HOW-TO GUIDE:
electric vehicle charger installation

CITY of BOSTON

Transportation

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INTRODUCTION

Many stakeholders are unfamiliar with the requirements and process for installing off-street Electric Vehicle (EV) Charging Stations. This document will provide guidance on how to navigate the range of decisions necessary to choose and install charging stations in a residential or commercial development. This document is not intended to be an installation manual, or replacement for approved codes or standards.

The process for installing EVSE at a condominium, development, or home is not complicated, but important procedures must be followed to ensure safe and efficient charging opportunities. This guide will increase understanding for the site assessment, EVSE selection, and installation in order to make the process easier and more successful. These guidelines explore communication networks, connection to the grid, user interface, as well as other considerations.

Boston, similar to many other leading cities, has created a Climate Action Plan to reduce our contribution to climate change impacts. Boston has long been a global leader in reducing carbon emissions and preparing the city for the effects of climate change. Mayor Martin J. Walsh has committed to a goal of being carbon neutral by 2050. Becoming carbon neutral means that our City can only release as much carbon pollution as our environment can safely absorb. In 2017, the transportation sector in Boston accounted for 29% of our total emissions.

Go Boston 2030 is the City's long-term plan to transform Boston's transportation system. The plan sets a goal to reduce drive-alone to work trips by half for both journeys originating in Boston and those coming into Boston from the region. However, it is expected that the reduction in the use of automobiles will be gradual, and demand will continue to exist for transportation that cannot be served by walking, biking, carpooling, and taking transit.

EV Charging Today

Significant barriers exist to shifting drivers out of internal combustion engine cars and in to EVs including the high upfront cost of EVs, perceived lack of access to charging infrastructure, lack of awareness, range anxiety. In a recent survey, 45% of Boston residents said that would consider purchasing an EV if they had sufficient access to charging infrastructure. The installation of electric vehicle supply equipment (EVSE) will become critical to reaching our neutrality goals. While the City is taking action to support EVSE infrastructure for residents of Boston in municipally owned parking assets, but it is recognized that in most cases, EV owners seek the economy and convenience of home charging. Many estimates agree that 80%-90% of charging will happen at home[1]. Residential charging, municipal charging, office, and other publically accessible charging must be offered together to create a network that will curb range anxiety, and support practical driving patterns.

Programs

On-site charging is an increasingly sought after amenity from building tenants. There are a number of programs available for those interested in installing EVSE. There are currently financial incentives available, upwards of 60% funding for EVSE installation from the Massachusetts State program and other incentives from local electric utilities. Charging stations can also earn Leadership in Energy & Environmental Design (LEED) points for the property, which is the most widely used green building rating system. It is recommended that after reading this document, the site host should evaluate which incentives they qualify for and should pursue those opportunities. If a site needs support understanding the incentives they qualify for, please contact ***btd@boston.gov.***

1 https://www.transportationandclimate.org/sites/default/files/EV_Siting_and_Design_Guidelines.pdf

DEFINITIONS AND ACRONYMS

DEFINITIONS

ZERO-EMISSION VEHICLE (ZEV): Any vehicle that emits no tailpipe emissions from the onboard source of power, such as battery electric vehicles and hydrogen fuel cell vehicles.

ELECTRIC VEHICLE (EV): Any vehicle that is licensed and registered for operation on public and private highways, roads, and streets and that operates exclusively on electrical energy from an off-board source that is stored in the vehicle's batteries, producing zero tailpipe emissions or pollution when stationary or operating.

PLUG-IN HYBRID ELECTRIC VEHICLE (PHEV): A hybrid electric vehicle whose battery can be recharged by plugging it into an external source of electric power, as well as by its on-board engine and generator.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE): Equipment for the purpose of transferring electric energy to a battery or other energy storage device in an electric vehicle. There are 3 different standardized indicators of electrical power and voltage, at which an electric vehicle's battery is recharged. The terms Level 1, Level 2, and Direct Current Fast Charging are the most common charging levels. The charging station levels are defined in the Technology Overview section.

EV INLET: Is located on the EV and consists of an electrical socket that, when combined with the connector, can provide conductive charging and information exchange.

CONNECTOR: Is a device that, by insertion into an EV inlet, establishes an electrical connection to the EV for the purpose of information exchange and charging.

COUPLER: The EV inlet and connector together are referred to as the coupler.

EVSE-INSTALLED: Means an installed Level 2 EVSE.

EV-READY: Means providing raceway to every parking space, adequate space in the electrical panel and space for additional transformer capacity to accommodate the future installation of the transformer, and the associated Level 2 EVSE.

RACEWAY: An enclosed conduit that forms a pathway for electrical wiring. Raceways protect wires and cables from heat, humidity, corrosion, water intrusion and general physical threats.

EVSE-INSTALLED: means an installed Level 2 EVSE.

ACRONYMS

AC: Alternating Current

ADA: Americans with Disabilities Act

CCS: Combo Charging System

DCFC: Direct Current Fast Charging

EV: Electric Vehicle

EVSE: Electric Vehicle Supply Equipment

FCEV: Fuel Cell Electric Vehicle

FEMA: Federal Emergency Management Association

ICE: Internal Combustion Engine

PHEV: Plug-In Hybrid Electric Vehicle

NEMA: National Electrical Manufacturers Association

NFPA: National Fire Protection Agency

SAE: Society of Automotive Engineers

TAPA: Transportation Access Plan Agreement with Boston's Transportation Department

ZEV: Zero Emission Vehicle

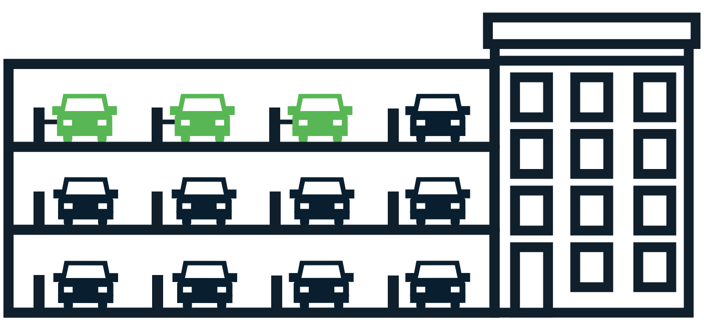
APPLICABLE REGULATIONS

Ordinances, policies, and laws about EVSE Installation and readiness support the holistic network of infrastructure and can increase adoption of electric vehicles.

Electric vehicle readiness policy for new developments

Boston's previous EV policy required that 5 percent of parking be equipped with EV chargers and an additional 10 percent be EV-ready in new construction projects above 50,000 square feet. This included all projects in certain areas of South Boston and Downtown regardless of their size, which was enforced by the parking freeze.

On March 7, 2019, Boston's Mayor Martin J. Walsh announced new electric EV infrastructure requirements for parking garages[2]. The policy applies to all new parking garages including large developments required to undergo the Transportation Access Plan Agreement. and in any new development in the South Boston or Downtown Parking Freeze Zones as defined by the Air Pollution Control Commission. The policy requires 25% of parking spaces in new off-street parking areas shall be equipped with electric vehicle charging stations, and the remaining 75% shall be EVSE Ready, at a minimum, equipped to accommodate electric vehicle infrastructure expansion.



*Large project review developments and all developments in the Parking Freeze Zone must equip **25%** of their total parking spaces to be EVSE (electric vehicle supply equipment) installed and the remaining **75%** of the total spaces to be EV (electric vehicle) ready.*

the policy allows for flexibility by allowing an EVSE Installed Requirement Equivalence. Each parking spot is worth one point and must be offset. Offset options include Level 1 Chargers, Level 2 Chargers, DCFC - 50kW, DCFC - 150kW, EV Carshare, and Electric Bike Parking amenities.

This policy and point system weights various charger types to ensure that the same number of EVs are served per unit of time as Level 2 EVSE. The EV Car Share and Electric Bike Parking weight is given based off of emissions reduced, and the reduced need for car ownership.

Right to charge

At the October 18, 2017 Council meeting, the Council unanimously voted to file the Right to Charge as a home rule petition with the state. The home rule petition allows condominium unit owners to install electric vehicle charging near their parking spaces. This was enacted into law by the Senate and House of Representatives in 2019.

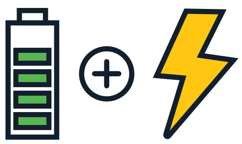
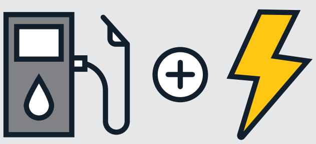
The proposal prohibits a condo association from unreasonably restricting an owner from installing an electric vehicle charging station on or in certain areas in which they have exclusive use, or on a common element, as long as the charging station is a reasonable distance for the dedicated parking spots. The proposal seeks to increase access to electric vehicle charging stations and will encourage increased use of electric vehicles as a result making it easier for the City of Boston to reduce its greenhouse gas emissions.

2 "Mayor Walsh's Remarks at the Boston Municipal Research Bureau." https://www.boston.gov/news/mayor-walshs-2019-remarks-2019-bos-ton-municipal-research-bureau

TECHNOLOGY OVERVIEW

ZEV TYPES

A Zero Emission Vehicle (ZEV) is a vehicle that emits no tailpipe emissions from the onboard source of power, such as battery electric vehicles and hydrogen fuel cell vehicles. ZEVs generate fewer emissions than gas- and diesel-powered vehicles. ZEVs can mean several types of vehicles. All ZEVs can be powered solely by electricity, but some can also use both electricity, and an engine. ZEVs are available for other applications besides passenger vehicles as well, including buses and tractor trailers. Below is a table of ZEV technology types.

TECHNOLOGY TYPE	DESCRIPTION	ZEV EXAMPLE
Battery-Electric 	Consists of a relatively large electrochemical storage battery as the sole power source for the vehicle. It provides energy for propulsion through an electric traction motor(s) as well as power for all vehicle accessory systems. Battery-electric drive is also characterized by zero "point-of-source" (i.e., vehicle) regulated emissions.	Electric Bus Electric Vehicle (EV) Electric Bike (eBike) Electric Scooter (eScooter) Zero Emission Motorcycle
Hybrid-Electric 	Consists of a fuel-burning prime power source – generally an internal combustion engine (ICE) – coupled with an electrochemical or electrostatic energy storage device. These two power sources work in conjunction to provide energy for propulsion through an electric traction drive system. Power for all vehicle accessory systems can be provided electrically or mechanically from the ICE or combinations of both.	Plug-In Hybrid Electric Vehicle (PHEV) Plug-In Hybrid Electric Bus
Fuel Cell Electric 	Consists of the fuel cell device itself which converts chemical energy into electric energy. It provides energy for propulsion through an electric traction motor(s), as well as power for all vehicle accessory systems. It can operate as a stand-alone prime power source or as the prime power source in a hybrid-electric drive system working in conjunction with an energy storage device. Fuel cells are also characterized by low to zero point-of-source regulated emissions, depending on the primary fuel stock (e.g., hydrogen, methane, alcohol, gasoline or diesel) on board the vehicle; hydrogen is the only fuel with zero point-of-source emissions.	Fuel Cell Electric Vehicle (FCEV)

EVSE supports both battery-electric vehicles and hybrid-electric vehicles. The scope of this How-To Guide is to provide guidance on installing charging infrastructure to support these battery types for light- and medium-duty vehicles. The focus of this section is on available and street-legal vehicles that incorporate battery energy storage that can connect to the grid for the supply of some or all energy requirements.

3 https://www.transit.dot.gov/sites/fta.dot.gov/files/Electric_Drive_Bus_Analysis_0.pdf

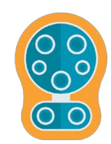
CHARGING BASICS

EVSE

EVSE delivers electrical energy from the power source to the EV. This ensures that a safe flow of electricity is supplied to the vehicle. This is the main interface between the vehicle, grid, and the utility.

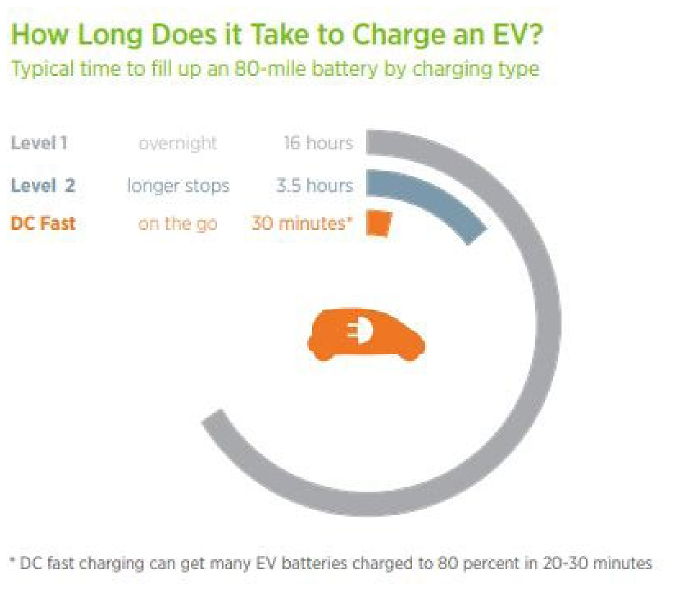
Charging station

There are currently three categories of charging stations - Level 1, Level 2 and Direct Current Fast Charging. They differ in the amount of power they require, the necessary infrastructure, cost, and the amount of time it takes to charge the vehicle. The charging station is the point of transfer from the vehicle to the grid.

	LEVEL OF CHARGING		
	LEVEL 1	LEVEL 2 INSTALLED	LEVEL 3 DC FAST CHARGING
COST PER SINGLE UNIT	**$300 - $1,500**	**$400 - $6,500**	**$10,000 - $40,000**
VOLTAGE AND POWER SPECIFICATIONS	120V/20A outlet with dedicated circuit (standard wall outlet)	208/240V/ 40A service with dedicated circuit (similar amount of energy required for a dryer plug)	240V or 480V AC 24kW - 350kW+ Needs dedicated transformers and electrical service.
RATE OF CHARGING PER HOUR	**SLOW:** Can fully recharge a battery in 8-12 hours, though larger batteries require 1-2 days	**FASTER:** Can fully recharge a car in 4-8 hours	**FASTEST:** Can recharge a battery to 80% capacity in 30 minutes
WALL OUTLET OR CONNECTOR	J1772 connected to standard wall outlet 	J1772 connector* 	CCS Combo(L), CHAdeMO(R), and Tesla  
RECOMMENDED LAND USE TYPE	Residential or office buildings with assigned parking stalls. Sufficient for overnight parking	Residential or office buildings with unassigned parking stalls. Well suited for indoor, or outdoor locations	Settings where people park for short durations, such as commercial properties or businesses
POWER CONVERSION LOCATION	In-vehicle	In-vehicle, limited by onboard charger	In EVSE Unit
UNIT	Outlet, on wall	Freestanding, or hanging station, or wall outlet	Freestanding unit, higher profile

* There are many wall outlets commonly used for Level 2 charging including the NEMA 14-50, 16-30, 6-50, and the outlet pictured the NEMA 14-30. Contact the EVSE manufacturer for more information

4 Margaret Smith, Jonathan Castellano. Costs Associated With Non-Residential Electric Vehicle Supply Equipment Factors to consider in the implementation of electric vehicle charging stations. U.S. Department of Energy Vehicle Technologies Office. Nov. 2015.



Source: Quick Guide to Fast Charging

Connectors and cord sets
Most EVSE and EVs use a standard SAE J1772 connector and inlet that's compatible for Level 1 and Level 2 chargers. Level 1 outlets are typical wall outlets.

Standardization of cords and connectors is an ongoing issue for DCFC. The SAE J1772 is an alternative to "hybrid" connectors that is a standard used by American auto manufacturers and able to be used for all charging levels. Previously, the standard was only used for Level 1 and Level 2 charging. This updated CSS Combo standard was developed in cooperation with European automotive experts who also adopted and endorsed a CSS combo strategy in their approach. Despite this standardization, there are two other connectors being used: Tesla, and CHAdeMO. The CHAdeMO connector was developed in Japan and is compatible with some EVs. Some stations may have both the CSS Combo, as well as the CHAdeMO. Tesla has a proprietary coupler that works only with their cars. The National Electric Code states that cords can be no longer than 25 feet, unless equipped with a retraction or other control device. Most recommend that the site design requires no more than 3-5 feet of cord distance from vehicle to charging station. EVSE cord sets cannot interfere with pedestrian routes, and cannot be placed in a way that creates a tripping hazard.

EVSE software
Different models of EVSE have different levels of technological capabilities.

Basic EVSE
Basic models, also known as "dumb" or non-networked chargers, communicate with only the vehicle, once it begins the charging session and ends the chariging session. Reporting and fee collection capabilities are very minimal for basic chargers. While payment can be possible on a basic charger, they typically work best when the EVSE is connected to a separate electrical meter or assigned to a specific person, so that payment can be allocated correctly.

Smart EVSE
All levels of chargers can be "smart". The capabilities offered by a smart charger typically make the upfront cost more expensive. Depending on the business model being used, smart chargers also typically require an on-going monthly, per session, or annual networking fee to the user, site host, or both.

The levels of communication available for a smart charger can include communication with the site host, utility grid, internet, and user. EVSE usually connects by cellular, Ethernet, or wi-fi. Garages can have network connection complications, and repeaters may need to be installed to ensure communication capabilities.

Smart chargers can communicate between and connect:
1. EV to parking space
2. EV to EVSE
3. User to payment network
4. EVSE to site host
5. User to vehicle

The information to the user can be provided by smart phone, RFID tag, or computer, and can include a high degree of information. Many smart chargers use an application on a smartphone - though there is not one common platform for EV charging at this time. The list below details smart chargers technology and the benefits to the host and user.

TECHNOLOGY	FUNCTION FOR SITE HOST	FUNCTION FOR USER
Advanced payment collection options	Little management and oversight required for payment system	Enables easy payment for fee collection.
RFID/NFC communication		Enables easy access control by issuing special key fobs
Network and telematics capability	• Support rate determination • Reporting including user identity and energy consumption • Communicate in-use status • Help troubleshoot issues • Regulatory enforcement • Offer alternative for parking regulations by charging a fee for time spent parked • Allows customized fee over time, energy, or session • Remote software upgrades and service	• Enables data collection • Demand response interaction with the grid • Communicates charging station availability and reservation capability • Communicates rate of charging Displays fee rates • Notifies for complete session • Reporting of fee totals, electricity used, date, location and time spent charging
Touch screens/video capabilities	• Advertisement opportunities, internal or external • Branding opportunity	• Easy to use • Interface for clear display of information

Smart chargers, and their associated networks, can also mitigate issues that may arise. System alerts can ensure more available access to and use of EVSE charging spaces. Alerts can also help users avoid regulatory enforcement - in cases of chargers that may have dwell time restrictions. As an alternative to parking regulations, dwelling at chargers could be disincentivized by charging a fee for time spent parked at charger, rather than electricity used.

Smart chargers support the data collection that is integral to understanding EV charging demand, which informs decisions on improving and expanding systems.

EVSE SELECTION

Selecting the appropriate EVSE for the situation is crucial to meeting the needs of potential users. The EVSE type should match the time it would take a typical user to re-charge their vehicle within the time they already spend at the site. An additional consideration is whether or not the parking is assigned to a specific person.

The type of EVSE can also be suggested based on the land use. Below are a few land uses with EVSE suggestions:

Residential parking areas, including condominiums, apartment buildings, multi family homes and single family homes can use slower chargers as residents typically spend each night at home, which is an opportune time for a car to charge. Level 1 chargers are appropriate when the parking is assigned, and Level 2 chargers work well when the parking is not assigned or if a valet service is available.

Office buildings also typically follow the same suggestion, since employees usually are at work for 8-9 hours, and their car sits dormant. Level 1 chargers are appropriate when the parking is assigned, and Level 2 chargers work well when the parking is not assigned or a valet service is available.

Commercial parking areas can vary widely for the amount of time that cars sit dormant. Typically, Level 1 chargers are not appropriate. The amount of time that it takes for Level 2 chargers and DCFC chargers to charge a car match the dwell time of commercial parking areas. It is suggested that these chargers be networked, as there may be many unique users who are accessing the charger. It is recommended that DCFC be installed in parking areas that are publicly owned and publicly available (e.g., Park & Ride lot, public library parking lot, on-street parking) or privately owned but publicly available (e.g., shopping center parking lot, commercial office parking garage). Commercial sites that can be a good fit for DCFC are areas where people spend 20-30 minutes such as grocery stores, pharmacies, and convenience stores. Sites that are a good fit for Level 2 chargers are areas where people spend around 1-4 hours, such as movie theaters, libraries, museums, and sit-down restaurants.

SITE SELECTION AND DESIGN

Existing site conditions have influence over what type of EVSE is installed, and where. The most common factors that will help to lower the cost of installation is distance from the charging station to the electric panel, level of charger, charger capabilities and existing electrical capacity.

CONNECTING TO POWER

Connecting to power is the most important consideration of the site selection process. Sites can vary in cost immensely based on the proximity to a power source. In general, the closer that the EVSE is to the power source, the less expensive the installation will cost. Cost installation averages should not be used to determine the cost of installation, as this is site specific.

Connecting to power occurs across various boundaries - including the public and private realm. The connection to power involves the local utility. In some cases the City of Boston is involved, if the public realm is affected by the system upgrade.

ELECTRICAL CAPACITY

EVSE requires a dedicated electrical circuit, which is the component of an electricity supply system which divides an electrical power feed into subsidiary circuits. An electrical circuit is the wiring pathway that runs from the power source, through wires to the devices being powered, then back again to the power source. A circuit is essentially a completed loop of electrical current. Dedicated circuits can be added into the existing electrical panel, or may require an additional panel.

Raceways are an enclosed conduit that forms a pathway for electrical wiring. Raceways protect wires and cables from heat, humidity, corrosion, water intrusion and general physical threats. They are required from the electrical panel to the EVSE location. Costs rise as the length of the raceway increases, because of the costs of construction and trenching.

Most sites have enough power for a Level 1 charger, or 120V. Level 2 chargers are equivalent to the amount of energy required for a standard clothes dryer. The continuous load required by a Level 2 charger, however, can burden a system. Upgraded circuits can relieve the system and reduce the safety risks. This can also be controlled through Smart EVSE systems, which limit the amount of wattage across chargers. DCFC typically require additional transformer capacity, and usually require utility upgrades to accommodate the additional anticipated load.

METERING

Previously, smart EVSE typically have integrated payment technology, and some basic chargers also have very simple payment systems too. Some sites, like residential or free public charging, make it more desirable to have a separate meter, though not required. Dedicated meters can increase the cost of installation. They isolate energy utilized for charging from the rest of the energy used by the building, which allows the host to allocate the energy use to the correct party. This requires that the EVSE connects directly to the utility grid. This also allows for communication from the meter to the utility. Some EVSEs have integrated meters, which can be helpful for saving space in a garage.

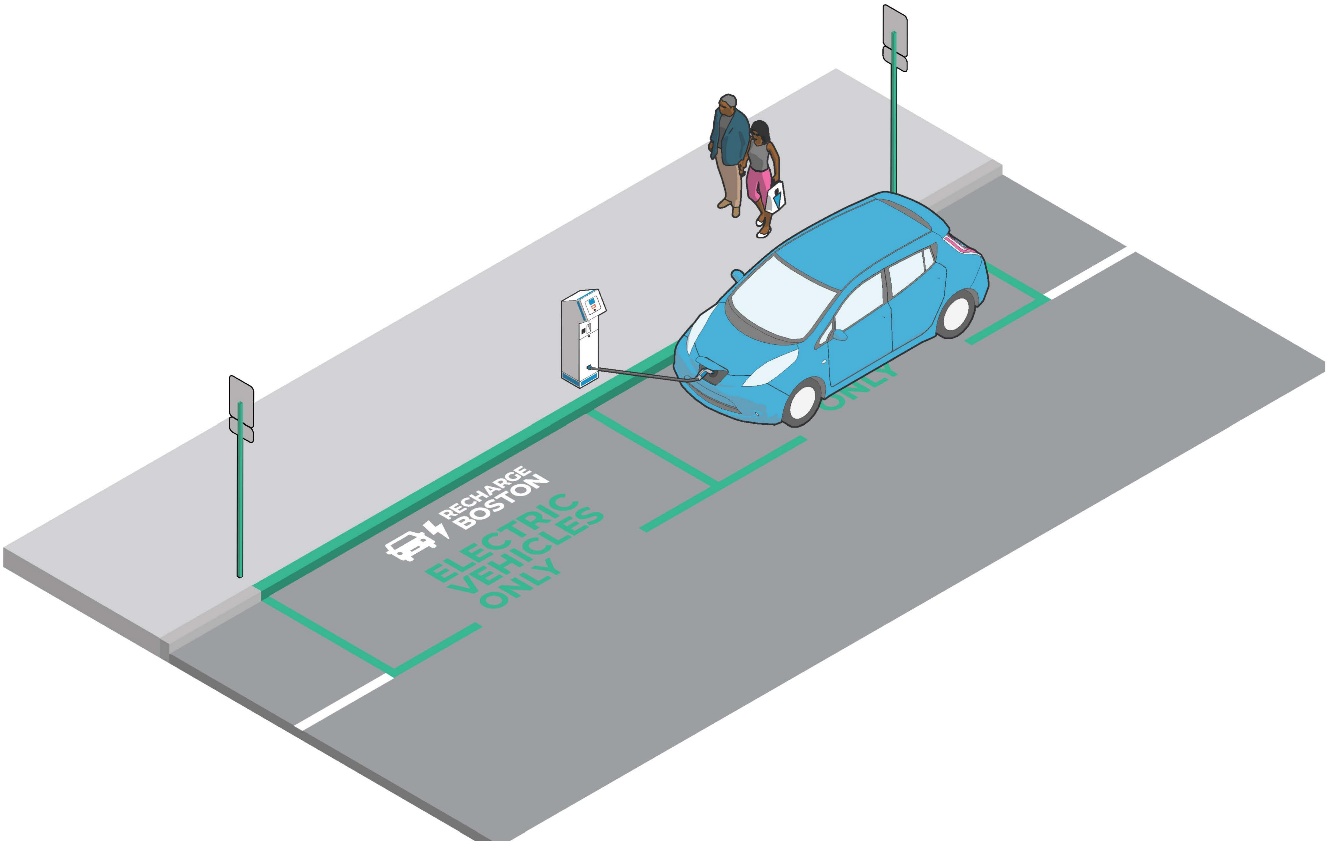
Separately metered services also offer the potential opportunity to take advantage of future time-of-use rate programs. Time-of-use rates, as implied by the name, change according to the time of day when electricity is consumed. During peak hours, as defined by the individual utility, rates are generally charged at a higher level than non-time-of-use rates would be. Time-of-use rates offer users a significant discount during off peak hours. These options are currently being investigated by utilities. Eversource launched its ConnectedSolutions program, which makes adjustments to your EV Charger to put less strain on the grid during peak demand. To learn more, visit Eversource's ConnectedSolutions website.

VISIBILITY

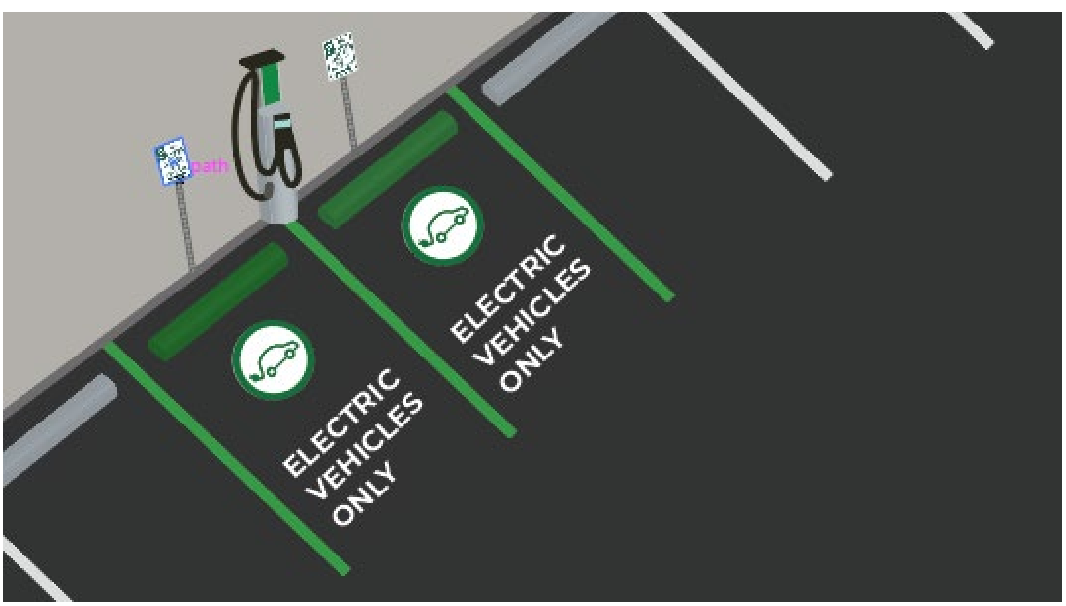
Many EVSE owners and operators will want to choose a site that has high visibility to make it easier for drivers to locate. Priority parking spaces, or premium parking spots, usually close to building entrances, are a good way to highlight EVSE, but hosts must consider if that location will increase the installation costs if the raceway needs to be longer. Dedicated spots are reserved for EVSE charging exclusively, and can be an opportunity to increase visibility, and reliability. Signage and pavement markings can help elevate visibility for dedicated and/or premium EV charging parking spaces.

SIGNAGE AND WAYFINDING

User visibility is incredibly important. There are three types of signage and wayfinding addressed in this document: general service signs, regulatory signs, and parking spot stencils. Wayfinding signage helps EV drivers locate an EV parking space, and also increases awareness. Regulatory signage designates a space for a specific use, and can involve time restrictions. Parking spot stencils help to increase visibility and clearly identify spaces. All should be provided. It is important to be consistent with the City of Boston suggested EVSE signage to help drivers easily locate EVSE regardless of the brand of the charger. A common visual identity will reduce confusion.



Suggested signage for curbside charging.



Suggested signage for off-street charging.

Figure 1

General service signs

General Service signs are intended to provide general guidance to the charging station and should be installed at a suitable distance in advance of the turn-off or intersecting roadway, or at the charging station. If a site is listed on a smartphone application, it typically gives an address, and drivers can become frustrated if the EVSE is challenging to find within the site. Signage should be placed at the parking entrance notifying the presence of EVSE. The City of Boston's Wayfinding Logo sign should be used for General Service EVSE signage.

C

D

Regulatory signs

Regulatory Signs are required for enforcing which vehicles park in EVSE parking spots, as well as the time duration that EVs are permitted to park and/or charge at public charging stations. If time limits or vehicle removal provisions are to be applied, regulatory signage including parking restrictions, hours and days of operations, towing, and contact information shall be installed immediately adjacent to, and visible from, the electric vehicle parking or charging station. Regulatory pavement markings can be used in addition to signage.

To be enforceable, regulatory signs should be no smaller than 12" x 18" and placed immediately adjacent to the EVSE at a height of 7 feet.

Sign A is a permissive sign that must be used to designate the number of hours an EV is permitted to park if a dwelling restriction is in place and if the parking space is reserved exclusively for EVs.

Sign B indicates that the space is reserved exclusively for EV charging, though the EV does not need to be actively charging. This sign must be used when there is no dwell restriction, but if the space is restricted for EV parking.

Sign C should be coupled with Sign A or B if the building requires that the EV must be actively charging.

Sign D should be coupled with Sign A or B to indicate that the EV must be actively plugged in, and must vacate the parking space when charging is complete.

Parking spot stencils

Parking spot stencils are not enforceable or required, but painting an EVSE symbol on the parking surface can help to identify EVSE spots. Parking spot stencils cannot be substituted for EVSE signage requirements. For the City of Boston approved stencil, refer to Figure 1.

To get the details for EVSE signage, regulatory signs and/or stencils suggestions for your project contact **btd@boston.gov.**

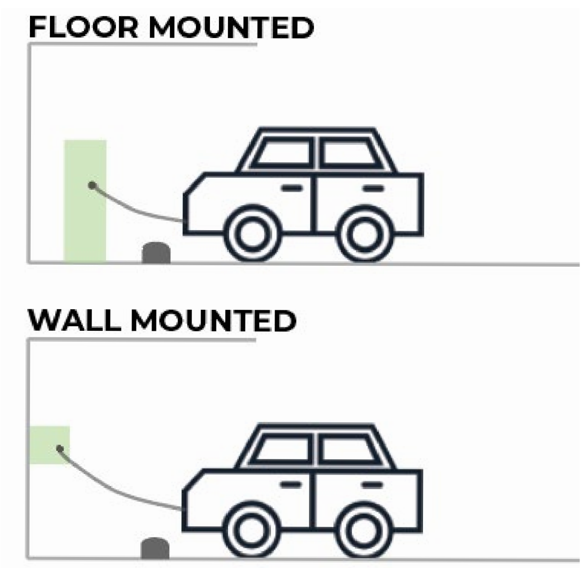
PARKING AND PLACEMENT

PARKING SPACE SIZE

EVSE must be installed in a way that does not reduce the minimum required off-street parking spot size. Ample space should be provided for loading and unloading, as well as the charging equipment

MOUNTING

EVSE can be wall mounted or floor mounted. Different mounting options have the opportunity to preserve floor space. Charging station outlets and connectors shall be no less than 36 inches and no higher than 48 inches from the surface of the floor. Level 1 outlets may be 12 inches and no higher than 48 inches from the surface of the floor.



Level 2 EVSE and DCFC can have multiple connectors. It is permissible to serve more than one parking spaces with one Level 2 EVSE or one DCFC EVSE unit, but each associated connector must be able to reach the individual parking space. One port may serve a few spaces with multiple connectors, but site hosts must take caution to ensure each connector can reach the intended space. This must be considered when choosing the mounting configuration.

LIGHTING

Lighting should be considered for EVSE. Inadequate lighting can create a tripping hazard. Lighting can increase safety and security of a site, and also deter vandalism. If lighting upgrades are necessary, it may present an opportunity to extend wiring for EVSE installations.

ACCESSIBILITY

Accessibility refers to the ease and ability that a driver can safely plug in an EV to the EVSE, and the ability to reach all additional necessary components. All pedestrian routes must also be safe and accessible to drivers of all physical abilities.

All EVSE placed and proposed must be compliant with the Americans with Disabilities Act requirements, and all codes relevant to Element ADA/ABA 2004 ANSI A117.1 2017 Section 502.11. All EVSE must comply with the Massachusetts Architectural Access Board's rules and regulations. An EVSE should have all relevant parts located within accessible reach, and be in a barrier-free access aisle for the user to move freely between the EVSE and the electric vehicle.

Standards for how many EVSE spaces should be ADA-accessible are currently being considered. The City of Boston Electric Vehicle Readiness Policy for New Large Developments requires that 5%, but not less than one, of the provided EVSE spaces be accessible, though this only applies to new large developments that trigger the Article 80 process.

EVSE PROTECTION

Bollards and curbs offer protection from traffic incidents and tripping hazards. Adequate EVSE protection, such as concrete-filled steel bollards, should be used where warranted. Wall-mounted barriers can be used as protection as well.

Boston's sea levels are expected to rise three feet or more before the end of the century. Some areas in Boston are in flood plains, or areas that are lower in elevation, adjacent to a river, and may be subject to flooding. Raceway shall be installed in a way that makes it resistant to flooding, if applicable. Plug caps are also suggested as an additional measure to build flood resiliency. Evaluate flood risk using Boston Planning and Development Agency's "Climate Resilience Layer" in the [Zoning Viewer.]

INSTALLATION

PERMIT ACQUISITION

For the City of Boston, there is a separate process for new and existing developments. An electrical permit is required to install EVSE for existing developments. However, installation of a charging station associated with a new development project of a new residential or non-residential property can be processed in association with the underlying permit(s).

Electrical permit applications can be found on the ISD Permit Portal. To apply for an electrical permit, create an account on the Inspectional Services portal. After the account is made, select "Apply for a permit" on the homepage. Enter the relevant project information including any team members, number of floors being worked on, existing service, new service information, and attach all necessary attachments. Under the description of construction/proposed job, detail that the job is an Electric Vehicle Charging Station. When the application is complete, click to apply for an electrical permit and await approval to begin work. After obtaining the required permit and satisfying the relevant requirements, site hosts can proceed with installation.

SAFE IMPLEMENTATION

Installation must be done safely, and in compliance with the applicable state and city laws.

It is required that Level 2 and DCFC are UL certified and installed by a Massachusetts licensed electrician. Consider the Eversource's preferred vendor list for qualified electricians. They must also be in compliance with NFPA 70, NEC article 625, and applicable MA electrical codes.

When appropriate, be sure to contact Dig Safe. The laws and rules regarding dig safe can be found by visiting the Dig Safe website.

MANAGEMENT AND OPERATION

HOST AGREEMENTS

There are different ways to manage and operate EVSE. Chargers can be owned or leased. Chargers can also be maintained by a third-party, or internally. Both owning and leasing have positive and negative implications. It can be more expensive to have a third-party operate the EVSE, as they typically charge a fee. Leasing chargers can have expenses associated with it as well, but as technology advances, it gives hosts the opportunity to have the latest EVSE without having to pay upfront ownership costs.

PARKING POLICY

Parking policies determine the system, procedures, and relationship for parking a vehicle in a garage or parking lot. Property management shall include proper signage to indicate the parking policy for applicable time and the enforcement vehicles. In some instances, it makes sense to create a separate system for ICE vehicles, and for EVs.

If a separate system is created, the enforcement should be incorporated with the parking lot management, and proper education to the parking enforcement individuals.

Here is a series of parking policy and operation options for the shared public charging stations:

Pay for time. This is equivalent to metered parking and generally means the energy cost is less important to the owner. This is adopted to incentivize drivers move and unplugged after they finish charging.

Pay for energy. This generally works best if there is a time limit and parking is well enforced. This arrangement works best with a notification after charging is complete.

Pay a fixed fee: This system charges regardless of time or energy.

Pay a membership: An example of this can be a fixed monthly fee for unlimited charging at specific charging stations with limited parking and charging time.

Combination: This system could have one or more of the suggested policies.

Penalty fee: This charges a driver in the event the vehicle does not vacate the space after the alloted time to reach a full charge.

APPENDIX A - RESOURCES

WXY EV Siting and Design Guidelines
Dig Safe
Eversource's Preferred Vendor List
Eversource ConnectedSolutions Program
Eversource Make Ready Program
BPDA's Flood Map Zoning Viewer
ISD Permit Portal
Recharge Boston - Electric Vehicles
Workplace Electric Vehicle Incentives
Resident Electric Vehicle Incentives
Right to Charge