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California Energy Commission
Clean Transportation Program

FINAL PROJECT REPORT

Public Plug-In Electric Vehicle Charge Stations at Los Angeles City Locations

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Prepared by: Los Angeles Department of Water and Power



Gavin Newsom, Governor

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PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program, formerly known as the Alternative and Renewable Fuel and Vehicle Technology Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to \$20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about \$100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce-training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued PON-13-606 to fund electric vehicle charging infrastructure in several specific categories to support the adoption of electric vehicles by a wide range of California citizens. In response to PON-13-606, the recipient submitted an application, which was proposed for funding in the CEC's notice of proposed awards April 2, 2014, and the agreement was executed as ARV-13-045 on January 15, 2015.

ABSTRACT

The goal of this agreement was to encourage plug-in electric vehicle adoption and increase electric vehicles miles driven in Los Angeles. This would be accomplished by installing electric vehicle charging stations and electric vehicle service equipment at key destinations owned, operated by the City of Los Angeles, and available to the public. The project was undertaken in cooperation with the Los Angeles Department of Transportation, the Los Angeles Police Department, the Los Angeles Public Library, and Los Angeles World Airports, as well as Zeco Systems, Inc. dba Greenlots.

The primary objectives of the project were:

- To accelerate plug-in electric vehicle adoption.
- To increase plug-in electric vehicle miles driven in Los Angeles.

Some of the key results:

- The project resulted in more than 14,092 charge sessions over a seven-month period.
- This project reduced greenhouse gas emissions by more than 236,630 pounds.
- This project saved about 12,080 gallons of gasoline.
- This project provided measurements of charge station use in Los Angeles.

Keywords: Plug-in Electric Vehicles, Electric Vehicle Charging Stations, Electric Vehicle Service Equipment, Los Angeles Department of Water and Power, Los Angeles Department of Transportation, Los Angeles Police Department, Los Angeles Public Libraries, Los Angeles World Airports, Greenhouse Gas Emissions

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EXECUTIVE SUMMARY

The City of Los Angeles is subject to poor air quality, which can be greatly improved by the adoption of plug-in electric vehicles (PEVs) and the increase in electric miles driven in the region. A key unresolved issue is the availability and proliferation of charging infrastructure in Los Angeles to support PEV drivers and provide confidence to those considering the purchase of PEVs. An additional barrier to the availability of infrastructure is the cost to install. The funding from the Energy Commission provides a huge opportunity for the City of Los Angeles to support the goal of expanding the number of chargers at its properties, which will give current PEV owners confidence to drive their vehicles throughout the City of Los Angeles to key destinations and encourage those considering PEVs to trade their gasoline vehicles in.

The Scope of Work covered by the Grant includes the installation of 104 electrical vehicle chargers at 29 key locations in the City of Los Angeles. These locations are managed by four separate and independent City Departments: Los Angeles Police Department (LAPD), Los Angeles Department of Transportation (LADOT), Los Angeles World Airports (LAWA), and Los Angeles Public Library (LAPL).

The objectives of this Agreement were to install at least 104 chargers at about 29 key locations that will be used by current drivers and encourage new drivers to adopt electric vehicle technology.

Ultimately, 119 chargers were installed and commissioned at 23 key locations, with meters installed on 89 of the 119 chargers. The deployments included hardware manufactured by two different companies (Siemens and Clipper Creek) and charge events were recorded over the course of six months.

After six months of usage and data recording, the following information was compiled:

- The project resulted in more than 14,000 charge sessions.
- Reduced greenhouse gas emissions by more than 236,630 pounds (lbs).
- Prevented use of more than 12,080 gallons of gasoline.

CHAPTER 1: Project Description

Overview

The \$500,000 grant from the California Energy Commission (Energy Commission) through agreement ARV-13-045 established a goal of installing 104 chargers at key destinations owned and operated by the City of Los Angeles with subsequent usage data for analysis. This specific target is consistent with broader objectives pursued by the Energy Commission and Los Angeles Department of Water and Power (LADWP):

- Promote the widespread adoption of Electric Vehicles (EVs)
- Decrease reliance on fossil fuels
- Reduce greenhouse gas emissions

The charger installation project continues a well-established practice of clean technology adoption in Los Angeles City. Not only does this project supplement the existing electric vehicle chargers already installed in the City, but it also leads by example. With this development, public drivers will have access to free charging stations and will be more eager to switch to EVs.

Objectives

The objectives of this agreement are to install at least 104 chargers at 29 key locations that will be used by current drivers and encourage new drivers to adopt EV technology.

As a result, the City of Los Angeles should see an increase in charger use over time. LADWP will also see an increase in EV adoption through the applications for their EV rebate program.

The primary objectives of the project were:

- To accelerate plug-in electric vehicle adoption.
- To measure PEV charge station usage.
- To further the sustainability goals of the City of Los Angeles.

In addition to these primary goals, the project also sought to better understand the characteristics of charge station usage.

Project Sites

The original objectives of this Agreement were to install at least 104 chargers at about 29 key locations that will be used by current drivers and encourage new drivers to adopt EV technology. Under further inspection, a few of the locations proved to be either infeasible or non-cost-effective, and were dropped from the list. Of the remaining 23 locations, many had the capacity for more chargers than originally anticipated. The resulting opportunity made up 119 public chargers, well beyond the minimum number of required charging stations.

Although some locations were dropped, other city locations, outside of the scope of the original agreement, were added, resulting in 185 public chargers at 36 locations. This report only studies the chargers installed at 23 of the original 29 sites. Table 1, on the next page, provides detail of the locations of the installed public chargers, the original number of charging stations planned for each site, and the number of charging stations that were installed. There were also two charging locations at LAWA sites, Parking Structures 1 and 7, that weren't

originally going to have chargers installed, but were determined to be suitable sites and 24 total charging units were installed between these locations.

Table 1: EV Charger Locations

Location	CEC Site ID	Address	Zip	Orig #	Units
LADOT - Aiso	LADOT 6	101 Judge John Aiso St	90012	6	6
LADOT - Broxton	LADOT 8	1036 Broxton Ave	90024	4	4
LADOT - Cherokee	LADOT 3	1710 N Cherokee Ave	90028	2	3
LADOT - Hollywood/Highland	LADOT 5	6801 Hollywood Blvd	90028	21	20
LADOT - Hollywood/Vine	LADOT 4	1627 N Vine St	90028	8	5
LADOT - Larchmont	LADOT 2	218 N Larchmont Blvd	90004	4	2
LADOT - Robertson	LADOT 1	123 S Robertson Blvd	90048	1	1
LADOT - Venice Beach	LADOT 7	200 N Venice Blvd	90291	4	4
LAPD - Harbor	LAPD 1	2175 John S Gibson Dr.	90731	2	3
LAPD - Hollenbeck	LAPD 2	2111 E 1st St	90033	1	2
LAPD - Mission	LAPD 3	11121 Sepulveda Blvd	91345	1	2
LAPD - North Hollywood	LAPD 5	11640 Burbank Blvd	91601	1	2
LAPD - Olympic	LAPD 6	1130 S Vermont Ave	90006	1	2
LAPD - Topanga	LAPD 9	21501 Schoenborn St	91304	1	2
LAWA - Admin West	LAWA	7301 World Way West	90045	10	10
LAWA - Parking Lot C	LAWA	6221 W 96th St	90045	10	6
LAWA - Parking Structure 1	LAWA	101 World Way	90045	0	6
LAWA - Parking Structure 7	LAWA	701 World Way	90045	0	18
Library - Chatsworth	Library 1	21052 Devonshire St	91311	2	2
Library - Dr Mary McLeod Beyhune	Library 2	3900 S Western Ave	90062	2	6
Library - Mid Valley Regional	Library 3	16244 Nordhoff St	91343	2	5
Library - Northridge	Library 4	9051 Darby Ave	91325	2	2
Library - Silverlake	Library 6	2411 Glendale Ave	90039	2	6
TOTAL				87	119

Source: California Energy Commission staff

Chapter 2: Project Execution

Planning

The Electric Transportation Group from LADWP oversaw the project on behalf of the other City Departments. Greenlots was the prime contractor for LADOT, LAPD, and the Libraries. LAWA used their own construction force to maintain security procedures at the airports. Greenlots also procured the equipment for all the locations. The EV chargers are rated at 30 Amps and 7.2 kilowatts. Figure 1 shows two types of Electric Vehicle Supply Equipment (EVSEs) used in this project.

Figure 1: EVSE: Siemens Versicharge (left) and Clipper Creek CS-40 (right)



Source: LADWP

Installation was performed by subcontractor crews with minimal interruptions to traffic and minor reductions in parking availability. Once the chargers were installed, meters were added to record usage data.

Testing and Verification

After installation and prior to public use, each EV charging station was tested and verified to be operational. This testing included specific tests of the ability of the charge station to:

- Turn on and provide power to a vehicle or test device.
- Automatically turn off in response to a major fault.
- Continue a charge session or reset in the case of a minor fault.

Installation and Commissioning

LADOT: Aiso

The installation at Aiso, shown in Figure 2, included six Siemens EVSE. The units were mounted on the Eastern wall of P2. Final unit test and verification was performed and acceptance completed on September 28, 2017.

Figure 2: Installation at LADOT: Aiso



Source: LADWP

LADOT: Broxton

The installation at Broxton, shown in Figure 3, included four Siemens EVSE. The units were wall-mounted on the first level of the parking garage. Final unit test and verification was performed and acceptance completed on September 6, 2017.

Figure 3: Installation at LADOT: Broxton



Source: LADWP

LADOT: Cherokee

The installation at Cherokee, shown in Figure 4, included three Siemens EVSE. The units were wall-mounted on the second level of the parking structure. Final unit test and verification was performed and acceptance completed on September 7, 2017.

Figure 4: Installation at LADOT: Cherokee



Source: LADWP

LADOT: Hollywood and Highland

The installation at Hollywood and Highland, shown in Figure 5, included 20 Siemens EVSE. The units were wall-mounted on the first level of the parking garage. Final unit test and verification was performed and acceptance completed on October 28, 2017.

Figure 5: Installation at LADOT: Hollywood and Highland



Source: LADWP

LADOT: Hollywood and Vine

The installation at Hollywood and Vine, shown in Figure 6, included five Siemens EVSE. The units were wall-mounted on the lower level of the parking garage. Final unit test and verification was performed and completed on September 14, 2017.

Figure 6: Installation at LADOT: Hollywood and Vine



Source: LADWP

LADOT: Larchmont

The installation at Larchmont, shown in Figure 7, included two Siemens EVSE. The units were wall-mounted on the first level of the parking garage. Final unit test and verification was performed and completed on September 6, 2017.

Figure 7: Installation at LADOT: Larchmont



Source: LADWP

LADOT: Robertson

The installation at Robertson, shown in Figure 8, included one Siemens EVSE. The unit was wall-mounted in the parking garage. Final unit test and verification was performed and completed on January 25, 2018.

Figure 8: Installation at LADOT: Robertson



Source: LADWP

LADOT: Venice Beach

The installation at Venice Beach, shown in Figure 9, included four Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on September 25, 2017.

Figure 9: Installation at LADOT: Venice Beach



Source: LADWP

LAPD: Harbor

The installation at Larchmont, shown in Figure 10, included three Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on September 26, 2017.

Figure 10: Installation at LAPD: Harbor

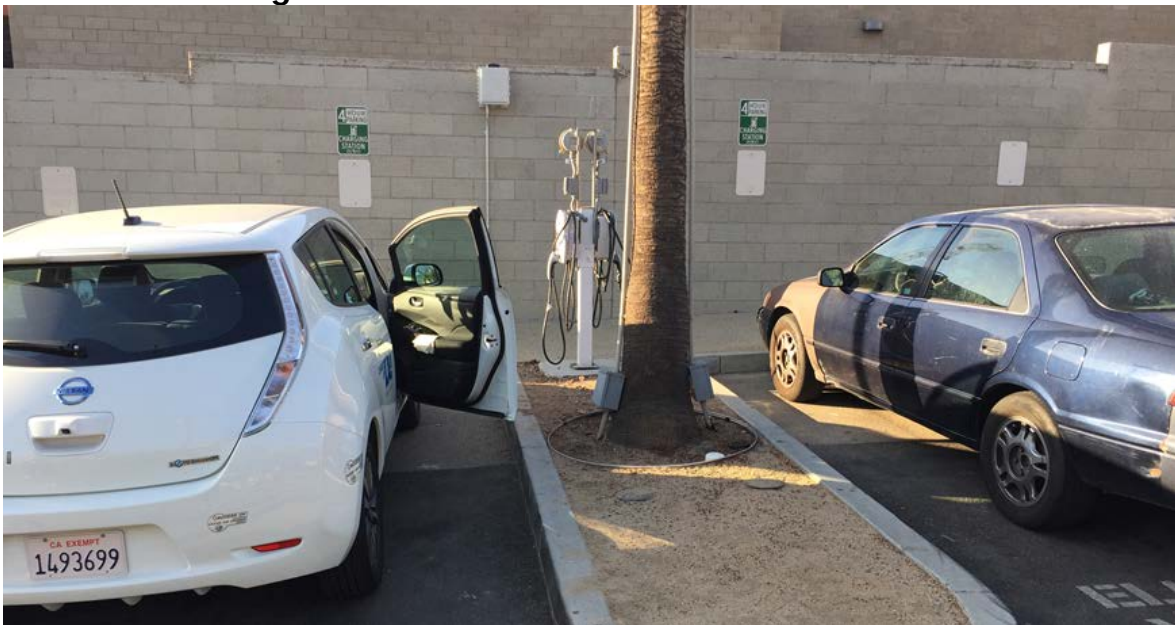


Source: LADWP

LAPD: Hollenbeck

The installation at Hollenbeck, shown in Figure 11, included two Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on November 17, 2017.

Figure 11: Installation at LAPD: Hollenbeck

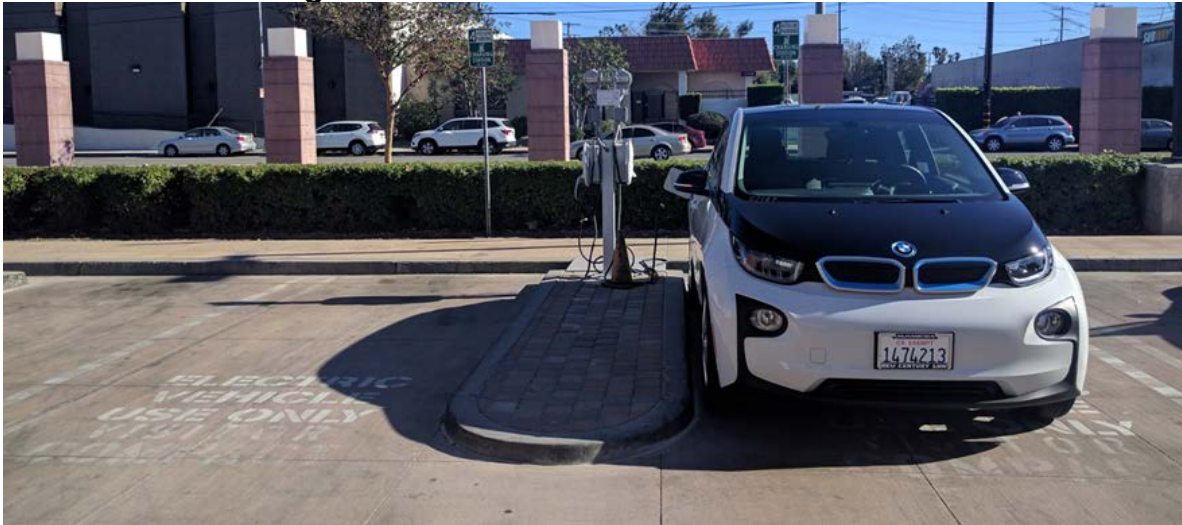


Source: LADWP

LAPD: Mission

The installation at Mission, shown in Figure 12, included two Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on September 26, 2017.

Figure 12: Installation at LAPD: Mission



Source: LADWP

LAPD: North Hollywood

The installation at North Hollywood, shown in Figure 13, included two Siemens EVSE. The units were wall-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on October 27, 2017.

Figure 13: Installation at LAPD: North Hollywood



Source: LADWP

LAPD: Olympic

The installation at Olympic, shown in Figure 14, included two Siemens EVSE. The units were wall-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on October 27, 2017.

Figure 14: Installation at LAPD: Olympic



Source: LADWP

LAPD: Topanga

The installation at Topanga, shown in Figure 15, included two Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on September 14, 2017.

Figure 15: Installation at LAPD: Topanga



Source: LADWP

LAWA: Admin West

The installation at Admin West, shown in Figure 16 included 10 Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on October 27, 2017.

Figure 16: Installation at LAWA: Admin West



Source: LADWP

LAWA: Parking Lot C

The installation at Parking Lot C, shown in Figure 17, included six Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on October 27, 2017.

Figure 17: Installation at LAWA: Parking Lot C



Source: LADWP

LAWA: Parking Structure 1

The installation at Parking Structure 1, shown in Figure 18, included six Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on October 27, 2017.

Figure 18: Installation at LAWA: Parking Structure 1



Source: LADWP

LAWA: Parking Structure 7

The installation at Parking Structure 7, shown in Figure 19, included 18 Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on October 27, 2017.

Figure 19: Installation at LAWA: Parking Structure 7



Source: LADWP

Library: Chatsworth

The installation at Chatsworth, shown in Figure 20, included two Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on September 26, 2017.

Figure 20: Installation at Library: Chatsworth

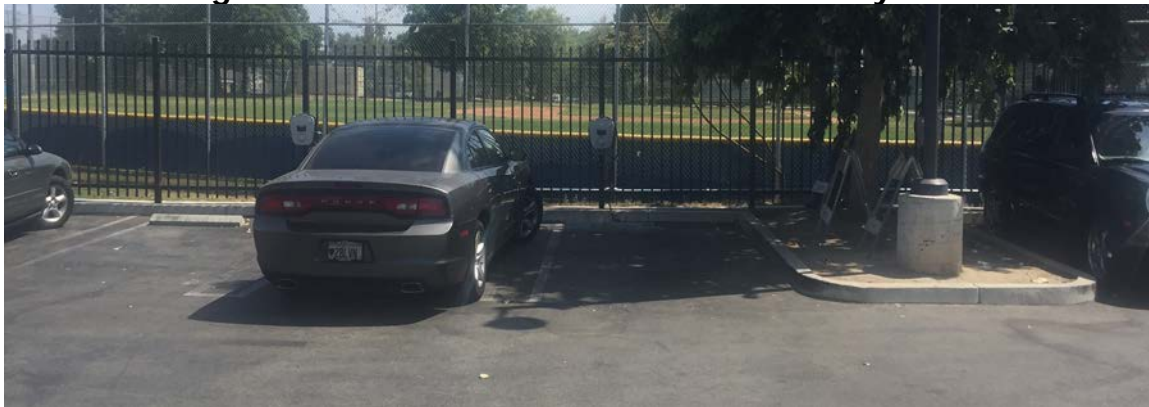


Source: LADWP

Library: McLeod Beyhune

The installation at McLeod Beyhune, shown in Figure 21, included six Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on September 26, 2017.

Figure 21: Installation at LAPD: McLeod Beyhune



Source: LADWP

Library: Mid Valley Regional

The installation at Mid Valley Regional, shown in Figure 22, included five Siemens EVSE. The units were pedestal-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on August 21, 2017.

Figure 22: Installation at Library: Mid Valley Regional



Source: LADWP

Library: Northridge

The installation at Northridge, shown in Figure 23, included two Siemens EVSE. The units were wall-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on September 26, 2017.

Figure 23: Installation at Library: Northridge

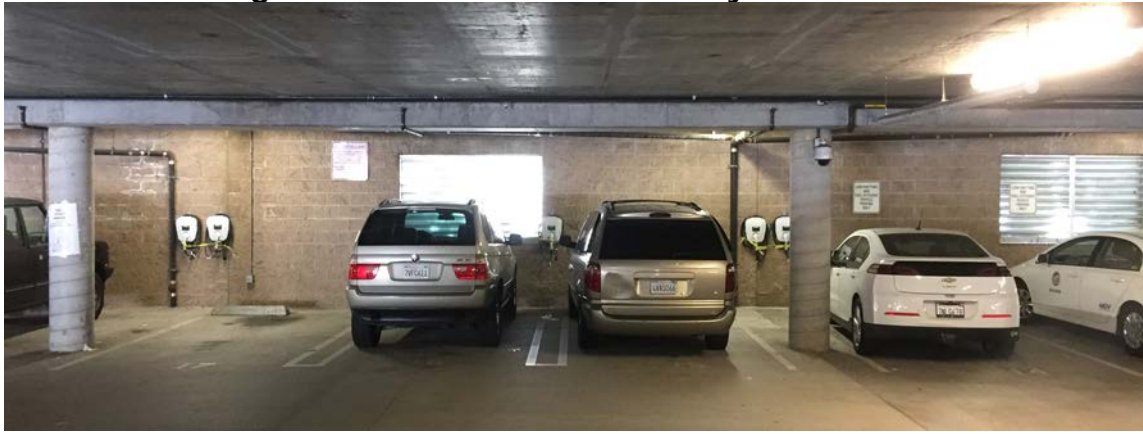


Source: LADWP

Library: Silverlake

The installation at Silverlake, shown in Figure 24, included six Siemens EVSE. The units were wall-mounted on the Northwest corner of the parking lot. Final unit test and verification was performed and completed on November 4, 2017.

Figure 24: Installation at Library: Silverlake



Source: LADWP

Chapter 3: Data and Analysis

This section details the technical findings from the project. It includes site-specific as well as aggregate information. A sample set of recorded charge event data is provided in Appendix B.

The results provided include:

- Charge station utilization,
- Greenhouse gases savings in units of pounds of carbon dioxide (CO₂),
- Estimated gallons of gasoline displaced
- Month over month changes in metrics over the course of data collection.

Findings

The chargers were immediately put to use after installation was completed. Spaces for these charging stations filled up as the locals came in each day and remained occupied throughout the day.

Although all of the chargers are energized and in use, we experienced delays related primarily to the following factors:

- Establishment of necessary cost-share funding for each City Department through an LADWP customer Rebate Program which was approved by LADWP's Board on February 16, 2016
- Establishment of separate Legal Agreements with each City Department partner based on site assessments and Grant/Rebate funding
- Development of low-cost Wi-Fi enabled charging hardware with new software and communication protocol by LADWP Contractor which was not considered in the original Grant application and Agreement
- Optimization of site designs and installation criteria to lower overall average installed unit cost
- Development of a standardized LADWP EV meter installation

The new chargers detailed in this report provided useful experience with installing and managing charging stations. The internal issues affecting meter installation have been standardized.

Changes in Usage over the Recording Period

The first readings arrived August 29, 2017. The data extracted from the smart chargers provided valuable usage information. One of the highlights from the compilation and analysis was the total number of charging events. The growth rate from September to April shows about 700 more sessions every month.

Unfortunately, the 40 chargers installed at LAWA were not networked chargers and are not included in this data set, as reflected in Table 2. The stations have been energized and operating as early as September 2016 but the LADWP meters were not installed until April 26th 2018 and have not yet been read. No data is available yet for these charging units, but they are being used.

A sample set of recorded charge data used to calculate the aggregate data in Table 2 is available in Appendix A.

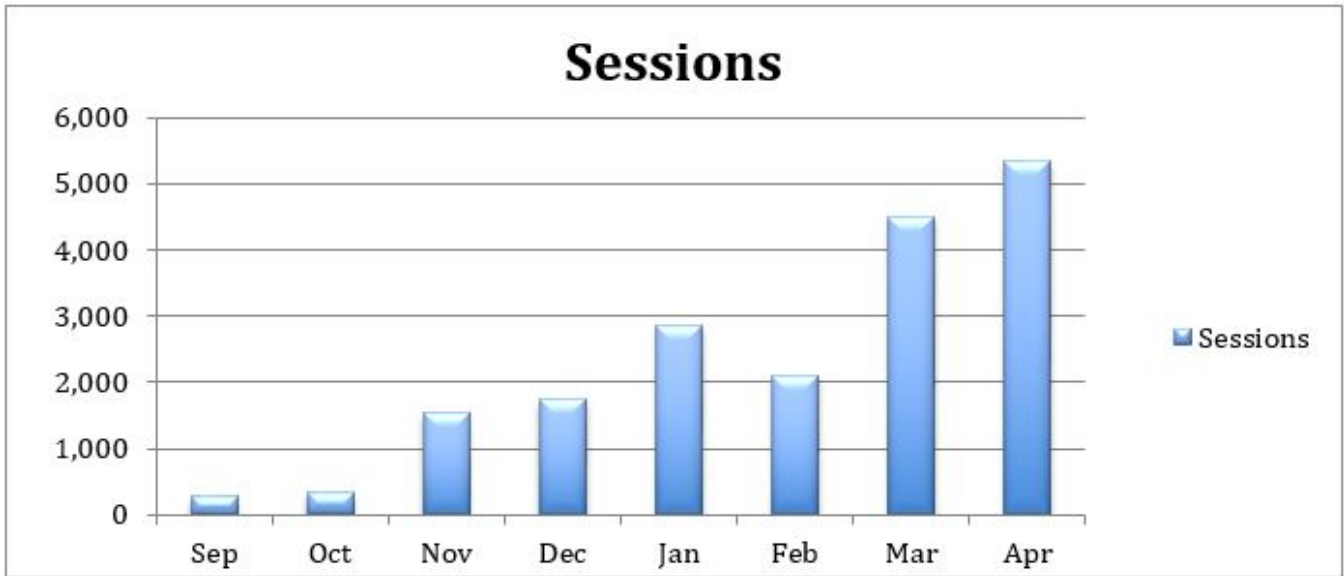
Table 2: LADOT, LAPD and LAPL Data Summary

Location	CEC Site ID	Units	Energy (kWh)	No. of Sessions	Estimated Saved Gasoline (gal)	Estimated CO2 Replaced (lbs.)	Data Began (thru 4/30/18)
Robertson	LADOT 1	1	563	56	60	1,100	3/6/2018
Larchmont	LADOT 2	2	6365	827	640	12,470	10/28/2017
Cherokee	LADOT 3	3	2884	335	290	5,650	9/12/2017
Hollywood and Vine	LADOT 4	5	10393	1134	1040	20,360	10/26/2017
Hollywood and Highland	LADOT 5	20	27754	3031	2780	54,370	10/27/2017
Aiso	LADOT 6	6	5381	695	540	10,540	9/28/2017
Venice Beach	LADOT 7	4	3217	322	320	6,300	9/25/2017
Broxton	LADOT 8	4	11874	1760	1190	23,260	9/6/2017
Harbor	LAPD 1	3	2496	320	250	4,890	10/9/2017
Hollenbeck	LAPD 2	2	3652	411	370	7,150	11/17/2017
Mission Area	LAPD 3	2	4993	763	500	9,780	10/31/2017
NoHo	LAPD 5	2	1212	118	120	2,380	11/22/2017
Olympic	LAPD 6	2	11527	1046	1150	22,580	10/27/2017
Topanga	LAPD 9	2	12659	1229	1270	24,800	9/14/2017
Chatsworth	Library 1	2	1752	317	180	3,430	9/30/2017
Dr Mary McLeod Beyhune	Library 2	6	2375	232	240	4,650	9/30/2017
Mid Valley Regional	Library 3	5	4695	545	470	9,200	8/29/2017
Northridge	Library 4	2	1840	267	180	3,600	11/7/2017
Silverlake	Library 6	6	5165	684	520	1,0120	11/1/2017
TOTAL		79	120797	14092	12110	236,630	

Source: LADWP

The following graphs in Figures 25, Figure 26, Figure 27, and Figure 28 illustrate the usage of the 79 chargers on sites from LADOT, LAPD, and LAPL, broken down by month. Session data with a duration under two minutes or usages of negative or 0 kilowatt hours (kWh) were excluded. The largest car battery at this time is 100kWh. Sessions over that amount were also excluded. The graphs in Figures 25, Figure 26, Figure 27, and Figure 28 show the number of charging sessions per month, energy usage in kilowatt-hours, CO2 displaced, and gallons of gasoline displaced.

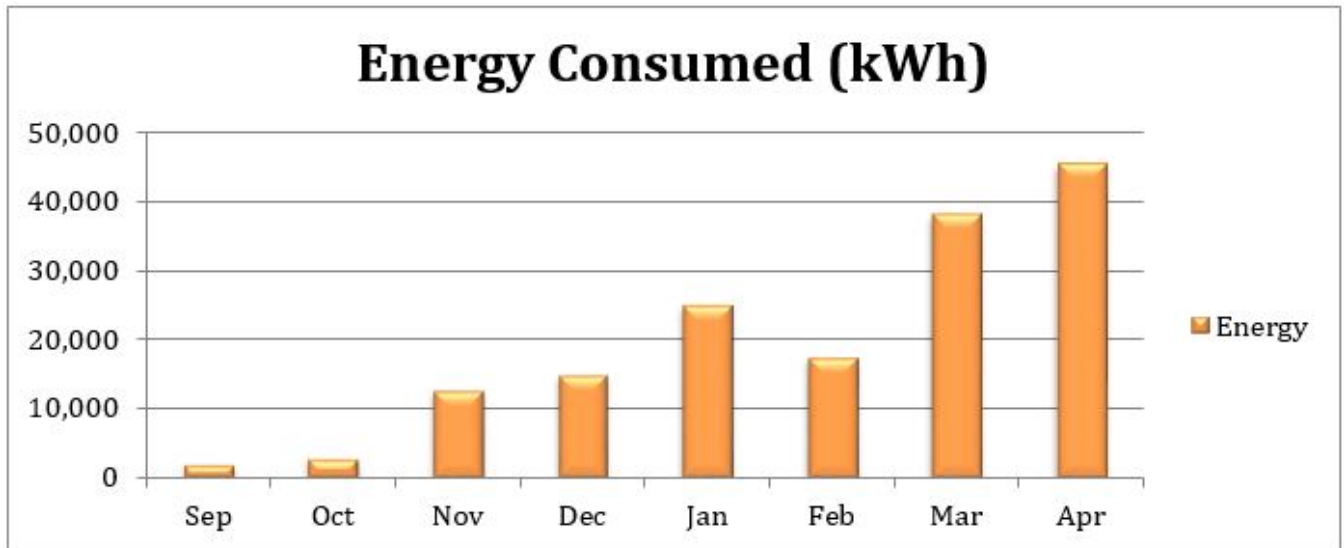
Figure 25: Number of Sessions



Source: LADWP

Average Charge Duration by Month

Figure 26: kWh of Energy Consumed

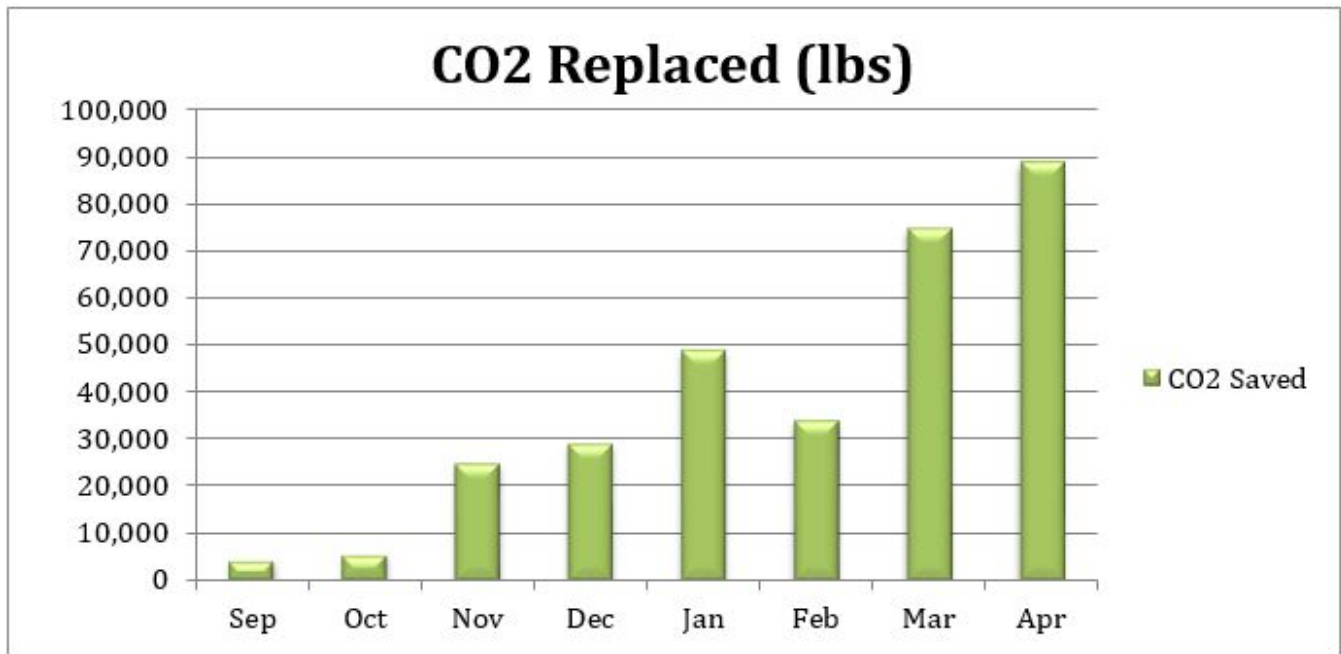


Source: LADWP

One of the reasons for the early increase in both the number of sessions and energy used was the units coming on-line to the Greenlots network. However, 78 of the 79 chargers from this data were recording data by the end of November. The Greenlots SKYNetwork, that captured all this data, allowed for better recording of usage across all sites.

Greenhouse Gas Emission Savings

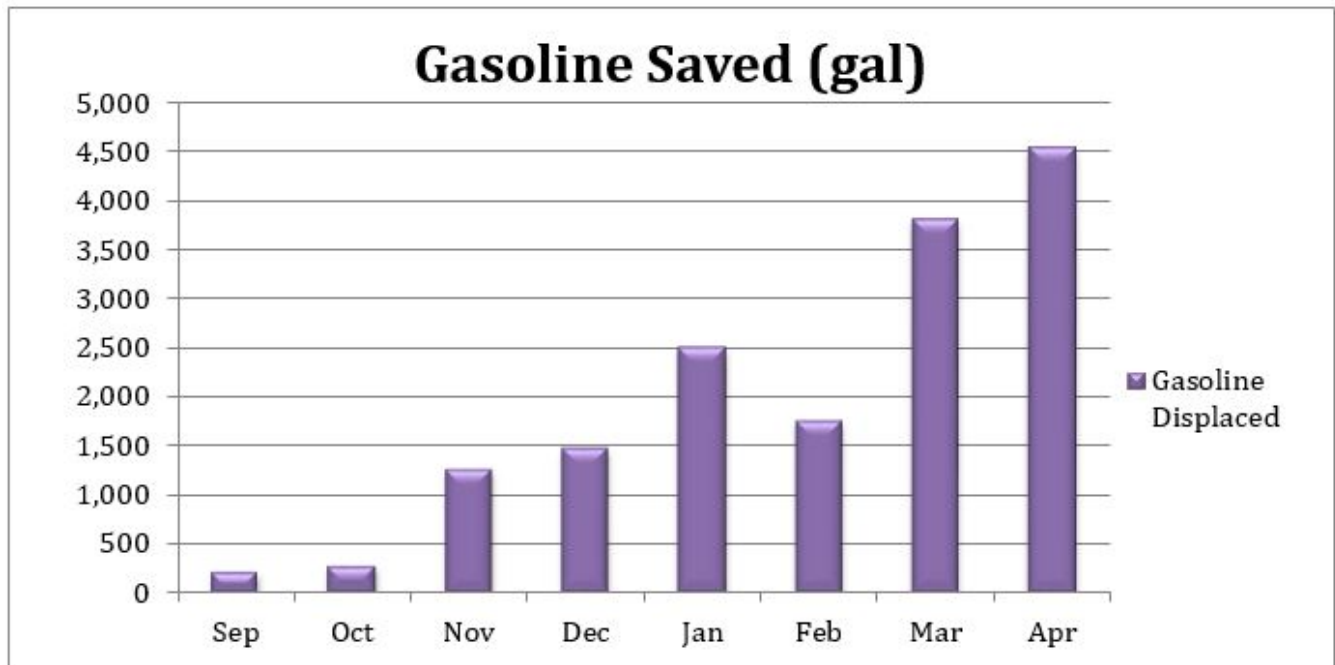
Figure 27: Pounds of CO2 Replaced



Source: LADWP

Monthly Gasoline Savings

Figure 28: Gallons of Gasoline Saved



Source: LADWP

Chapter 4: Summary and Conclusions

The Los Angeles Department of Water and Power expanded its network of EV supply equipment with the Energy Commission's award of \$500,000 in grant funding and LADWP's approximate \$400,000 in match share funding. One hundred and nineteen charging stations were included in the expansions, which are shared for public EVs.

The 119 chargers were completed in late 2017 and data gathered over the seven following months indicates 120,799 kWh used at the charging stations, displacing approximately 12,080 gallons of gasoline and preventing at least 236,630 lbs. of CO₂ from being released into the atmosphere over the seven months of data collection.

These installations work to support Governor Brown's Executive Order B-16-12, which directs state government to adopt zero-emission vehicles as well as Executive Order B-18-12, which calls for reduced greenhouse gas emissions. Additionally, the project facilitates the widespread adoption of EVs.

The project and its results are consistent with broader goals pursued by the Energy Commission and LADWP. The increased availability of charging encourages rapid adoption of EVs. The infrastructure built for this project will ultimately further the development green transportation technology. Meanwhile, meters on the chargers allow for the continued tracking of environmental benefits. Recognizing these achievements, the project has succeeded on multiple fronts in advancing EV infrastructure and adoption of EVs.

GLOSSARY

CALIFORNIA ENERGY COMMISSION - The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The Energy Commission's five major areas of responsibilities are:

- Forecasting future statewide energy needs
- Licensing power plants sufficient to meet those needs
- Promoting energy conservation and efficiency measures
- Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels
- Planning for and directing state response to energy emergencies.

CARBON DIOXIDE (CO₂) - A colorless, odorless, non-poisonous gas that is a normal part of the air. Carbon dioxide is exhaled by humans and animals and is absorbed by green growing things and by the sea. CO₂ is the greenhouse gas whose concentration is being most affected directly by human activities. CO₂ also serves as the reference to compare all other greenhouse gases (see carbon dioxide equivalent).

ELECTRIC VEHICLE (EV) – A broad category that includes all vehicles that are fully powered by Electricity or an Electric Motor.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE) - Infrastructure designed to supply power to EVs. EVSE can charge a wide variety of EVs including BEVs and PHEVs.

KILOWATT-HOUR (kWh) -- The most commonly used unit of measure telling the amount of electricity consumed over time. It means one kilowatt of electricity supplied for one hour. In 1989, a typical California household consumes 534 kWh in an average month.

LOS ANGELES DEPARTMENT OF TRANSPORTATION (LADOT) - a municipal agency that oversees transportation planning, design, construction, maintenance and operations within the City of Los Angeles.

LOS ANGELES DEPARTMENT OF WATER AND POWER (LADWP) - An electric, municipal utility serving the greater Los Angeles, California, region.

LOS ANGELES POLICE DEPARTMENT (LAPD) - Officially the City of Los Angeles Police Department, the police department of Los Angeles, California. The LAPD operates with 9,988 officers and 2,869 civilian staff, in an area of 498 square miles and a population of 4,030,904 people.

LOS ANGELES PUBLIC LIBRARY (LAPL) - The public library system operating in the City of Los Angeles, covering an area of 470 square miles and 4 million people.¹

¹ [Los Angeles Public Library Webpage](https://www.lapl.org/) (https://www.lapl.org/).

LOS ANGELES WORLD AIRPORTS (LAWA) - is the City of Los Angeles department that owns and operates Los Angeles international (LAX) and Van Nuys (VNY) general aviation airports.²

PLUG-IN ELECTRIC VEHICLE (PEV) - PLUG-IN ELECTRIC VEHICLE (PEV) - is a general term for any car that runs at least partially on battery power and is recharged from the electricity grid. There are two different types of PEVs to choose from - pure battery electric and plug-in hybrid vehicles.

PLUG-IN HYBRID ELECTRIC VEHICLE (PHEV) - PHEVs are powered by an internal combustion engine and an electric motor that uses energy stored in a battery. The vehicle can be plugged in to an electric power source to charge the battery. Some can travel nearly 100 miles on electricity alone, and all can operate solely on gasoline (similar to a conventional hybrid).³

² [Los Angeles World Airports Webpage](https://www.lawa.org/) (https://www.lawa.org/).

³ [Plug in Electric Vehicle Definition](https://afdc.energy.gov/vehicles/electric.html) (https://afdc.energy.gov/vehicles/electric.html).

APPENDIX A: Sample of Detailed Charge Session Data

Location	CEC Site ID	Charge Station Name	Start Date	Duration (H:M:S)	Energy (kWh)	Saved Gasoline (Gallons)	Saved Co2 (lbs)
LADOT Larchmont	LADOT 2	Larchmont 1	10/28/2017	001:32:39	1.85	0.18	3.62
LADOT Larchmont	LADOT 2	Larchmont 2	10/30/2017	002:43:24	15.70	1.57	30.76
LADOT Larchmont	LADOT 2	Larchmont 2	10/31/2017	020:05:07	16.55	1.66	32.42
LADOT Larchmont	LADOT 2	Larchmont 1	11/1/2017	000:53:00	0.45	0.04	0.88
LADOT Larchmont	LADOT 2	Larchmont 2	11/1/2017	004:25:50	19.05	1.91	37.32
LADOT Larchmont	LADOT 2	Larchmont 1	11/1/2017	000:34:55	1.80	0.18	3.53
LADOT Larchmont	LADOT 2	Larchmont 2	11/1/2017	002:59:25	9.76	0.98	19.12
LADOT Larchmont	LADOT 2	Larchmont 1	11/3/2017	000:39:51	2.08	0.21	4.07
LADOT Larchmont	LADOT 2	Larchmont 1	11/3/2017	000:38:58	3.77	0.38	7.39
LADOT Larchmont	LADOT 2	Larchmont 2	11/3/2017	000:39:09	1.48	0.15	2.9
LADOT Larchmont	LADOT 2	Larchmont 1	11/3/2017	001:18:14	4.03	0.4	7.89
LADOT Larchmont	LADOT 2	Larchmont 2	11/4/2017	000:39:41	4.03	0.4	7.89
LADOT Larchmont	LADOT 2	Larchmont 1	11/4/2017	003:33:48	20.13	2.01	39.43
LADOT Larchmont	LADOT 2	Larchmont 2	11/4/2017	002:12:43	6.44	0.64	12.62
LADOT Larchmont	LADOT 2	Larchmont 2	11/5/2017	000:57:52	1.58	0.16	3.1
LADOT Larchmont	LADOT 2	Larchmont 1	11/5/2017	000:34:32	0.93	0.09	1.82
LADOT Larchmont	LADOT 2	Larchmont 1	11/5/2017	001:00:49	2.28	0.23	4.47
LADOT Larchmont	LADOT 2	Larchmont 2	11/5/2017	000:52:18	5.10	0.51	9.99
LADOT Larchmont	LADOT 2	Larchmont 1	11/6/2017	001:08:31	4.14	0.41	8.11
LADOT Larchmont	LADOT 2	Larchmont 2	11/7/2017	003:34:21	13.29	1.33	26.04
LADOT Larchmont	LADOT 2	Larchmont 1	11/7/2017	002:33:59	14.51	1.45	28.43
LADOT Larchmont	LADOT 2	Larchmont 1	11/8/2017	000:13:36	0.82	0.08	1.61
LADOT Larchmont	LADOT 2	Larchmont 2	11/8/2017	002:15:37	7.72	0.77	15.12
LADOT Larchmont	LADOT 2	Larchmont 2	11/9/2017	004:20:53	4.44	0.44	8.7
LADOT Larchmont	LADOT 2	Larchmont 1	11/9/2017	002:03:40	7.19	0.72	14.09
LADOT Larchmont	LADOT 2	Larchmont 2	11/10/2017	007:34:54	3.79	0.38	7.42
LADOT Larchmont	LADOT 2	Larchmont 1	11/10/2017	000:09:15	0.50	0.05	0.98
LADOT Larchmont	LADOT 2	Larchmont 1	11/10/2017	003:58:48	21.53	2.15	42.18
LADOT Larchmont	LADOT 2	Larchmont 2	11/10/2017	000:11:02	0.57	0.06	1.12
LADOT Larchmont	LADOT 2	Larchmont 2	11/11/2017	001:45:42	0.53	0.05	1.04
LADOT Larchmont	LADOT 2	Larchmont 1	11/11/2017	001:49:49	6.02	0.6	11.79
LADOT Larchmont	LADOT 2	Larchmont 2	11/11/2017	001:29:15	2.22	0.22	4.35
LADOT Larchmont	LADOT 2	Larchmont 1	11/12/2017	000:34:58	3.43	0.34	6.72
LADOT Larchmont	LADOT 2	Larchmont 2	11/12/2017	000:09:02	0.53	0.05	1.04
LADOT Larchmont	LADOT 2	Larchmont 2	11/12/2017	000:16:42	1.45	0.14	2.84
LADOT Larchmont	LADOT 2	Larchmont 2	11/12/2017	001:15:33	7.32	0.73	14.34
LADOT Larchmont	LADOT 2	Larchmont 2	11/12/2017	000:41:35	1.76	0.18	3.45
LADOT Larchmont	LADOT 2	Larchmont 1	11/12/2017	000:53:53	4.43	0.44	8.68
LADOT Larchmont	LADOT 2	Larchmont 2	11/12/2017	000:19:41	0.93	0.09	1.82
LADOT Larchmont	LADOT 2	Larchmont 2	11/13/2017	008:30:03	4.73	0.47	9.27
LADOT Larchmont	LADOT 2	Larchmont 1	11/13/2017	000:39:00	3.79	0.38	7.42
LADOT Larchmont	LADOT 2	Larchmont 1	11/13/2017	001:46:13	0.03	0	0.06
LADOT Larchmont	LADOT 2	Larchmont 2	11/13/2017	002:26:55	13.95	1.4	27.33
LADOT Larchmont	LADOT 2	Larchmont 2	11/14/2017	000:22:57	0.42	0.04	0.82
LADOT Larchmont	LADOT 2	Larchmont 2	11/14/2017	000:23:13	2.29	0.23	4.49
LADOT Larchmont	LADOT 2	Larchmont 2	11/14/2017	000:41:16	2.15	0.21	4.21
LADOT Larchmont	LADOT 2	Larchmont 2	11/15/2017	001:01:00	5.94	0.59	11.64
LADOT Larchmont	LADOT 2	Larchmont 2	11/15/2017	001:58:12	9.42	0.94	18.45
LADOT Larchmont	LADOT 2	Larchmont 1	11/15/2017	002:54:58	16.74	1.67	32.79
LADOT Larchmont	LADOT 2	Larchmont 1	11/15/2017	000:14:23	0.84	0.08	1.65
LADOT Larchmont	LADOT 2	Larchmont 2	11/15/2017	000:43:51	2.62	0.26	5.13
LADOT Larchmont	LADOT 2	Larchmont 1	11/15/2017	000:20:15	1.96	0.2	3.84
LADOT Larchmont	LADOT 2	Larchmont 2	11/16/2017	001:59:00	11.73	1.17	22.98
LADOT Larchmont	LADOT 2	Larchmont 2	11/16/2017	000:30:21	0.81	0.08	1.59
LADOT Larchmont	LADOT 2	Larchmont 2	11/17/2017	003:34:29	6.87	0.69	13.46
LADOT Larchmont	LADOT 2	Larchmont 1	11/17/2017	000:09:17	0.51	0.05	1
LADOT Larchmont	LADOT 2	Larchmont 2	11/17/2017	002:59:14	16.89	1.69	33.09
LADOT Larchmont	LADOT 2	Larchmont 2	11/18/2017	001:35:21	2.72	0.27	5.33
LADOT Larchmont	LADOT 2	Larchmont 2	11/18/2017	000:53:30	1.54	0.15	3.02
LADOT Larchmont	LADOT 2	Larchmont 1	11/18/2017	001:40:18	9.76	0.98	19.12
LADOT Larchmont	LADOT 2	Larchmont 2	11/18/2017	003:13:01	17.77	1.78	34.81
LADOT Larchmont	LADOT 2	Larchmont 1	11/19/2017	002:13:05	1.09	0.11	2.14
LADOT Larchmont	LADOT 2	Larchmont 2	11/19/2017	000:23:38	2.30	0.23	4.51
LADOT Larchmont	LADOT 2	Larchmont 1	11/19/2017	002:36:27	14.24	1.42	27.9
LADOT Larchmont	LADOT 2	Larchmont 2	11/19/2017	002:33:25	14.99	1.5	29.37
LADOT Larchmont	LADOT 2	Larchmont 2	11/20/2017	004:33:46	6.17	0.62	12.09
LADOT Larchmont	LADOT 2	Larchmont 1	11/20/2017	004:26:40	16.87	1.69	33.05

Source: Los Angeles DOT