SANDAG

Regional EV Charger Management Strategy

Peer Agency Research and Analysis Summary Report

FINAL | November 2021

Kimley»Horn
Expect More. Experience Better.

energetics
Clean Energy Consulting

Table of Contents

List of Figures

List of Tables

1. Introduction and Purpose

The San Diego Association of Governments (SANDAG) and local partners were awarded a Caltrans Planning Grant to develop a Regional EV Charger Management Strategy. This project will develop a regional electric vehicle (EV) charger management strategy to support the reliable operation and expansion of public EV charger infrastructure located at public parking areas such as Park & Rides (including mobility hubs), transit stations, rest areas, and other commuter lots to serve light-duty passenger vehicles.

The project establishes a project stakeholder team with transit agencies, Caltrans District 11, San Diego Air Pollution Control District, governments, and other public agencies, and documents existing practices for treatment of public chargers. It will prepare a management strategy that addresses site-level and region-wide needs, develop a roadmap to implement the strategy through adequate policies and procedures, and engage stakeholders including those representing disadvantaged communities. This project directly supports implementation of SANDAG's Regional Transportation Plan, state transportation electrification policies, and state GHG reduction policies.

This Peer Agency Research and Analysis Summary Report documents existing practices for deployment of public EV chargers and management practices at peer agencies in California and around the nation. These practices will be benchmarked against local practices within the San Diego Region—along with barriers cited by local agencies that will influence the development of resources and strategies—to help public agencies better deploy and manage public Electric Vehicle Charging Stations (EVCS).

2. Background

The State of California has been at the forefront of Zero Emission Vehicle (ZEV) policy and deployment. In September 2020, Governor Gavin Newsom signed Executive Order N-79-20[1], which mandates 100% ZEV sales for new passenger vehicles by 2035 and pushes other vehicle sectors towards 100% zero emissions as well. Assembly Bill 2127[2] requires the California Energy Commission (CEC) to prepare a statewide assessment of the charging infrastructure needed to achieve the goal of 5 million ZEVs on the road by 2030 to reduce emissions of greenhouse gases to 40 percent below 1990-levels by 2030. Executive Order N-79-20 directed the CEC to expand this assessment to support the levels of electric vehicle adoption required by the executive order.

Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment[3], updated in July 2021, outlines a portfolio of charging solutions needed to support the state's aggressive vehicle goals. The report finds "Between 1,086,000 and 1,229,000 chargers needed at Multi-unit dwellings (MUDs), workplaces, and public locations to support electrified intraregional travel for nearly 8 million light-duty ZEVs in 2030. The statewide estimate (p. 55) includes:

- 265,000 - 395,000 Level 1 and Level 2 chargers at MUDs,
- 791,000 - 803,000 public and work Level 2 chargers, and

1 https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf

2 https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB2127

3 https://a19.asmdc.org/sites/a19.asmdc.org/files/pdf/ab-2127-ev-charging-infrastructure-assessment.pdf

- 30,000 - 31,000 public DC fast chargers.

The AB 2127 *Infrastructure Assessment* shows a San Diego regional goal for 2030 of a total of 121,628 chargers (Table C-15: County-Level EVI-Pro 2 Results):

- 36,993 multi-unit dwelling (MUD) chargers
- 30,986 Workplace chargers
- 50,336 Public chargers
- 3,313 DCFC chargers

To meet these state and regional goals, SANDAG, SDG&E, San Diego County, City of San Diego, and the San Diego County Air Pollution control district founded the Accelerate to Zero Emissions Collaboration[4] (A2Z) to bring regional EV stakeholders together and accelerate EV investment and adoption. In 2020, A2Z developed a regional Gap Analysis. The San Diego Accelerate to Zero Gap Analysis[5] used slightly different methodology (see table 2 page 20) to project future needs, but also identified regional needs in excess of 150,000 total EV charging stations by 2030.

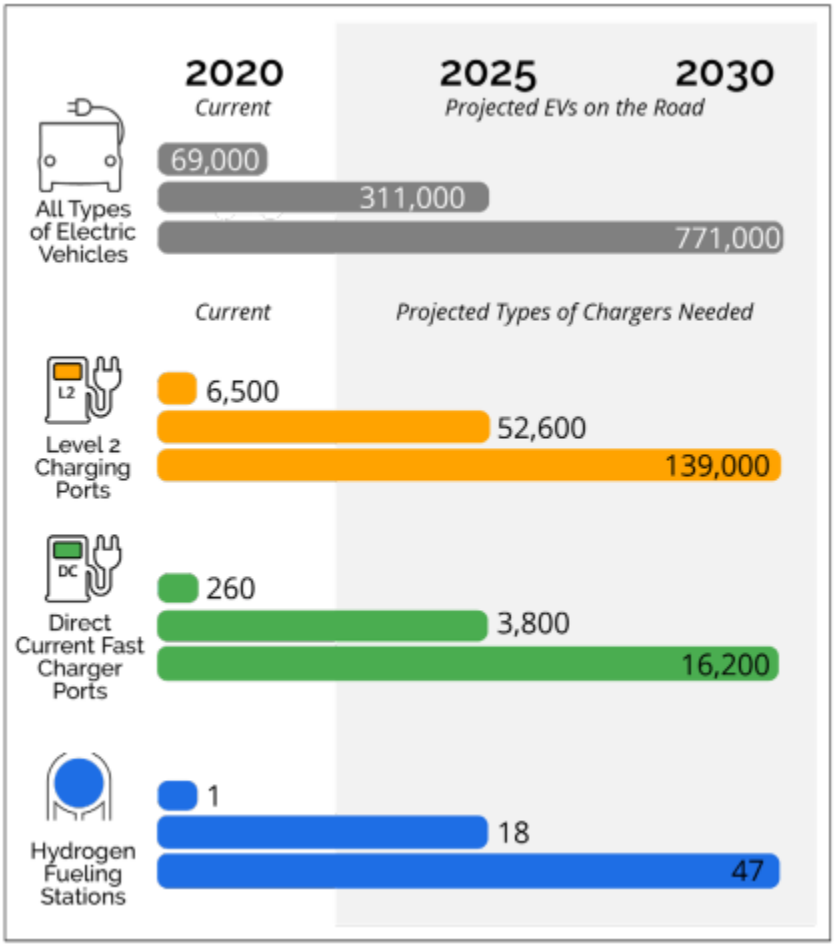

Figure 1: Accelerate to Zero Gaps Analysis

4 http://a2zsandiego.com/static/zero/

5 https://www.sdge.com/sites/default/files/2021-07/FINAL%20San%20Diego%20Regional%20EV%20Gap%20Analysis%20%281%29.pdf

Although public agencies are not expected to build all of these charging stations themselves, they can show leadership in providing public charging on public sites. The Accelerate to Zero Gaps Analysis also identified additional action public agencies can take to support charging in the region such as enhanced employee education, streamlined permitting, building codes, and workforce development support.

3. Charging Applications

Electric vehicle charging is available at three levels, based on the rate at which a vehicle can recharge. Higher levels indicate faster charging rates but are typically costlier and are more likely to require upgrades to a site's electrical infrastructure. This section provides an overview of the three levels of EV charging, and **Table 1** includes common use cases for each charging level.

3.1 Level 1 Charging

Level 1 charging uses a standard 120-volt alternating current (VAC) outlet available in all residential and commercial locations. Almost all plug-in vehicles come with a Level 1 cord set charger as standard equipment, with a total power output of 1.2-1.6 kilowatts (KW). Level 1 charging is the lowest cost and slowest EV charging option, providing around 3-5 miles of electric range per hour. It is rarely deployed in public locations but is a possibility for long-term parking lots. For a new installation, a Level 1 charging station and installation is nearly the same price as basic Level 2 charging.

3.2 Level 2 Charging

Level 2 charging uses 240 VAC and provides 3.3 and 19.2 KW output (between 10-54 miles of electric range per hour). Level 2 uses the same connector and charge port as Level 1. Level 2 charging units are more expensive than Level 1, typically with more advanced controls and monitoring capabilities. The speed of charging is dictated by both the power output of the charging unit and the acceptance rate of the vehicle. Most installed Level 2 stations are 32-amp (7.7 KW) output, the maximum served on a 40-amp circuit. Many new larger vehicles are capable of 48-amp (11.5 KW) charging (60-amp circuit required). The highest-power Level 2 stations can output 80 amps (19.6 KW).

J1772 standard dictates that all vehicles should be able to charge on whatever power is provided by the station. Dedicated Level 2 stations may not be optimal for long-dwell-time transit locations; however, some Level 2 stations offer the ability to share available power among multiple stations, or delay charging to take advantage of renewable energy. For example, a dedicated 32-amp output charging station could deliver approximately 200 miles of range in 8 hours. Using a power-sharing system, it could deliver two vehicles 100 miles each or four vehicles 50 miles each.

3.3 Direct Current Fast Charging (DCFC)

DCFC is the fastest and the most expensive EV charging option and uses three-phase 208, 440, or 480 VAC that is converted into direct current (DC) to add 75-300 miles of electric range per hour. Because of its high power demands, DCFC often requires upgrades to a site's electrical service. DCFC is ideal for sites where EVs need to gain a maximum amount of range in a short time, such as along highway corridors and some high-turnover retail shops. There are three different standards for DCFC: CHAdeMO (which served mostly Japanese vehicles prior to 2021), CCS, and Tesla (which has their own standard).

Projects receiving state funds have general been required to install stations with plugs for both CHAdeMO and CCS. DCFCs come in a range of power levels, with 50 kW having been the most common, but as a

2020, most new stations are being built with at least 100-150 kW capabilities. DCFC can provide a charging experience that is similar to a gas station experience for EV drivers without access to charging at home. Taxis and transportation network company (TNC) drivers are most likely to use DCFC.

	Level 1	Level 2	DCFC
Charging Speed/Power	3-5 miles of range/hour 1.2-1.6 kW	10-54 miles of range/hour 1.2-1.6 kW	75-300 miles of range/hour 25-150+ kW
Ideal Dwell Time	8+ Hours	1-4 hours (full power) 4-10 hours (power sharing)	15 minutes - 1 hour
Typical Applications	> Residential > Workplace Charging > Long term parking	> Residential > Workplace Charging > Retail shops > Commercial office buildings > Parks & public facilities	> Public access > Retail shops > Highway corridors > Hospitality & recreation facilities > Taxi/TNC fleets

Table 1: Charging Levels

With longer range electric vehicles becoming more common, drivers with access to home charging may not need to regularly use public charging. However, as car manufacturers offer fewer models of internal combustion engine vehicles in accordance with the executive order, more residents may buy EVs without home charging and depend on public charging infrastructure.

3.4 Wireless Charging

Inductive (or wireless) charging systems are available at power levels equivalent to Level 2 and lower power DCFC, and require similar power supply to a parking area. Compatible vehicles parked over an inductive pad embedded in the pavement can receive a charge. Wireless charging has not seen widespread deployment but is potentially a supporting technology for autonomous vehicles, which lack a driver to perform the task of plugging the vehicle in and managing payment. State policy will require all autonomous vehicles used for TNC services to be zero emissions by 2030.[6]

3.5 Micromobility

Personally-owned e-bikes or scooters generally have battery sizes in the 250-500 watt-hour range (.25-.5 kWh). Using a simple 120-V wall outlet and a charger of 100-150 watts, they may charge in 2-5 hours. There is no standardization in charging plugs, so riders would need to supply their own cord and a safe place to park/secure their vehicle. Some vendors offer charging docks that can serve one or more brand of e-scooter or bikes for micromobility rentals. These docks can offer charging and additional security for the vehicles. Docking for 20 bikes or scooters may have an equivalent power requirement as a single Level 2 charging station.

[6] https://ww2.arb.ca.gov/our-work/programs/clean-miles-standard/about

Figure 2: Battery Swapping Station in Taiwan

Although battery swapping[7]--where a battery is removed and replaced with a fully charged one—for full-size vehicles has not been widely adopted, it does have applications for e-bike and scooters. In this application, a user could remove the battery from their mobility device and swap it for a fully charged one held in a vending machine/cabinet and continue their trip without waiting to charge. The power cabinet itself would require a power supply similar to that of a bike or scooter docking station.

4. Review of Peer Jurisdictions

There are many different approaches for public agencies providing charging. Many of these approaches seem to be driven by the requirements of grant programs. The below tables represent publicly-sited charging in jurisdictions within California and across the nation. Each table contains information on the agency's parking and charging cost structure, which was pulled from the PlugShare[8] website, and more information can be found at the agency-specific reference links provided. These practices will be compared with local needs and practices to inform the Regional EV Charger Management Strategy.

4.1 San Francisco Municipal Transportation Agency, California[9]

Location Type	Municipal Parking
Type of Charging	Level 2
Number of Locations	18 with charging
Number of Charging Ports	59
Ownership Structure	Municipality owned/operated
Utility Provider/Funding Sources	PG&E/ SFPUC Hetch Hetchy Power
EVSP	ChargePoint
Fee	Varies by location
Parking Rules	Pay parking – varies by location
More Information	https://www.sfmta.com/sites/default/files/reports-and-documents/2019/07/evroadmap_final_june2019.pdf https://www.sfmta.com/projects/electric-mobility-san-francisco

Table 2: SFMTA Municipal Parking

[7] https://electrek.co/2021/08/30/gogoro-named-global-leader-in-light-electric-vehicle-battery-swapping-passes-200-million-swaps/

[8] https://www.plugshare.com/

[9] Information on SFMTA chargers pulled from the below-mentioned RFP (RFP No. SFMTA-2021-46) and associated attachments. This RFP is available, with Event ID, at https://sfcitypartner.sfgov.org/pages/index.aspx

Approximately 60 Level 2 chargers are located in parking lots and garages managed by the San Francisco Municipal Transportation Agency (SFMTA). Most of these were installed in 2011 and 2012. Charging was free until late 2017 when the city adopted a resolution to impose a fee to charge that would cover the costs of management, operation, and maintenance, along with the ChargePoint vendor fee for processing credit card payments. The resolution specified that while the cost at each location would vary depending on that location's electricity prices, the fee could not exceed $2.75 per charge session.

In September 2021, SFMTA released a Request for Proposals (RFP) to choose one or more tenants to install, operate, and maintain Electric Vehicle Supply Equipment (EVSE) at the existing locations and potentially add charging stations to additional lots and garages. SFMTA released the RFP to support the city's goal of 80% sustainable trips by 2030, which necessitates the expansion of Level 2 EV charging stations and the addition of DCFC. The existing SFMTA owned/operated EVSE are reaching the end of their useful life and will need to be replaced in the near-term.

Below is the breakdown of criteria SFMTA is using to evaluate proposals. For the Approach to Lease Opportunity section, SFMTA will be evaluating proposers' method of addressing off-street parking facilities, the initial plan and schedule, the EV charging station types they intend to use, and their pricing and access policies. In addition, SFMTA will be reviewing their ability to meet the needs of accessible vehicles and how proposers will encourage off-peak charging.

Under the proposer qualifications/references, SFMTA will review proposers' contract or lease experience, team member experience, key personnel, budget and schedule performance, and public entity experience. When evaluating proposers' base rent and percentage rent proposal, SFMTA will score each section separately. The proposer with the highest base rent will be given the highest possible score of 15, while others will be calculated as a proportion of the highest base rent. The calculation for the percentage rent will be similar, but the maximum points given will be 10.

Evaluation Element	Proposal Section/ Criteria	Maximum Points
Minimum Qualifications	Similar Project Experience, Financial Solvency	Pass/Fail
Proposal	Approach to Lease Opportunity	50
	Proposer Qualifications/ References	25
	Base Rent and Percentage Rent Proposal	25
Oral Interview *(if necessary)*	Professionalism, Understanding of the Lease Opportunity, Quality of Presentation,	15
TOTAL		**115**

Table 3: Base Rent and Percentage Rent Proposal Scoring

Once finalized, these tenants will pay to lease the parking spaces from SFMTA for nine years and be responsible for all permitting and installation logistics, including updating electrical infrastructure as needed. In addition, the tenant is required to share with SFMTA quarterly reports detailing usage of each station and SFMTA must always have direct access to the tenant's account representative. Tenants will pay a base rent per stall starting at $250/stall/month and increasing to $500 over the course of the

agreement. In addition, tenants will pay a monthly-percentage-rent based on gross monthly revenue tiers and corresponding percentages that the tenant determines and includes in their proposal. Throughout the nine-year agreement, the tenant will be allowed to relocate, remove, or install additional charging stations with written approval from SFMTA.

4.2 City of Pasadena, California

Location Type	Municipal Parking
Type of Charging	Level 2, DCFC, Tesla
Number of Locations	5 with charging
Number of Charging Ports	120
Ownership Structure	Municipality Owned/Operated roles for L2 and DCFC; Tesla Owned/Municipality Operated for Tesla
Utility Provider/Funding Sources	Pasadena Water and Power
EVSP	Greenlots; Powerflex
Fee	Currently free, except Del Mar Station DCFC, Tesla Fees apply
Parking Rules	Regular parking fees and limits apply
More Information	https://ww5.cityofpasadena.net/water-and-power/electrification/ https://ww5.cityofpasadena.net/water-and-power/marengochargingplaza/

Table 4: City of Pasadena Municipal Parking and Charging

The City of Pasadena has an extensive charging network, including 60 Level 2 or DC fast charging stations at city-owned or -operated parking facilities. This includes the Marengo Charging Plaza, which is currently the nation's largest public fast charging station with 24 Tesla Super Chargers and 20 DCFC. Of the five lots, four offer free charging. However, four of the five require regular parking fees (excluding the public library). The Del Mar Station requires payment for DC fast charging ($0.15/kWh off-peak and $0.20/kWh on-peak), but the Level 2 charging is free. The Pasadena Convention Center also offers two accessible parking spots with Level 2 charging access.

At four of the five locations, the chargers are municipally owned. Tesla owns their chargers at the Marengo Charging Plaza and the Pasadena Convention Center, and its chargers are operated under a contract. Tesla does not pay rent or lease to occupy the spaces where their chargers are located at Marengo Plaza. The chargers at the Pasadena Convention Center were installed using a rebate from Pasadena Water & Power under a Commercial Rebate Program Agreement, allowing the city to claim Low Carbon Fuel Standard (LCFS) credits and requiring the equipment remain in place for a minimum of five years. The City may evaluate charging fees in the future.

4.3 Los Angeles County Metropolitan Transportation Authority, California

Location Type	Public – transit oriented
Type of Charging	30-amp output Level 2
Number of Locations	5 Locations in 2012 Pilot, 16 total locations as of 2020
Number of Charging Ports	73
Ownership Structure	LA metro retained ownership after initial grant period and solicited for 3rd party operator
Utility Provider/Funding Sources	LADWP, CEC Grant
EVSP	EV Gateway (transitioned from EV Connect)
Fee	$3 for all day or cap of 3 hours for $1 per hour and $0.25; rounded by minute. Pricing has not been updated since 2013, except for $0.25 fee
Parking Rules	Same as transit patrons. Paid parking weekdays
More Information	Metro EV Charge Stations Fact Sheet Public Electric Vehicle Charging Stations at Metro Transit Locations

Table 5: LA Metro Public, Transit-Oriented Charging

The Los Angeles County Metropolitan Transit Authority (LA Metro) originally installed stations at five sites under a CEC grant, with stations going live in 2012. It has periodically added more stations, mostly in conjunction with new extensions of the light rail lines to Culver City/Santa Monica and Azusa. The charge fee of $1 an hour and capped at $3 was common in 2012 and reflected the average amount of energy that most vehicles could take. LA Metro recognizes a future need to increase the hourly fee or convert into a per kWh fee given the increasing battery capacity of vehicles. The three-hour fee cap was appropriate for transit patrons who would leave their cars all day but would be finished charging within three hours.

There are stations from at least three different manufacturers; however, all networked stations use the Open Charge Point Protocol (OCPP). This protocol allows stations to respond to a common set of commands and opens the potential to separate network services from the original provider. LA Metro did this through an RFP process and selected EV Gateway as the new network operator for these stations starting in 2020. The updated report will share more details that come from the RFP.

Additionally, the LA Metro board passed a resolution[10] to form a Zero Emissions Transportation Infrastructure Working Group (ZETIWG) with the City of LA, LA County, and Metrolink to share best practices and develop common approaches to providing public EV charging. Specific goals include coordinating applications for shared charging, exploring collective procurement opportunities, setting cross-agency standards for charging infrastructure, exploring ways to maximize coordination with private industry investments, and sharing lists and maps of assets that can be used in a unified plan for Zero Emissions (ZE) infrastructure.

[10] https://boardagendas.metro.net/board-report/2021-0689/

4.4 Alameda County, California

Location Type	County-owned public/workplace Parking
Type of Charging	Level 1, Level 2, DCFC
Number of Locations	7 with charging
Number of Charging Ports	93
Ownership Structure	Agency Owned/Operated roles
Utility Provider/Funding Sources	PG&E
EVSP	ChargePoint
Fee	$0.29/kWh to $1.50/hr, Include higher on-peak fees
Parking Rules	Varies by location
More Information	https://www.acgov.org/sustain/what/transportation/evcharging.htm

Table 6: Alameda County County-Owned Public/Workplace Parking and Charging

Alameda County has strong EVCS penetration, including over 90 ports in its county-owned and -operated parking garages and lots. Much of the county-owned charging network can be found around public buildings, such as the lots for the Environmental Health Building, the Public Works Building, the Water District, and the Juvenile Justice Center. The County owns and operates these lots and the EVCS and claims the resulting LCFS credits. Over one-third of the ports are Level 1 chargers, most are Level 2, and only a few are DCFC. Four of the seven stations require users to pay for parking and all but one requires payment for charging. The fees for charging range from $0.29/kWh to $1.50/hr.

4.5 City of Berkeley, California

Location Type	Municipal Parking
Type of Charging	Level 2
Number of Locations	5 with charging
Number of Charging Ports	27
Ownership Structure	Agency Owned/Operated roles
Utility Provider/Funding Sources	PG&E, CEC
EVSP	ChargePoint
Fee	$1.50/hr
Parking Rules	Varies by location
More Information	Berkeley Electric Mobility Roadmap

Table 7: City of Berkeley Municipal Parking and Charging

The City of Berkeley has an extensive charging network, including five municipality-owned and -operated lots at the West Branch of the Berkeley Library, the Berkeley Marina, the Telegraph Channing Garage, the Center Street Garage, and the Oxford Garage. These locations are home to 27 Level 2 ChargePoint ports. All but one location (the Marina) requires users to pay for parking. All five charge

$1.50/hour for charging, and one (again, the Marina) has a maximum allowed charging time of four hours.

In addition, in April 2020 the city released the *Berkeley Electric Mobility Roadmap,* which includes an overview of the city's existing EVSE infrastructure and anticipated needs over the next decade with a particular emphasis on equity and access. The Roadmap prioritizes future public and workplace EVSE installations based on current EVSE locations and workplace density, and overlayed that information with possible sites, such as municipal-owned buildings, lots, and parking meters.

4.6 Bay Area Rapid Transit District (BART), California

Location Type	Transit Park and Ride
Type of Charging	Level 2
Number of Locations	4 with charging
Number of Charging Ports	96
Ownership Structure	Agency Owned/Operated
Utility Provider/Funding Sources	PG&E, BAQMD grant
EVSP	Greenlots/Chargepoint
Fee	Chargepoint $0.13/kWh 24 hours a day, seven days a week Greenlots $0.26/kWh plus a $0.50 transaction fee
Parking Rules	Paid Parking M-F, $3/day
More Information	https://www.bart.gov/guide/parking/electric-vehicle

Table 8: BART Transit Park and Ride

BART offers EVCS at the Warm Springs and Lafayette stations as part of a pilot. This pilot has been ongoing since 2017, and it is unknown when/if the program will be rolled out system-wide. Stations were installed using grant funds from the Bay Area Air Quality Management District; stub-outs (conduit and power capacity) for charging were included in the Warm Springs Station design as part of the Silicon Valley Extension.

In addition to charging fees, parking payment is required Monday through Friday from 4:00am to 3:00pm. Parking payment is not required on weekends and holidays. Color-coded signs in front of each EV charging stall specify the required type of parking payment for that specific charging space. EV Charging was also included in the Milpitas and Berryessa Transit centers[11], which serve BART but are separately managed by the Santa Clara Valley Transportation Authority (VTA).

[11] https://www.vta.org/projects/bart-sv/phase-i/parking#accordion-who-patrols-the-parking-areas-at-the-milpitas-and-berryessa-transit-center

4.7 City of Seattle, Washington

Location Type	Public Rights of Way
Type of Charging	Level 2, DCFC
Number of Locations	18 DCFC, 30+ L2
Number of Charging Ports	30-50 DCFC, 50-100 L2
Ownership Structure	City/ utility owned and private operator options
Utility Provider/Funding Sources	Municipal Utility
EVSP	Greenlots
Fee	$0.33/kWh DC, $0.19 Level 2
Parking Rules	Regular street parking rules apply, spaces painted for EV charging only
More Information	Public Electric Vehicle Charging Program – FAQ

Table 9: City of Seattle, Public Rights of Way

The City of Seattle's work on EV Charging included early effort with the DOE's EV Project as early as 2009. Initial plans sought frequent charging along main highways (I-5, I-90) serving Seattle. Today, those routes show a multitude of charging sites providing Level 2 and DCFC with an increasing number of secondary corridors.

The Seattle EVSE Prioritization Model[12] takes into account site prioritization and transportation services, and offers a number of unique operating considerations:

- The EV Charging Rights of Way project was an early effort and allows private operators following certain rules to place stations curbside
- Multi-year leases for rights of way projects provide certainly to businesses
- Required data sharing agreements are important for municipalities to gain access and insight to trends
- Street-light based charging provides locations of value and potential power sources

Despite these efforts, Seattle has limited success in success in attracting private operators to build stations in the public-right of way due to the requirement of going through the public engagement process, which is labor intensive and slows the process. The municipal utility Seattle City Light has been responsible for most installations on publicly owned sites within the City. The City is currently looking at revised permitting models that would encourage more participation from private vendors.

[12] https://seattlecitygis.maps.arcgis.com/apps/webappviewer/index.html?id=bb9d049a8bbe4827b5c83d61d0a48e46

4.8 Oregon Department of Transportation, Oregon

Location Type	Interstate Highway exits
Type of Charging	DCFC, Level 2, 120 V
Number of Locations	44
Number of Charging Ports	44 DCFC (CHAdeMO) and 44 level 2, additional ports being added
Ownership Structure	Vendor Operated on Public and private sites with long term easements
Utility Provider/Funding Sources	ARRA, CMAQ, Volkswagen Mitigation funding
EVSP	EV Charging Solutions
Fee	Free until upgrades complete. Per use and membership options TBD
Parking Rules	Free Parking
More Information	https://www.oregon.gov/odot/Programs/Pages/Electric-Vehicles.aspx

Table 10: Oregon DOT, West Coast Electric Highway Exits

The West Coast Electric Highway initiative was led by the Oregon and Washington Departments of Transportation (DOT) using American Recovery and Reinvestment Act funding, completed in 2011-2012. The DOTs sought a common charging experience by using a single vendor across multiple sites on major highway corridors. In 2020, Oregon DOT solicited a new vendor to replace the original infrastructure, which only served the CHAdeMO fast charging standard, with equipment that could serve all standards. They are also expanding the number of plugs and adding 120 V outlets accessible to electric bikes and scooters. The State provided funding for upgrades but expected a vendor to put up some of their own money for capital costs. The state was seeking at least a 25% cost share be the selected vendor is providing close to a 50% share. Stations are located on a variety of property types, and the winning bidder can now take over site agreements, which are structured as low- or no-cost leases with renewal options for up to five 5-year terms.

Type of Lessor Entities—there are 38 individual site owners leasing the 44 sites. Slightly over half of the sites are held by either corporations or Limited Liability Companies (LLC). Six of the sites are owned by one corporate entity. Other entity types are:

- Municipality (9)
- Tribe (4)
- Private party (4)
- Transit district (1)
- State or federal government (2)

Requirements for the new vendor included:

- Turnkey service for state government
- Certified, stationary, connected to the grid, and networked
- Meet provisions for use of WCEH branding & logo
- Accessible via smart phone app displaying operational status transparent pricing ability to "remote start"

- Open access
- Required payment options
- Interoperability
- Ability for universal roaming
- Ability to enable utilities to employ managed charging

4.9 New York State Thruway Authority, New York

The New York State Thruway Authority offers public EV charging at three different location types along the New York State Thruway (I-87 and I-90): service areas, entrances and exits, and welcome centers. **Tables 11, 12, and 13** describe each in detail.

Location Type	Interstate Highway Service Area (toll highway)
Type of Charging	DCFC
Number of Locations	9 with charging
Number of Charging Ports	10
Ownership Structure	Agency Owned/Operated roles
Utility Provider/Funding Sources	National Grid, NYSEG, Rochester G&E, Central Hudson
EVSP	EV Connect
Fee	$0.30 per kWh. Pay by EV Connect App, RFID card or credit card.
Parking Rules	Free Parking (highway tolls apply)
More Information	https://www.thruway.ny.gov/travelers/travelplazas/electric-vehicles.html

Table 11: New York State Thruway Authority, Interstate Highway Service Area

The Authority offers DC fast charging at 9 of the 27 total Service Areas along the New York State Thruway mainline (I-87 and I-90), at the Angola, Dewitt, Malden, Modena, Ontario, Plattekill, Ulster, and Warners Service Areas. The DC fast charging provided at Service Areas complements charging provided at other facilities throughout the 500+ mile network. The 50-100 kW charging stations along the thruway corridor enable fast-charge-capable EVs to be powered in approximately 30 minutes. Access is provided 24/7 and payment is required. Parking spaces adjacent to charging stations are reserved for EVs. Parking is free, but highway tolls apply for all vehicles.

Location Type	Interstate Highway Entrance/Exit (toll highway)
Type of Charging	Level 2
Number of Locations	9 with charging
Number of Charging Ports	18
Ownership Structure	Agency Owned/Operated roles
Utility Provider/Funding Sources	National Grid, NYSEG, Rochester G&E, Central Hudson
EVSP	EV Connect
Fee	Free
Parking Rules	Free Parking (highway tolls apply)
More Information	https://www.thruway.ny.gov/travelers/travelplazas/electric-vehicles.html

Table 12: New York State Thruway Interstate Highway Entrance/Exit

The Authority offers Level 2 charging at 9 of the 76 Interchanges along the Thruway entrance and exits (I-87 and I-90). Charging is provided at the Angola, Dewitt, Malden, Modena, Ontario, Plattekill, Ulster, and Warners Service Areas. The 7.2 kW charging stations along the Thruway corridor enable EVs to be powered in approximately 25 miles per hour of plugged time. Access is provided 24/7 and no payment is required. Parking spaces adjacent to charging stations are reserved for EVs. Parking is free and Thruway tolls are not required but apply for vehicles accessing the charging stations from the highway. The service areas feature a restaurant and restroom but otherwise don't have the uses where a traveler would get a full charge on Level 2.

Location Type	Interstate Highway Welcome Centers (toll highway)
Type of Charging	DCFC
Number of Locations	3 with charging
Number of Charging Ports	8
Ownership Structure	Agency Owned/Operated roles
Utility Provider/Funding Sources	National Grid, Central Hudson
EVSP	Greenlots
Fee	Free. Activate charging stations using Greenlots App or RFID card.
Parking Rules	Free Parking (highway tolls apply)
More Information	https://www.thruway.ny.gov/travelers/travelplazas/electric-vehicles.html

Table 13: New York State Thruway Interstate Highway Welcome Centers

The Authority offers DC Fast charging at all 3 of the Welcome Centers along the New York State Thruway mainline (I-87 and I-90) and the Niagara Thruway extension (I-190). The DC Fast charging provided at Welcome Centers complements charging provided at other facilities throughout the 500+ mile

network. The 50-100 kW charging stations along the Thruway corridor enable fast-charge-capable EVs to be powered in approximately 30 minutes. Access is provided 24/7 and no payment is required. Parking spaces adjacent to charging stations are reserved for EVs. Parking is free and Thruway tolls are not required but apply for vehicles accessing the charging stations from the highway.

4.10 City of Utica, New York

Location Type	Municipal (City Hall)
Type of Charging	Level 2
Number of Locations	1
Number of Charging Ports	2
Ownership Structure	Agency Owned/Operated
Utility Provider/Funding Sources	National Grid, NYSERDA grant
EVSP	ChargePoint
Fee	Free
Parking Rules	Free Parking
More Information	Cleaner, Greener Communities Program Fact Sheet

Table 14: City of Utica Municipal Charging

The City of Utica provides Level 2 charging at no cost for public use. Installation was completed in November of 2017 and funded by New York State's Cleaner Greener Communities Initiative. The State-funded grant program subsidized the installation and fully funded the charging station including 3 years of service. The City retains ownership after the initial 3-year period and must pay network service fees to keep the stations operational. The location at Utica City Hall is at a municipal parking lot with approximately 50 total spaces in downtown Utica with access to local services, restaurants, and retail. The charging stations are near local transit routes and the train station.

4.11 Capital District Transit Authority (CDTA), Rensselear, New York

Location Type	Rail Station (AMTRAK)
Type of Charging	Level 2
Number of Locations	1
Number of Charging Ports	2
Ownership Structure	Agency Owned/Operated
Utility Provider/Funding Sources	National Grid, NYSERDA grant
EVSP	ChargePoint
Fee	Free
Parking Rules	1-hour free parking
More Information	Cleaner, Greener Communities Program Fact Sheet

Table 15: CDTA Rail Station (AMTRAK) Charging

The CDTA provides free, public Level 2 charging at the Rensselear Train Station. Installation was completed in June of 2018 and funded by New York State's Cleaner Greener Communities initiative. The state-funded grant program subsidized the installation and fully funded the charging station including 3 years of service. The CDTA retains ownership after the initial 3- year period and must pay network service fees to keep the stations operational. The location at the Rensselear Train Station is in a public parking garage in New York's Capital Region with access to local services, restaurants, and retail. The charging stations provide direct access to nationwide rail and regional bus service; however, the stations are not designated for long-term parking.

4.12 NYS Office of Parks, Recreation, and Historic Preservation, New York

Location Type	State Park
Type of Charging	Level 2
Number of Locations	1
Number of Charging Ports	2
Ownership Structure	Agency Owned/Operated
Utility Provider/Funding Sources	NYSEG, NYSERDA grant
EVSP	ChargePoint
Fee	Free
Parking Rules	Park admission fees apply
More Information	https://www.nyserda.ny.gov/About/Newsroom/2018-Announcements/2018-07-09-Tompkins-County-EV-Charging-Stations

Table 16: NYS Office of Parks State Park

The New York State Office of Parks, Recreation, and Historic Preservation provides free public Level 2 charging at Taughannock Falls State Park. Installation was completed in October of 2017 and funded by New York State's Cleaner Greener Communities initiative. The location at Taughannock Falls State Park is in a public park within New York's Finger Lakes Region, approximately 10 miles from the City of Ithaca, which provides access to local services, restaurants, medical and educational facilities, and retail. The station serves park visitors who come to view the namesake waterfalls, as well as enjoying camping, hiking, boating, or other outdoor activities. The park charges an entrance fee, in addition to fees for camping, boat launching, and other activities. Station operations are funded as part of the regular operating budget.

5. Best Practices and Common Themes

Based on the above review of peer jurisdictions, there are almost as many ways to implement and manage public-access EVSE as there are examples to pull from. In many instances, the funding apparatus and/or terms of the funding agreement dictate the management strategy and those, in turn, are a function of the needs and trends at the time the projects were implemented. It's therefore imperative that management strategies take a holistic, forward-looking approach that address both current needs, but also, as much as can be anticipated, future needs as well. **Table 17** summarizes best practices and common themes that can help ensure charging management strategies are best positioned to meet the current and future needs of the community.

Common Themes	> Funding/financing apparatuses often dictate EVSE options – in terms of equipment type and location. > More focus being placed on dual-use charging locations to maximize benefits and utilization. > Also, more focus on issues of equity and access – ensuring all drivers can use public charging including lower-income individuals and those in need of accessible parking options. > Parking rules and fees generally applied equally to EV drivers and non-EV drivers. EV assessed regular payment methods (parking meter, hourly lot). > Many agencies have multiple vendors and have not planned for operations beyond initial grant terms, and continue with ad-hoc deployments based on funding availability.
Best Practices	> Facilitate future public/private partnerships with effective infrastructure planning and by developing attractive contract terms. > Use Open Charge Point Protocol (OCPP) compliant equipment. > Use port-level charging data to determine future needs, in addition to current, to maximize equipment longevity and usefulness. > Variable time-of-use fees are a step towards strong grid integration. > Retain LCFS revenues to cover costs. > Select charger types based on anticipated use cases at the site. > Maximize utilization and return on investment with dual-use charging stations.

Table 17: Common Themes and Best Practices

5.1 Public or Private Ownership and Operations

There are good examples of both private and public ownership and operations for EV charging among the agencies included in the study. While the choice of ownership and operating model was often driven by grant terms, jurisdictions have generally continued to follow their initial operating model.

One notable exception is the City and County of San Francisco, which has issued an RFP for a third party to take over ownership and operations of charging in public lots and pay the city a lease fee. The high demand for charging and limited parking in San Francisco may make this model more feasible there than elsewhere. The City of Seattle tried to attract private operators to deploy charging in the public right of way but found that vendors were not interested in navigating the permitting process. San Francisco, LA Metro, and the State of

Oregon all ran RFP around nine years after the original station deployment, indicating that 8-10 years is a good target to plan operations.

Public/Private partnerships are likely to form the basis for many charger operations in the future, as well as the operation of many other mobility hub amenities such as carshare or scooter share. **Jurisdictions should work to make their facilities attractive for future partnerships by including power capacity and stub outs in construction, as well as finding contractual terms that will be attractive to private operators.**

5.2 Technology, Equipment, and Data

Regarding technology and data management, there are a few best practices that should inform future management strategies. **First, the use of equipment following Open Charge Point Protocol (OCPP) allows EVCS flexibility and means station hosts are less tied to individual manufacturers.** This enables a management strategy that takes advantage of current market trends (in terms of best-cost EVCS, for example) while leaving space for future changes in the network vendor.

Second, data gathering and sharing is a vital part of future-planning and future-proofing. One vendor requirement should be the ability to aggregate information across stations to inform decision-making. Having full access to port-level charging data provides the managing entity (municipal, county, transit authority, etc.) with the ability to develop a strategy that considers current use and is better able to identify gaps. Charging station data can be combined with driver surveys and public comments, as in the case of Berkeley's *Electric Mobility Roadmap,* to assess community needs and opportunities for system improvements. Oregon DOT included charging data to help inform responses to their management RFP.

Data helps inform pricing strategies. For example, agencies seeing low usage may consider lowering fees to optimize utilization. **Implementing time-of-use pricing can help encourage charging when utility costs are lower and discourage charging at times the grid is most strained.**

Strong data tracking is required for the accrual of LCFS credits. These credits are available to the owner or operator of public charging equipment and can offset a substantial portion of operating costs. Credits are accrued based on the totally amount of energy dispensed, as well as the carbon intensity of the electricity used at the time of charging.

5.3 Charger Type Selection Based on Expected Use Cases

When determining the type of EVSE to be deployed at specific locations, it is best to consider the typical use-case and ensure appropriate infrastructure for the location(s) and drivers. For example, DCFC charging is found throughout New York State's thruway Welcome Centers, Service Areas, and entrances/exits, where drivers are typically trying to limit their charging time and continue their trip. In contrast, slower Level 2 charging is appropriate at Park & Rides, workplaces, and central business/shopping districts where drivers are prepared and expecting to leave their vehicles for hours at a time; in these instances, DCFC is not necessary. Similarly, a vehicle will typically remain in place at Park & Rides for 8-10 hours, meaning a 7kW station is not necessary, when an average commuter would require less than 1 hour to recover their commute distances. In these cases, using load management can increase the number of ports installed and make charging available to a greater number of drivers.

Finally, installing charging stations in locations that allow for dual use is an increasingly common and important aspect of charging strategy. This is especially true as equity and access considerations become a more central part of the discussion. Currently, many EV drivers without consistent access to at-home charging rely on public DCFC stations. However, locations such as Park & Rides and other public lots that allow for commuter charging during the day and overnight charging for nearby multi-unit dwelling residents (and others without dedicated at-home parking/charging) provide an opportunity to increase the cost-effectiveness of existing Level 2 charging infrastructure while simultaneously reducing the need for more costly DCFC installations.

Some efforts to this end can be seen at Pasadena's Del Mar Station Parking Garage and Alameda County's AlcoPark Garage that vary charging prices based on the time of day and day of the week. At the same time, initial research shows that public DCFC are important for EV ride-share drivers, again many of whom do not have the opportunity to charge their vehicle at home. Therefore, both considerations must be incorporated into the planning process.

5.4 Conclusions and Next Steps

Overall, perhaps the most important lesson learned is that EVSE management is changing rapidly – both in terms of needs and opportunities – and flexibility and adaptability are therefore vital. Collecting and analyzing as much data as possible allows managers to stay abreast of trends, anticipate needs, find gaps, and plan ahead. This, in turn, helps ensure appropriate sitting and specific infrastructure and better allows for the optimization of stations through dual-use and access considerations. Although direct municipal ownership of charging stations is still common, both public and private operators should be influenced to maximize utilization to accrue more community benefits and improve return on investment. The findings in this report will be compared to local agency practices across the San Diego region and will inform the regional charger management strategy.

6. Acronym Reference

- San Diego Association of Governments (SANDAG)
- Electric Vehicle (EV)
- Electric Vehicle Service Provider (EVSP)
- Zero Emissions (ZE)
- Electric Vehicle Charging Stations (EVCS)
- Zero Emission Vehicle (ZEV)
- California Energy Commission (CEC)
- Accelerate to Zero Emissions Collaboration (A2Z)
- Direct current fast charging (DCFC)
- Direct current (DC)
- Electric Vehicle Supply Equipment (EVSE)
- Low Carbon Fuel Standard (LCFS)
- Los Angeles County Metropolitan Transportation Authority (LA Metro)
- Open Charge Point Protocol (OCPP)
- Zero Emissions Transportation Infrastructure Working Group (ZETIWG)
- Bay Area Rapid Transit District (BART)
- Santa Clara Valley Transportation Authority (VTA)
- Department of Transportation (DOT)
- Limited Liability Companies (LLC)
- Capital District Transit Authority (CDTA)
- Open Charge Point Protocol (OCPP)