location 2	SoCal	12421.83274	4.19E+07	2	323.9167534	24.91667334
6616 MIRAMAR RD - Location 2	SoCal	7391.90453	2.49E+07	2	304.7769148	23.44437806
6695 MIRA MESA BLVD - Location 2	SoCal	11422.92673	3.85E+07	2	303.8582993	23.37371533
8505 COSTA VERDE BLVD - Location 2	SoCal	24391.73325	8.22E+07	2	303.0959967	23.31507667
2777 HEALTH CENTER DR - Location 2	SoCal	20206.511	6.81E+07	2	315.0207795	24.23236766
3385 SANDROCK RD - Location 2	SoCal	10705.751	3.61E+07	2	314.9146159	24.22420122
13985 TORREY DEL MAR DR - Location 2	SoCal	2781.419863	9.37E+06	2	303.2500531	23.32692716
8345 Mira Mesa Bl. - Location 2	SoCal	15590.20746	5.25E+07	2	307.5309802	23.65622925
9320 MIRA MESA BLVD - Location 2	SoCal	8645.871017	2.91E+07	2	312.1600073	24.01230826
16629 DOVE CANYON RD - Location 2	SoCal	7137.328968	2.41E+07	2	308.6790704	23.74454388
16998 W BERNARDO DR - Location 2	SoCal	12257.44967	4.13E+07	2	304.5515308	23.42704083
11030 RANCHO CARMEL DR - Location 2	SoCal	9876.077117	3.33E+07	2	310.8921352	23.91477963
12507 RANCHO BERNARDO RD - Location 2	SoCal	6328.506037	2.13E+07	2	306.1866559	23.55281968
9205 Twin Trails Dr. - Location 2	SoCal	13451.28783	4.53E+07	2	307.4763142	23.65202417
12889 EL CAMINO REAL - Location 2	SoCal	13243.26323	4.46E+07	2	291.0216155	22.38627812
10299 SCRIPPS TRL STE A - Location 2	SoCal	4544.052568	1.53E+07	2	326.0915341	25.08396416
12010 Scripps Highland Drive - Location 2	SoCal	7379.296979	2.49E+07	2	313.1682931	24.0898687
2919 ALTA VIEW DR - Location 2	SoCal	13733.50302	4.63E+07	2	340.8349822	26.21807556
1291 HOLLISTER ST - Location 2	SoCal	18529.22172	6.24E+07	2	348.7368847	26.8259142
2325 ROLL DR - Location 2	SoCal	1381.49672	4.66E+06	2	363.4968863	27.96129895

4360 PALM AVE - Location 2	SoCal	9948.812992	3.35E+07	2	348.3132731	26.7933287
1605 CACTUS RD - Location 2	SoCal	2308.151769	7.78E+06	2	355.9036663	27.3772051
1790 S SAN DIMAS AVE - Location 2	SoCal	6657.757098	2.24E+07	2	132.4675699	10.18981307
845 W. ARROW HWY - Location 2	SoCal	18180.57443	6.13E+07	2	128.0800193	9.852309178
11274 LAUREL CANYON BLVD - Location 2	SoCal	25935.67343	8.74E+07	4	88.45108713	6.803929779
918 S SAN GABRIEL BLVD - Location 2	SoCal	37410.00017	1.26E+08	4	209.1902087	16.09155452
687 S SAN JACINTO AVE - Location 2	SoCal	12973.65558	4.37E+07	2	264.54071	20.34928538
833 RAMONA BLVD - Location 2	SoCal	7306.076198	2.46E+07	2	262.1459515	20.16507319
26988 ORTEGA HWY - Location 2	SoCal	7496.64419	2.53E+07	2	193.9990737	14.92300567
157 HIGUERA ST - Location 2	SoCal	11366.19274	3.83E+07	2	365.2527186	28.09636297
151 N SANTA ROSA ST - Location 2	SoCal	17480.3704	5.89E+07	2	369.1332972	28.39486902
145 VIA VERA CRUZ - Location 2	SoCal	8207.031237	2.77E+07	2	278.5748006	21.42883082
578 E MISSION RD - Location 2	SoCal	4152.248655	1.40E+07	2	283.341305	21.795485
102 E CARMEL ST - Location 2	SoCal	4558.114838	1.54E+07	2	281.8642343	21.68186418
190 W SAN MARCOS BLVD - Location 2	SoCal	7655.693304	2.58E+07	2	281.6199798	21.66307537
800 S RANCHO SANTA FE RD - Location 2	SoCal	3966.52972	1.34E+07	2	279.4626627	21.4971279
998 K STREET - Location 2	SoCal	777.3040516	2.62E+06	2	361.2194166	27.78610897
210 S GAFFEY ST - Location 2	SoCal	19646.44476	6.62E+07	2	129.2266992	9.940515323
2490 S WESTERN AVE - Location 2	SoCal	4565.873331	1.54E+07	2	134.0861799	10.31432153
990 N WESTERN AVE - Location 2	SoCal	9708.299698	3.27E+07	2	131.8702975	10.14386904
779 W SAN YSIDRO BLVD - Location 2	SoCal	9176.842905	3.09E+07	2	351.15306	27.01177384
302 W 1ST ST - Location 2	SoCal	64065.75876	2.16E+08	6	450.6483641	34.66525877
4505 W 1ST ST - Location 2	SoCal	42882.16251	1.45E+08	4	308.7400738	23.74923645
2921 S BRISTOL ST - Location 2	SoCal	43365.61362	1.46E+08	4	324.8504116	24.9884932
1935 STATE ST - Location 2	SoCal	12800.05929	4.31E+07	2	160.7908436	12.36852643
340 W. Carrillo Street - Location 2	SoCal	20587.64699	6.94E+07	2	158.0495911	12.15766086
231 N MILPAS ST - Location 2	SoCal	9662.71855	3.26E+07	2	154.6644742	11.89726724
3898 STATE ST - Location 2	SoCal	7654.723492	2.58E+07	2	164.8113471	12.67779593
1298 COAST VILLAGE RD - Location 2	SoCal	1740.811943	5.87E+06	2	149.3943403	11.49187233
1476 E VALLEY RD - Location 2	SoCal	1553.638291	5.24E+06	2	150.5330848	11.57946806
26954 SECO CANYON RD - Location 2	SoCal	7768.676363	2.62E+07	2	25.34507366	1.94962105
26015 SOUTH BOUQUET CANYON RD - Location 2	SoCal	11339.52292	3.82E+07	2	22.67039756	1.743876735
11651 TELEGRAPH RD - Location 2	SoCal	30421.05239	1.03E+08	4	225.4150057	17.33961582
22301 EL CAMINO REAL - Location 2	SoCal	527.0926413	1.78E+06	2	368.001207	28.30778515
1509 N BROADWAY - Location 2	SoCal	22799.30249	7.68E+07	2	308.762074	23.75092877
2301 S BROADWAY - Location 2	SoCal	16871.32868	5.69E+07	2	301.0141518	23.15493475
100 E CLARK AVE - Location 2	SoCal	3424.404998	1.15E+07	2	297.957803	22.919831
1104 E CLARK AVE - Location 2	SoCal	6354.206046	2.14E+07	2	294.7387541	22.67221185
432 WILSHIRE BLVD - Location 2	SoCal	27933.00056	9.41E+07	4	175.3955065	13.49196204
11427 WOODSIDE AVE - Location 2	SoCal	5035.747084	1.70E+07	2	335.4838392	25.80644917
9035 MISSION GORGE RD - Location 2	SoCal	10111.25645	3.41E+07	2	328.9571428	25.3043956

9750 N MAGNOLIA AVE - Location 2	SoCal	7631.932918	2.57E+07	2	332.0002808	25.53848314
105 E LERDO HWY - Location 2	SoCal	7561.621572	2.55E+07	2	185.2964468	14.25357283
15410 VENTURA BLVD - Location 2	SoCal	13923.58611	4.69E+07	2	61.14922333	4.70378641
4441 VAN NUYS BLVD - Location 2	SoCal	19478.18244	6.56E+07	2	62.45144336	4.803957182
4 N BALDWIN AVENUE - Location 2	SoCal	8130.416115	2.74E+07	2	99.63136592	7.663951225
1196 E LOS ANGELES AVE - Location 2	SoCal	13141.91791	4.43E+07	2	83.77251113	6.444039318
1356 N ERRINGER - Location 2	SoCal	461.6303538	1.56E+06	2	74.79288484	5.753298834
2605 STEARNS STREET - Location 2	SoCal	9625.380801	3.24E+07	2	72.58712775	5.583625211
5803 LOS ANGELES AVE - Location 2	SoCal	5895.485127	1.99E+07	2	72.03218883	5.540937602
1220 SYCAMORE DRIVE - Location 2	SoCal	5768.924705	1.94E+07	2	81.22531771	6.248101362
2405 N. SYCAMORE DRIVE - Location 2	SoCal	13020.69145	4.39E+07	2	78.54415349	6.041857961
660 VIA DE LA VALLE - Location 2	SoCal	9429.96375	3.18E+07	2	286.2946165	22.02266281
3250 FIRESTONE BLVD - Location 2	SoCal	45337.72565	1.53E+08	4	223.1517305	17.16551773
3520 SWEETWATER SPRINGS BLVD - Location 2	SoCal	11008.33224	3.71E+07	2	342.7511702	26.36547463
8659 Jamacha Road - Location 2	SoCal	24357.78984	8.21E+07	2	342.3233322	26.33256401
10961 BEACH BLVD - Location 2	SoCal	27290.50033	9.20E+07	4	270.0979857	20.77676813
25357 N. CHIQUELLA LN - Location 2	SoCal	14952.55629	5.04E+07	2	24.33434746	1.871872882
19534 ORANGE BELT DR - Location 2	SoCal	229.3604594	7.73E+05	2	265.0711504	20.3900885
29950 MURRIETA ROAD - Location 2	SoCal	4014.535398	1.35E+07	2	250.6006824	19.27697557
26730 MCCALL BLVD - Location 2	SoCal	3891.854222	1.31E+07	2	242.3484501	18.64218847
9055 SUNLAND BLVD - Location 2	SoCal	12924.19519	4.36E+07	2	56.96726664	4.382097434
13617 FOOTHILL BLVD - Location 2	SoCal	31616.83017	1.07E+08	4	89.79579089	6.90736853
15948 ROXFORD ST - Location 2	SoCal	9120.593828	3.07E+07	2	38.87755882	2.990581447
19156 VENTURA BLVD - Location 2	SoCal	11860.79669	4.00E+07	2	70.01310012	5.385623086
5605 RESEDA BLVD - Location 2	SoCal	16255.01336	5.48E+07	2	67.59698498	5.199768075
106 E TEHACHAPI BLVD - Location 2	SoCal	3983.98633	1.34E+07	2	210.8649548	16.22038114
20436 BRIAN WAY - Location 2	SoCal	2448.774461	8.25E+06	2	234.4154358	18.0319566
27750 STALLION SPRINGS DR - Location 2	SoCal	415.0793937	1.40E+06	2	253.9686589	19.53605068
27691 YNEZ RD - Location 2	SoCal	11266.30214	3.80E+07	2	254.9310823	19.61008325
44260 RED HAWK PKWY - Location 2	SoCal	8285.101076	2.79E+07	2	262.9816675	20.22935904
33165 US HIGHWAY 79 S - Location 2	SoCal	7634.842353	2.57E+07	2	265.5696403	20.42843387
40212 WINCHESTER RD - Location 2	SoCal	7668.300856	2.58E+07	2	254.2633976	19.55872289
45000 PECHANGA PKWY - Location 2	SoCal	5208.373561	1.76E+07	2	263.9268434	20.30206488
701 LAS TABLAS RD - Location 2	SoCal	3258.082297	1.10E+07	2	358.7858861	27.59891431
1152 E AVENIDA DE LOS ARBOLES - Location 2	SoCal	5740.800166	1.93E+07	2	105.5272687	8.117482211
1640 Moorpark Road - Location 2	SoCal	7490.82532	2.52E+07	2	107.5451936	8.272707203
2861 MOORPARK RD - Location 2	SoCal	5446.947231	1.84E+07	2	106.6530608	8.204081602
56 E THOUSAND OAKS BLVD - Location 2	SoCal	6622.843878	2.23E+07	2	109.6501245	8.434624958
73010 Ramon Blvd. - Location 2	SoCal	2669.891521	9.00E+06	2	313.8666662	24.14358971
40462 SIERRA DR - Location 2	SoCal	558.1266147	1.88E+06	2	354.0161538	27.23201183
1700 CRENSHAW BLVD - Location 2	SoCal	35500.441	1.20E+08	4	226.1609977	17.39699982

24505 HAWTHORNE BLVD - Location 2	SoCal	21730.08513	7.32E+07	2	115.7264003	8.902030793
21712 Plano Trabuco Rd. - Location 2	SoCal	5256.864144	1.77E+07	2	192.0055088	14.76965452
14002 AVENUE 232 - Location 2	SoCal	564.9152964	1.90E+06	2	287.7346493	22.13343456
16638 AVENUE 168 - Location 2	SoCal	723.9644099	2.44E+06	2	275.561589	21.19704531
3850 S PRATT ST - Location 2	SoCal	475.692623	1.60E+06	2	280.3188695	21.56298996
610 W INYO AVE - Location 2	SoCal	11948.07974	4.03E+07	2	283.3584332	21.79680255
13891 RED HILL AVE - Location 2	SoCal	32077.00581	1.08E+08	4	309.7089313	23.82376395
5687 Adobe Rd. - Location 2	SoCal	2357.612164	7.95E+06	2	370.0827784	28.46790603
73434 29 PALMS HWY - Location 2	SoCal	1492.540156	5.03E+06	2	367.3968843	28.26129879
73943 29 Palms Hwy - Location 2	SoCal	1139.043804	3.84E+06	2	368.6539212	28.35799394
1212 W FOOTHILL BLVD - Location 2	SoCal	26066.598	8.78E+07	4	291.6203383	22.43233371
2401 N EUCLID AVE - Location 2	SoCal	3836.574957	1.29E+07	2	148.212549	11.40096531
27706 MCBEAN PARKWAY - Location 2	SoCal	5025.079156	1.69E+07	2	23.47084701	1.80544977
27241 HENRY MAYO DR - Location 2	SoCal	1119.162664	3.77E+06	2	15.51078614	1.193137396
27602 NEWHALL RANCH RD - Location 2	SoCal	8006.280222	2.70E+07	2	19.39968874	1.492283749
28070 N THE OLD ROAD - Location 2	SoCal	3519.931448	1.19E+07	2	16.91988079	1.301529292
29200 VALLEY CENTER RD - Location 2	SoCal	1066.792834	3.60E+06	2	312.1062306	24.00817159
13703 VICTORY BLVD - Location 2	SoCal	47206.06783	1.59E+08	4	120.6941629	9.284166375
7700 TELEGRAPH RD - Location 2	SoCal	6553.017438	2.21E+07	2	89.97894211	6.921457085
9460 TELEPHONE RD - Location 2	SoCal	5901.788903	1.99E+07	2	88.06438909	6.774183776
12117 PALMDALE RD - Location 2	SoCal	7300.257328	2.46E+07	2	227.9510685	17.53469758
12130 Bear Valley Rd. - Location 2	SoCal	3939.8599	1.33E+07	2	222.9304451	17.14849578
13724 BEAR VALLEY RD - Location 2	SoCal	7618.840461	2.57E+07	2	226.499475	17.42303654
14475 PALMDALE RD - Location 2	SoCal	5986.647424	2.02E+07	2	233.1436766	17.93412897
16088 MOJAVE DR - Location 2	SoCal	4665.763933	1.57E+07	2	234.1416428	18.0108956
15655 US HIGHWAY 395 - Location 2	SoCal	3298.329481	1.11E+07	2	231.8868469	17.83744976
16881 STODDARD WELLS RD - Location 2	SoCal	94.55663759	3.19E+05	2	239.3328048	18.41021575
16869 S D ST - Location 2	SoCal	4485.863868	1.51E+07	2	238.5212698	18.34778998
17918 Bear valley Rd. - Location 2	SoCal	5926.034195	2.00E+07	2	233.4224831	17.95557562
17771 SANTIAGO BLVD - Location 2	SoCal	12688.53095	4.28E+07	2	151.8310544	11.67931188
2825 S MOONEY BLVD - Location 2	SoCal	16420.36625	5.53E+07	2	294.7751043	22.67500802
110 S AKERS ST - Location 2	SoCal	12426.6818	4.19E+07	2	301.4396216	23.1876632
2411 N DINUBA BLVD - Location 2	SoCal	8359.776575	2.82E+07	2	303.3333423	23.33333402
32792 ROAD 124 - Location 2	SoCal	828.2191641	2.79E+06	2	308.2215265	23.70934819
443 N GIDDINGS ST - Location 2	SoCal	13947.3465	4.70E+07	2	299.5720343	23.04400264
15641 AVENUE 384 - Location 2	SoCal	165.3528893	5.57E+05	2	329.844571	25.37265931
3251 BUSINESS PARK DR - Location 2	SoCal	4168.735453	1.40E+07	2	275.5512953	21.19625349
1610 S MELROSE DR - Location 2	SoCal	10960.81147	3.69E+07	2	271.4493184	20.8807168
298 SYCAMORE AVE - Location 2	SoCal	9128.837227	3.08E+07	2	273.8556485	21.06581911
1211 E VISTA WAY - Location 2	SoCal	8542.101168	2.88E+07	2	272.1033322	20.93102555
1501 N SANTA FE AVE - Location 2	SoCal	13090.51789	4.41E+07	2	271.578229	20.890633
1740 E VISTA WAY - Location 2	SoCal	3411.312541	1.15E+07	2	273.2386358	21.0183566

1203 N GRAND AVE - Location 2	SoCal	8709.393681	2.94E+07	2	133.1377226	10.24136327
31505 AGOURA RD - Location 2	SoCal	7447.183795	2.51E+07	2	101.0169943	7.770538027
6982 WESTMINSTER BLVD - Location 2	SoCal	23253.65926	7.84E+07	2	144.5018389	11.11552607
12525 HADLEY ST - Location 2	SoCal	28518.7668	9.61E+07	4	243.1789679	18.70607446
2600 PELLISSIER PLACE - Location 2	SoCal	6858.023207	2.31E+07	2	115.4253389	8.878872224
33986 ORANGE ST - Location 2	SoCal	2627.704713	8.86E+06	2	232.4154002	17.87810771
20101 ROSCOE BLVD - Location 2	SoCal	28619.14231	9.64E+07	4	124.1772505	9.552096192
6618 WOFFORD BLVD - Location 2	SoCal	299.6718053	1.01E+06	2	253.677825	19.51367885
17499 YORBA LINDA BLVD - Location 2	SoCal	8391.78036	2.83E+07	2	151.6124438	11.66249568
19751 YORBA LINDA BLVD - Location 2	SoCal	7894.266974	2.66E+07	2	157.4882937	12.11448413
21440 YORBA LINDA BLVD - Location 2	SoCal	4943.13007	1.67E+07	2	158.6480379	12.20369522
23611 LA PALMA AVE - Location 2	SoCal	2748.446266	9.26E+06	2	163.0327772	12.54098286
12045 BRYANT ST - Location 2	SoCal	4056.2373	1.37E+07	2	227.8301527	17.52539636
31429 YUCAIPA BLVD - Location 2	SoCal	4168.735453	1.40E+07	2	218.0466922	16.77282248
34429 YUCAIPA BLVD - Location 2	SoCal	6758.132606	2.28E+07	2	225.6097247	17.35459421
35112 WILDWOOD CANYON RD - Location 2	SoCal	6407.545688	2.16E+07	2	228.0831615	17.54485857
9225 S Brookhurst st - Location 2	SoCal	34943.7691	1.18E+08	4	270.7783237	20.82910182
58581 US HIGHWAY 371 - Location 2	SoCal	271.0623611	9.13E+05	2	327.4690244	25.18992495
15333 RANCHERIAS RD - Location 2	SoCal	4111.516565	1.39E+07	2	247.0854019	19.00656938
8955 MONTECITO AVE - Location 2	SoCal	4351.544952	1.47E+07	2	373.9125078	28.7625006
803 W ARROW HWY - Location 2	SoCal	24261.29358	8.18E+07	2	117.2521632	9.019397169
11510 CEDAR AVE - Location 2	SoCal	5927.004006	2.00E+07	2	187.2095871	14.40073747
755 PALM CANYON DR - Location 2	SoCal	513.515278	1.73E+06	2	432.7913045	33.29163881
300 S BREA BLVD - Location 2	SoCal	22649.46659	7.63E+07	2	141.9016634	10.91551257
1791 Maggio Road - Location 2	SoCal	267.1831144	9.00E+05	2	568.0877306	43.6990562
1800 GOLDEN ACORN WAY - Location 2	SoCal	191.0528985	6.44E+05	2	428.3659274	32.95122519
633 BIRMINGHAM DRIVE - Location 2	SoCal	5413.488728	1.82E+07	2	278.9660335	21.45892566
21324 PATHFINDER RD - Location 2	SoCal	9469.241122	3.19E+07	2	139.503827	10.73106361
2249 HUNTINGTON DR - Location 2	SoCal	4817.539459	1.62E+07	2	110.1531921	8.473322473
14039 HIGHWAY 8 BUSINESS - Location 2	SoCal	5005.198016	1.69E+07	2	353.4502297	27.1884792
1969 US HIGHWAY 111 - Location 2	SoCal	1807.728948	6.09E+06	2	546.2468776	42.01899059
398 AURORA DR - Location 2	SoCal	14955.95063	5.04E+07	2	536.7673304	41.28979465
3892 SIERRA AVE - Location 2	SoCal	3199.893597	1.08E+07	2	173.0832509	13.31409622
11971 VALLEY VIEW ST - Location 2	SoCal	15750.22639	5.31E+07	2	143.5300017	11.04076936
1860 E ROUTE 66 - Location 2	SoCal	4489.258209	1.51E+07	2	126.0174609	9.693650841
910 E ROUTE 66 - Location 2	SoCal	9880.926175	3.33E+07	2	123.1874062	9.475954322
2010 S HACIENDA BLVD - Location 2	SoCal	17238.8873	5.81E+07	2	124.0243962	9.540338166
4304 HIGHLAND AVE - Location 2	SoCal	8450.938871	2.85E+07	2	200.0456247	15.38812497
14604 Hwy 178 - Location 2	SoCal	464.0548829	1.56E+06	2	257.6346863	19.8180528
29145 HEATHERCLIFF RD - Location 2	SoCal	1277.726872	4.31E+06	2	120.8406195	9.295432266
1798 MAIN ST - Location 2	SoCal	4557.145026	1.54E+07	2	402.3275236	30.94827104

105 E LINCOLN AVE - Location 2	SoCal	21589.94734	7.28E+07	2	145.4028519	11.18483476
703 E PALMDALE BLVD - Location 2	SoCal	11323.03612	3.82E+07	2	105.468235	8.112941151
2133 PALOS VERDES DR W - Location 2	SoCal	3994.169353	1.35E+07	2	124.3407134	9.56467026
16095 SAN DIEGUETO RD - Location 2	SoCal	240.0283877	8.09E+05	2	293.4645439	22.57419569
6089 La Flecha - Location 2	SoCal	1352.887276	4.56E+06	2	291.6683242	22.43602494
23880 SANTA MARGARITA PKWY - Location 2	SoCal	9063.859845	3.05E+07	2	189.719853	14.59383484
3390 LA SIERRA AVE - Location 2	SoCal	13170.52735	4.44E+07	2	191.0888602	14.69914309
1670 DEVORE RD - Location 2	SoCal	310.8246395	1.05E+06	2	181.5843593	13.96802764
1933 W HIGHLAND AVE - Location 2	SoCal	13516.26521	4.55E+07	2	182.8289897	14.06376844
247 E 40TH ST - Location 2	SoCal	13382.91611	4.51E+07	2	192.2538483	14.78875756
295 N WATERMAN AVE - Location 2	SoCal	23611.51976	7.96E+07	2	195.3634975	15.02796135
3211 KENDALL DR - Location 2	SoCal	5272.381131	1.78E+07	2	187.7655336	14.44350259
10821 TIERRASANTA BLVD - Location 2	SoCal	12169.68171	4.10E+07	2	319.1615927	24.55089175
3595 SAGUNTO ST - Location 2	SoCal	1440.170326	4.85E+06	2	256.2556559	19.71197353
26050 MENIFEE RD - Location 2	SoCal	2541.876381	8.57E+06	2	240.8181628	18.52447406
3995 E. THOUSAND OAKS BLVD - Location 2	SoCal	11481.60033	3.87E+07	2	103.1890343	7.937618025
4801 LAUREL CANYON BLVD - Location 2	SoCal	34080.15181	1.15E+08	4	125.4381429	9.649087915
920 S SEAWARD AVE - Location 2	SoCal	6726.128821	2.27E+07	2	98.7395133	7.595347177
150 S CITRUS AVE - Location 2	SoCal	16313.68697	5.50E+07	2	125.898088	9.684468305
49709 29 PALMS HWY - Location 2	SoCal	488.3001746	1.65E+06	2	304.08924	23.39148
19004 LA PUENTE RD - Location 2	SoCal	19262.39934	6.49E+07	2	132.9590294	10.22761764
20905 VENTURA BLVD - Location 2	SoCal	15053.4167	5.07E+07	2	73.86907417	5.682236475
575 W PACIFIC COAST HWY - Location 2	SoCal	29840.1352	1.01E+08	4	246.9905611	18.99927393
24336 VICTORY BLVD - Location 2	SoCal	15006.86574	5.06E+07	2	83.92912637	6.456086644
1141 WEST AVENUE L - Location 2	SoCal	7997.067011	2.70E+07	2	115.8333269	8.910255918
25361 Railroad Canyon Road - Location 2	SoCal	1352.40237	4.56E+06	2	230.5377336	17.73367182
406 S BAY FRONT - Location 2	SoCal	2399.314066	8.09E+06	2	175.9682724	13.53602095
400 ORANGE AVE - Location 2	SoCal	7665.391421	2.58E+07	2	334.9926842	25.76866802
1010 FAIRWAY DR - Location 2	SoCal	10613.61889	3.58E+07	2	133.0251026	10.2327002
1206 W WESTFIELD AVE - Location 2	SoCal	7697.395206	2.59E+07	2	256.4820168	19.72938591
480 MCKINLEY ST - Location 2	SoCal	19815.19199	6.68E+07	2	185.3364566	14.25665051
2345 FENTON PKWY - Location 2	SoCal	8619.686102	2.90E+07	2	323.2074138	24.86210875
36228 HIDDEN SPRINGS RD - Location 2	SoCal	5443.067984	1.83E+07	2	237.9107632	18.30082794
1375 East Ontario Avenue - Location 2	SoCal	7869.536777	2.65E+07	2	178.9688605	13.76683542
30616 Benton Road - Location 2	SoCal	6290.198476	2.12E+07	2	257.6339787	19.81799836
22388 AVENUE 152 - Location 2	SoCal	4966.890456	1.67E+07	2	286.0986711	22.00759008
2403 GOLDEN HILL RD - Location 2	SoCal	1408.166541	4.75E+06	2	342.8627158	26.37405506
1330 N PLAZA DR - Location 2	SoCal	2385.736702	8.04E+06	2	297.4389703	22.87992079
12155 TECH CENTER DRIVE - Location 2	SoCal	2736.32362	9.22E+06	2	321.8633702	24.75872078

12611 MORENO BEACH DR - Location 2	SoCal	1665.651539	5.61E+06	2	220.6633072	16.97410055
1260 W MAIN ST - Location 2	SoCal	7843.351862	2.64E+07	2	309.3567085	23.79666988
4021 BROAD ST - Location 2	SoCal	6765.891099	2.28E+07	2	357.7998902	27.52306848
26468 Carl Boyer Dr. - Location 2	SoCal	2313.485733	7.80E+06	2	27.9519433	2.150149484
16505 SIERRA LAKES PRKWAY - Location 2	SoCal	5314.567938	1.79E+07	2	170.1738618	13.09029706
79-795 HWY 111 - Location 2	SoCal	8330.197319	2.81E+07	2	336.5762166	25.8904782
6009 COFFEE RD - Location 2	SoCal	7690.121618	2.59E+07	2	164.6865632	12.66819717
7014 ARCHIBALD ST - Location 2	SoCal	10982.63223	3.70E+07	2	187.3191414	14.40916472
28015 SCOTT RD - Location 2	SoCal	3872.942895	1.31E+07	2	252.5439716	19.42645936
1195 FOOTHILL BLVD - Location 2	SoCal	6737.766561	2.27E+07	2	113.7905367	8.753118206
13601 APPLE VALLEY RD - Location 2	SoCal	3729.895674	1.26E+07	2	240.7001216	18.51539397
206 E HARVARD BLVD - Location 2	SoCal	10870.61898	3.66E+07	2	71.97486996	5.536528458
30107 Antelope Rd. - Location 2	SoCal	5708.311475	1.92E+07	2	246.8032633	18.98486641
6020 ARLINGTON AVE - Location 2	SoCal	14153.91638	4.77E+07	2	192.0378183	14.77213987
8906 SUNSET BLVD - Location 2	SoCal	13562.33127	4.57E+07	2	80.020606	6.15543123
2651 RECHE CANYON RD - Location 2	SoCal	551.337933	1.86E+06	2	203.8173512	15.67825778
390 W ATEN RD - Location 2	SoCal	2597.155646	8.75E+06	2	541.2516801	41.63474462
537 E PINE ST - Location 2	SoCal	5173.460341	1.74E+07	2	313.6009327	24.12314867
1710 San Elijo Road - Location 2	SoCal	3510.718237	1.18E+07	2	283.2711071	21.79008516
774 N VENTURA AVE - Location 2	SoCal	7174.181811	2.42E+07	2	104.669915	8.051531925
855 State st - Location 2	SoCal	2674.255673	9.01E+06	2	234.7221925	18.05555327
775 N LEMOORE AVE #A - Location 2	SoCal	8001.431163	2.70E+07	2	332.3767524	25.56744249
5200 LAKE ISABELLA BLVD - Location 2	SoCal	1587.5817	5.35E+06	2	239.1142606	18.39340466
14030 PALM DR - Location 2	SoCal	4060.116546	1.37E+07	2	306.4108706	23.57006697
38995 SKY CANYON DR - Location 2	SoCal	4919.369684	1.66E+07	2	252.3264177	19.40972444
1606 PLAZA BLVD - Location 2	SoCal	29831.8918	1.01E+08	4	667.2862044	51.32970803
460 W TEFFT ST - Location 2	SoCal	2292.149876	7.72E+06	2	319.659075	24.58915962
130 W FOOTHILL PKWY - Location 2	SoCal	12092.09678	4.08E+07	2	184.4939882	14.19184525
1325 BROOKSIDE AVE - Location 2	SoCal	8111.019882	2.73E+07	2	210.2756801	16.17505232
15 W. WOODBURY RD - Location 2	SoCal	14892.91287	5.02E+07	2	83.54550538	6.426577337
17661 VENTURA BLVD - Location 2	SoCal	11541.24375	3.89E+07	2	66.65648726	5.127422097
2110 E. Mission Ave. - Location 2	SoCal	5573.022748	1.88E+07	2	286.5803895	22.04464535
3648 BALDWIN PARK BLVD - Location 2	SoCal	36176.88464	1.22E+08	4	233.6460571	17.97277362
56504 29 PALMS HWY - Location 2	SoCal	4719.58848	1.59E+07	2	324.4644451	24.95880347
42081 BIG BEAR BLVD - Location 2	SoCal	2576.304695	8.68E+06	2	265.8543806	20.45033697
77985 AVENIDA MONTEZUMA - Location 2	SoCal	5569.143501	1.88E+07	2	339.7596749	26.1353596
26745 Hwy 189 - Location 2	SoCal	1872.221424	6.31E+06	2	223.1736463	17.16720356
525 N La Brucherie Rd - Location 2	SoCal	8580.408729	2.89E+07	2	538.1488215	41.39606319
703 S EUCLID AVE - Location 2	SoCal	29286.37274	9.87E+07	4	316.6400375	24.35692596
33423 SIERRA DR - Location 2	SoCal	107.1641893	3.61E+05	2	335.8040641	25.83108185
616 Monterey Trail - Location 2	SoCal	867.4965367	2.92E+06	2	71.48168588	5.498591222

1000 N PACIFIC AVE - Location 2	SoCal	33922.07251	1.14E+08	4	146.9883538	11.30679645
101 E MAIN ST - Location 2	SoCal	1602.128875	5.40E+06	2	468.9216015	36.07089242
10238 CHERRY AVE - Location 2	SoCal	12737.99135	4.29E+07	2	173.4378027	13.34136944
1054 C BARONA RD - Location 2	SoCal	109.5887184	3.69E+05	2	351.9484733	27.07295948
110 S HARBOR BLVD - Location 2	SoCal	20130.86569	6.78E+07	2	140.0419195	10.77245535
1101 ANDRADE AVE - Location 2	SoCal	11306.54933	3.81E+07	2	557.5417369	42.88782592
12340 HIGHLAND AVE - Location 2	SoCal	14127.24656	4.76E+07	2	159.5949224	12.27653249
13007 CAMINO DEL SUR - Location 2	SoCal	1642.860965	5.54E+06	2	304.4557374	23.41967211
13302 RANCHERO RD - Location 2	SoCal	264.7585853	8.92E+05	2	221.2604031	17.02003101
14088 EUCLID AVE - Location 2	SoCal	7456.397006	2.51E+07	2	165.0443558	12.69571968
16898 SPORTSMAN CTR - Location 2	SoCal	316.6435095	1.07E+06	2	235.2715037	18.09780798
1703 MAIN ST - Location 2	SoCal	11884.55708	4.01E+07	2	195.4308048	15.03313883
1808 DURFEE AVE - Location 2	SoCal	30061.25226	1.01E+08	4	226.3122964	17.40863818
20238 HWY 119 - Location 2	SoCal	4231.773212	1.43E+07	2	152.0507624	11.69621249
2199 S VICTORIA AVE - Location 2	SoCal	11593.12867	3.91E+07	2	93.97474314	7.228826396
2384 FOOTHILL BLVD - Location 2	SoCal	4586.239376	1.55E+07	2	73.79120046	5.676246189
2400 LINCOLN BLVD - Location 2	SoCal	31379.71122	1.06E+08	4	176.4541826	13.57339866
250 N TURNPIKE RD - Location 2	SoCal	9147.748555	3.08E+07	2	168.5617307	12.96628698
25941 RAPID FALLS RD - Location 2	SoCal	2313.970639	7.80E+06	2	185.6345626	14.27958174
268 E 4TH ST - Location 2	SoCal	4917.914966	1.66E+07	2	231.8265459	17.83281123
27570 JEFFERSON AVE - Location 2	SoCal	6977.310042	2.35E+07	2	252.1423341	19.39556416
31587 CANYON ESTATES DR - Location 2	SoCal	3566.967313	1.20E+07	2	226.7610056	17.44315428
3240 CAHUENGA BLVD - Location 2	SoCal	4177.463758	1.41E+07	2	68.91070288	5.300823299
33440 STATE HIGHWAY 74 - Location 2	SoCal	2496.295232	8.41E+06	2	249.7967985	19.21513835
35514 HWY 190 - Location 2	SoCal	263.7887736	8.89E+05	2	283.4644827	21.80496021
3801 PORTOLA PARKWAY - Location 2	SoCal	3490.352192	1.18E+07	2	164.0238048	12.61721576
40245 170TH ST - Location 2	SoCal	750.1493249	2.53E+06	2	143.2865137	11.02203951
404 MOFFETT PL - Location 2	SoCal	7589.746111	2.56E+07	2	175.9936115	13.53797012
42460 60TH ST W - Location 2	SoCal	6428.396639	2.17E+07	2	123.4874128	9.499031752
4748 E STETSON LN - Location 2	SoCal	3901.067433	1.31E+07	2	156.9221041	12.07093108
4811 5TH AVE - Location 2	SoCal	440.7794029	1.49E+06	2	267.9094477	20.60841906
505 W AVENUE J - Location 2	SoCal	10217.93573	3.44E+07	2	121.8183776	9.37064443
522 N LAS POSAS RD - Location 2	SoCal	6676.668425	2.25E+07	2	133.2777616	10.25213551
5593 AVENUE 400 - Location 2	SoCal	1242.813652	4.19E+06	2	340.4891382	26.19147217
1190 NORTH MAIN ST. - Location 2	SoCal	3476.774828	1.17E+07	2	515.1972247	39.63055575
632 N GARFIELD AVE - Location 2	SoCal	52954.62649	1.78E+08	6	298.2420797	22.94169844
6320 IRVINE BLVD - Location 2	SoCal	4275.414737	1.44E+07	2	166.2202566	12.78617358
6501 QUAIL HILL PKWY - Location 2	SoCal	2810.999118	9.47E+06	2	170.0405078	13.08003906
6599 COLLINS DRIVE - Location 2	SoCal	3360.882334	1.13E+07	2	89.85709987	6.912084606
7070 SUMMIT VALLEY RD - Location 2	SoCal	1129.345687	3.81E+06	2	233.9013427	17.99241098
7155 VALJEAN AVE - Location 2	SoCal	35529.05044	1.20E+08	4	110.980256	8.536942773
8352 KIMBALL AVE HANGAR #3, F350 - Location 2	SoCal	2095.763014	7.06E+06	2	161.0558028	12.38890791

8606 RESEDA BLVD - Location 2	SoCal	38341.98918	1.29E+08	4	115.278945	8.867611157
11910 FOOTHILL BLVD - Location 2	SoCal	17092.44574	5.76E+07	2	50.85861549	3.912201191
120 E CALLE PRIMERA - Location 2	SoCal	39547.46509	1.33E+08	4	706.7444149	54.36495499
1004 DAIRY AVE - Location 2	SoCal	5544.413304	1.87E+07	2	290.6295088	22.35611606
1049 RIVERSIDE AVE - Location 2	SoCal	8624.53516	2.91E+07	2	348.3878037	26.79906182
10625 Nacimiento Lake Dr - Location 2	SoCal	78.55474507	2.65E+05	2	375.2602613	28.86617395
12618 LIMONITE AVE - Location 2	SoCal	9677.750631	3.26E+07	2	181.2784651	13.94449731
1275 N BLACKSTONE ST - Location 2	SoCal	9002.276804	3.03E+07	2	281.6263173	21.66356287
13760 VALLEY BLVD - Location 2	SoCal	16110.51142	5.43E+07	2	116.778713	8.98297792
14542 ROAD 192 - Location 2	SoCal	580.4322831	1.96E+06	2	276.3116932	21.25474563
1456 N FARMERSVILLE BLVD - Location 2	SoCal	931.5041067	3.14E+06	2	307.3969634	23.64592026
14941 WHITTIER BLVD - Location 2	SoCal	19888.89768	6.70E+07	2	124.3931338	9.568702597
1551 W MISSION BAY DR - Location 2	SoCal	8865.048453	2.99E+07	2	321.4811483	24.7293191
1595 E BARDSLEY AVE - Location 2	SoCal	5825.173781	1.96E+07	2	278.0494389	21.38841838
1777 E PALM CANYON - Location 2	SoCal	6296.502252	2.12E+07	2	302.9778789	23.30599068
1880 LAKE AVE - Location 2	SoCal	15445.22062	5.21E+07	2	86.14451568	6.626501206
2008 W AVENUE I - Location 2	SoCal	5882.39267	1.98E+07	2	122.466522	9.420501692
2015 MISSION DR - Location 2	SoCal	2496.295232	8.41E+06	2	250.0663919	19.2358763
20651 PALOMAR ST - Location 2	SoCal	2670.861333	9.00E+06	2	235.9922021	18.15324631
2155 S MISSION RD - Location 2	SoCal	3741.533414	1.26E+07	2	286.1214107	22.00933928
2261 EAGLE GLEN PKWY - Location 2	SoCal	3122.308664	1.05E+07	2	191.5782941	14.73679185
23691 AVENUE 95 - Location 2	SoCal	1548.789233	5.22E+06	2	239.6335165	18.43334743
2450 MONTECITO RD - Location 2	SoCal	90.19248509	3.04E+05	2	331.7021645	25.51555111
246 W EL ROBLAR DR - Location 2	SoCal	2469.140506	8.32E+06	2	108.1775258	8.321348137
27350 VALLEY CENTER RD - Location 2	SoCal	272.0321728	9.17E+05	2	307.3298929	23.64076099
29010 ALESSANDRO BLVD - Location 2	SoCal	4066.420322	1.37E+07	2	225.228228	17.3252483
30821 hwy 99 - Location 2	SoCal	1505.632614	5.07E+06	2	302.8920729	23.29939022
31186 HAWTHORNE BLVD - Location 2	SoCal	1497.389215	5.05E+06	2	128.7617367	9.904748979
34220 Monterey Ave - Location 2	SoCal	1696.200607	5.72E+06	2	315.5558718	24.2735286
36218 B HWY 99 - Location 2	SoCal	114.9226826	3.87E+05	2	318.1303663	24.47156664
3701 W MAGNOLIA BLVD - Location 2	SoCal	31480.57164	1.06E+08	4	131.7983544	10.13833495
380 N VALENCIA BLVD - Location 2	SoCal	3279.418154	1.11E+07	2	334.3685737	25.72065952
3855 PELICAN WAY - Location 2	SoCal	1415.440129	4.77E+06	2	107.0209561	8.232381242
3989 SOUTH ""K"" STREET - Location 2	SoCal	1332.521231	4.49E+06	2	274.0533417	21.08102628
4111 TELEGRAPH RD - Location 2	SoCal	11945.17031	4.03E+07	2	95.22892617	7.325302013
412 S BURNETT RD - Location 2	SoCal	1002.300358	3.38E+06	2	257.5035617	19.80796629
41575 ECLECTIC ST - Location 2	SoCal	5676.792596	1.91E+07	2	324.9076616	24.99289705
43411 MONROE ST - Location 2	SoCal	7195.517668	2.42E+07	2	335.0613542	25.77395032
4358 W AVENUE L - Location 2	SoCal	5630.241636	1.90E+07	2	120.9360124	9.302770188
21600 CORWIN RD - Location 2	SoCal	326.826532	1.10E+06	2	251.7008841	19.36160647
515 S LOVERS LN - Location 2	SoCal	10296.97538	3.47E+07	2	303.6923615	23.36095089
515/507 Orchard - Location 2	SoCal	3349.244594	1.13E+07	2	322.7513282	24.82702525

5884 WASHINGTON BLVD - Location 2	SoCal	47030.04701	1.58E+08	4	173.8378003	13.37213848
7601 TOPANGA CANYON BLVD - Location 2	SoCal	32180.77566	1.08E+08	4	141.8015481	10.90781139
7901 W SUNSET BLVD - Location 2	SoCal	26254.25656	8.85E+07	4	153.8709996	11.83623074
7954 LACEY BLVD - Location 2	SoCal	907.258815	3.06E+06	2	319.6828583	24.5909891
84-425 INDIO BLVD - Location 2	SoCal	2944.833129	9.92E+06	2	344.1408076	26.47236982
90 W MORTON AVE - Location 2	SoCal	8915.47866	3.00E+07	2	256.4961818	19.73047552
9001 ELIZABETH LAKE RD - Location 2	SoCal	105.7094718	3.56E+05	2	64.24800056	4.942153889
951 W TEAPOT DOME AVE - Location 2	SoCal	182.3245935	6.14E+05	2	247.00955	19.00073461
9605 CARLTON HILLS BLVD - Location 2	SoCal	6053.564429	2.04E+07	2	328.7193671	25.28610516
9690 BLACK MOUNTAIN RD - Location 2	SoCal	8153.206689	2.75E+07	2	311.7171273	23.97824056
978 CUYAMACA ST - Location 2	SoCal	17550.19684	5.91E+07	2	341.7184787	26.28603683
13735 HESPERIA RD - Location 2	SoCal	4448.526119	1.50E+07	2	235.3561584	18.10431988
600 E BORDER ST - Location 2	SoCal	223.5415894	7.53E+05	2	77.26153119	5.943194707
410 E PLANZ RD - Location 2	SoCal	10461.84336	3.53E+07	2	152.4220196	11.72477074
79-880 AVENUE 42 - Location 2	SoCal	1641.406247	5.53E+06	2	333.1651573	25.62808902
900 SOUTH HARBOR BLVD - Location 2	SoCal	28940.63488	9.75E+07	4	276.7597325	21.28921019
4207 KNOX AVE - Location 2	SoCal	492.1794213	1.66E+06	2	147.9008965	11.37699204
3951 Grand Ave - Location 2	SoCal	11553.8513	3.89E+07	2	147.6082786	11.35448297
2601 DEL ROSA AVE - Location 2	SoCal	29711.63515	1.00E+08	4	385.6381678	29.66447444
4530 WALDEN WEAVER RD - Location 2	SoCal	1140.983427	3.85E+06	2	258.450305	19.88079269
211 5TH AVE - Location 2	SoCal	2937.559541	9.90E+06	2	560.8803801	43.14464463
42197 Margarita Rd - Location 2	SoCal	7220.247865	2.43E+07	2	258.0797515	19.85228858
13310 OSBORNE ST - Location 2	SoCal	40475.08995	1.36E+08	4	98.92247318	7.609421014
9280 HAVEN AVE - Location 2	SoCal	15192.58468	5.12E+07	2	165.4557433	12.72736487
11810 De Palma Rd. - Location 2	SoCal	1174.926835	3.96E+06	2	204.6991539	15.74608876
4900 WING WAY - Location 2	SoCal	557.156803	1.88E+06	2	345.129797	26.54844592
14220 CHINO HILLS PKWY - Location 2	SoCal	5763.59074	1.94E+07	2	146.6702539	11.28232722
16266 Bear Valley Rd. - Location 2	SoCal	8064.468922	2.72E+07	2	229.2511198	17.63470152
2741 GATEWAY ROAD - Location 2	SoCal	5165.216942	1.74E+07	2	272.9297321	20.99459478
1002 MANHATTAN BCH BLVD - Location 2	SoCal	22458.8986	7.57E+07	2	105.5034895	8.115653036
1544 PALMDALE RD - Location 2	SoCal	6690.245789	2.25E+07	2	230.8113845	17.75472189
33638 AGUA DULCE CANYON RD - Location 2	SoCal	113.9528709	3.84E+05	2	68.23198078	5.248613906
1560 N MAPLE STREET - Location 2	SoCal	4948.464034	1.67E+07	2	176.5378179	13.57983215
886 W OAK VALLEY PKWY - Location 2	SoCal	1911.013891	6.44E+06	2	236.7870707	18.21439005
30351 HWY 78 - Location 2	SoCal	124.6207993	4.20E+05	2	357.8386484	27.52604988
27040 FIR AVE - Location 2	SoCal	4765.654535	1.61E+07	2	219.492219	16.88401685
2974 LENWOOD RD - Location 2	SoCal	1136.134369	3.83E+06	2	287.8910945	22.14546881
903 KERN ST #B - Location 2	SoCal	6635.936335	2.24E+07	2	186.1265833	14.31742948
16166 SPUNKY CANYON RD - Location 2	SoCal	96.01135509	3.24E+05	2	31.34653957	2.411272275
8404 FOOTHILL BLVD - Location 2	SoCal	13652.52375	4.60E+07	2	60.3484444	4.642188031

27885 ALISO CREEK ROAD - Location 2	SoCal	9006.640957	3.04E+07	2	186.8610004	14.37392311
40500 CALIFORNIA OAKS RD - Location 2	SoCal	5103.633901	1.72E+07	2	244.669348	18.82071908
2000 EAST TEHACHAPI BLVD - Location 2	SoCal	249.2415986	8.40E+05	2	207.3276024	15.94827711
101 W BIG BEAR BLVD - Location 2	SoCal	2628.674525	8.86E+06	2	272.2455661	20.94196662
1315 STATE HWY 2 - Location 2	SoCal	1677.289279	5.65E+06	2	222.3611448	17.10470345
1900 EAST HOBSONWAY - Location 2	SoCal	185.2340285	6.24E+05	2	535.9699626	41.22845866
11920 FOOTHILL BLVD. #110 - Location 2	SoCal	17696.6384	5.96E+07	2	162.334336	12.48725662
3697 EL CAJON BLVD - Location 2	SoCal	58357.44729	1.97E+08	6	966.1238901	74.31722232
20-000 N INDIAN CANYON RD - Location 2	SoCal	717.1757282	2.42E+06	2	301.16374	23.16644154
58181 29 PALMS HWY - Location 2	SoCal	1766.511953	5.95E+06	2	328.8840062	25.29876971
11400 MING AVE - Location 2	SoCal	1055.155094	3.56E+06	2	165.0156933	12.69351487
8765 DOS LAGOS DR - Location 2	SoCal	2533.148076	8.54E+06	2	193.2496045	14.8653542