

ACCESSIBILITY AND SIGNAGE FOR PLUG-IN ELECTRIC VEHICLE CHARGING INFRASTRUCTURE



Report and Recommendations
May 2012



CALIFORNIA
PLUG-IN ELECTRIC VEHICLE
COLLABORATIVE

This report was developed by the California Plug-In Electric Vehicle Collaborative, a multi-stakeholder partnership working to ensure a strong and enduring transition to a plug-in electric vehicle marketplace. Members played a guiding and consulting role in developing the report, although individual organizations may not formally endorse every recommendation.

The PEV Collaborative would like to thank Barbara Lee of the Northern Sonoma County Air Pollution Control District as the lead author of this report. The document was developed by volunteers of the Collaborative Working Groups and Collaborative staff. A special thanks to Dave Head of Sonoma County and Jim Helmer of LightMoves for their contributions.

California Plug-In Electric Vehicle Collaborative

James Boyd, *2012 Chairman*
California Plug-In Electric Vehicle Collaborative

Diane Wittenberg, *Executive Director*
California Plug-In Electric Vehicle Collaborative

Adrienne Alvord
Union of Concerned Scientists

Robert Babik
General Motors

Forrest Beanum
CODA Automotive

Janice Berman
Pacific Gas and Electric Company

John Boesel
CALSTART

Dan Bowermaster
Electric Power Research Institute

Elisabeth Brinton
Sacramento Municipal Utility District

Jack Broadbent
Bay Area Air Quality Management District

Dan Davids
Plug In America

Nancy Gioia
Ford Motor Company

Elmer Hardy
Honda Motor Company

Bonnie Holmes - Gen
American Lung Association in California

Roland Hwang
Natural Resources Defense Council

Enid Joffe
Clean Fuel Connection, Inc.

Christine Kehoe
California State Senate

Alex Kim
San Diego Gas and Electric

Doug Kim
Southern California Edison

Andreas Klugescheid
BMW Group Representative Office California

Barbara Lee
Northern Sonoma County Air Pollution Control District

Alan Lloyd
International Council on Clean Transportation

Bonnie Lowenthal
California State Assembly

Richard Lowenthal
Coulomb Technologies

Ron Mahabir
Greenlots

Marvin Moon
Los Angeles Department of Water and Power

Mary Nichols
California Air Resources Board

Diarmuid O'Connell
Tesla Motors, Inc.

Terry O'Day
NRG Energy

Alex Padilla
California State Senate

Colin Read
ECotality

Clifford Rechtschaffen
Office of Governor Edmund G. Brown Jr.

Michael Peevey
California Public Utilities Commission

Carla Peterman
California Energy Commission

Nancy Skinner
California State Assembly

Tom Turrentine
Institute of Transportation Studies, UC Davis

Eileen Tutt
California Electric Transportation Coalition

Barry Wallerstein
South Coast Air Quality Management District

V. John White
CEERT

Jason Wolf
Better Place

Tracy Woodard
Nissan North America, Inc.

Toshio Yoshidome
Toyota North America

Table of Contents

| | |
|--|----|
| Executive Summary | 5 |
| Purpose of Report and Intended Use | 6 |
| Background | 7 |
| Discussion of Projected PEV Fleet and Users | 7 |
| Overview of PEV Infrastructure Expansion | 8 |
| Accessible Charging | 8 |
| Identifying, Locating, and Designating Charging Stations | 9 |
| Recommended Guidelines | 11 |
| Accessible Electric Vehicle Parking | 12 |
| Accessible Electric Vehicle Charging | 12 |
| <i>Installation with Construction of New Facilities</i> | 13 |
| <i>Installation at Existing Facilities</i> | 20 |
| <i>Installation of Accessible Card-reading Devices</i> | 28 |
| Electric Vehicle Signage | 30 |
| <i>General Service Signs</i> | 30 |
| <i>Regulatory Signs</i> | 32 |
| Conclusions and Next Steps | 34 |
| Definitions | 35 |
| Endnotes | 39 |

Executive Summary

The California Plug-In Electric Vehicle (PEV) Collaborative provided recommendations and suggested actions to accomplish the six goals outlined for PEV market success in its 2010 report, *Taking Charge: Establishing California Leadership in the Plug-In Electric Vehicle Marketplace*. Two of these goals relate to vehicle charging infrastructure. The first is to simplify and prioritize home charging installations, and the second is to optimize the placement of non-residential charging infrastructure. To achieve these two goals, the PEV Collaborative suggested several actions that will benefit from early standardization on issues such as charging accessibility, and signage to locate, identify, and restrict the use of charging facilities. To advance these actions, the PEV Collaborative established a Working Group on Infrastructure Coordination to develop recommendations on accessibility and signage for plug-in electric vehicle charging infrastructure.

This report provides a clear delineation of the service provided by charging infrastructure and is intended to ensure that charging is accessible and complies with federal and state requirements. The report also endorses standard signs that comport with federal and state requirements for highway and street signs. The report does not provide any legal advice, however,

and should not be construed to do so.

The PEV Collaborative recommends accessibility standards for charging infrastructure installed as part of the new construction of facilities, and also standards for installations at existing facilities. The recommended standards distinguish between charging that is publicly available and charging that is restricted in access (e.g., residential).

The PEV Collaborative also recommends standardized general purpose signs to identify charging stations and direct users to the stations, and regulatory signs to designate the permissible uses of the charging facilities and to prohibit certain uses where necessary. All regulatory signs must be supported by appropriate rules, ordinances, or policies.

To ensure that the intent of the main provisions of these recommendations is clearly understood, this report includes definitions of key terms used. The report includes additional definitions that could be incorporated into some of the supporting rules, ordinances, or policies that property owners or local jurisdictions would need to put in place to implement some of the recommendations.

Purpose of Report and Intended Use

This report has been prepared by members of California Plug-In Electric Vehicle (PEV) Collaborative. The recommendations in this report are intended to encourage and support the efficient and effective introduction of PEVs. In particular, this report recommends a consistent set of definitions of terms and infrastructure installation guidelines for accessibility and signage with the intent that these aspects of infrastructure installation will become more standardized and consistent across jurisdictions, making it more efficient and cost effective.

In preparing these recommendations, the PEV Collaborative considered the important work underway by several groups that have emerged into leadership roles in the early installation of PEV infrastructure.

Among the efforts reviewed and incorporated are: the *County of Sonoma Electric Vehicle Charging Station Program and Installation Guidelines*,¹ and *Ready, Set, Charge, California! A Guide to EV-Ready Communities*² by the Bay Area Climate Collaborative. The PEV Collaborative members also consulted with subject matter experts, PEV users, fleet managers, architects, accessibility specialists, and labor organizations.

This report includes recommendations that can help standardize and streamline the installation of charging infrastructure for PEVs. These recommendations are not regulatory. The report does not provide legal advice, nor should it be construed to do so. It is also not intended to endorse any particular product.

Background

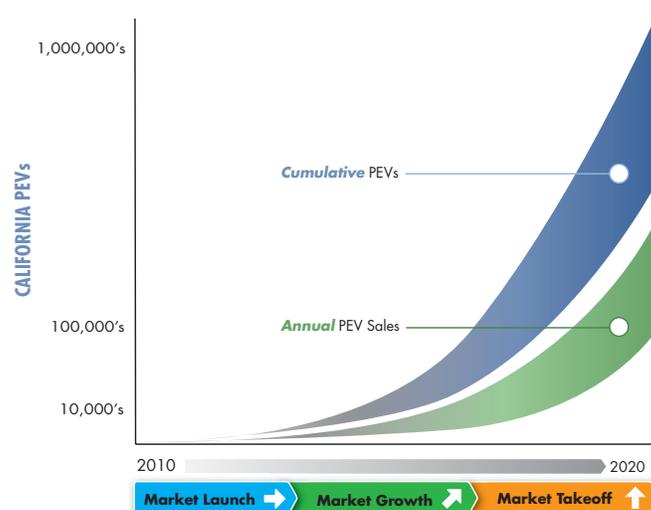
To understand the importance and necessity of providing accessible PEV charging infrastructure and standardized signage to achieve PEV market success, it is valuable to examine the projected growth of the PEV market and supporting infrastructure in California, and the current state of accessible charging stations and signage. This section discusses the projected expansion of the PEV fleet and users, provides an overview of PEV infrastructure expansion, describes the concept of accessible charging, and provides information about the

standardization of signage for charging stations.

Discussion of Projected PEV Fleet and Users

Currently, the California market accounts for 11% of annual new car sales nationally, at more than 1.1 million cars per year. By 2020, annual California car sales are expected to grow to 1.7 million. California also has a strong track record for early adoption of green vehicle technology, accounting for more than 20% of new hybrid electric vehicles sold in the

Figure 1: A vision for sustained market expansion in California



Source: California Plug-In Electric Vehicle Collaborative, *Taking Charge: Establishing California Leadership in the Plug-In Electric Vehicle Marketplace* (2010).

United States.³ A number of firms and organizations have prepared analyses of the future California market for electric vehicles.

Estimates of market penetration in 2020 range from roughly 2% to almost 14%.⁴ The California Air Resources Board estimates electric vehicles will make up approximately 5% of new vehicle sales in California by 2020.⁵ As Figure 1 shows, if these projections for 2020 are borne out, annual sales of PEVs will be in the hundreds of thousands, and there may be more than a million PEVs on the road in California. The large majority of PEVs currently available and planned for introduction are passenger cars, with a small number of light duty trucks.

Overview of PEV Infrastructure Expansion

All of these PEVs will need opportunities to charge their batteries. In the late 1990s, about 1,300 public charging stations were installed throughout California in anticipation of the first wave of PEVs. Many of these stations have been or will be upgraded for compatibility with the new PEVs by the California Energy Commission, using funds from AB 118 under the Alternative and Renewable Fuel & Vehicle Technology Program. New public and residential charging also is being funded through AB 118 and grants from the U.S. Department of Energy (DOE), with a target of at least 4,000 combined charging points.⁶ In addition, separate DOE grants will support the installation of between 500 and 700 charging stations in the Los Angeles and San Francisco Bay areas, and the Bay Area Air Quality Management District has program funds for 3,000 residential chargers, 2,000 public charging points, and up to 50 connections with fast charging capability.⁷ It is important to bear in mind that onboard recharging of batteries is only one method of providing fuel to PEVs. The recommendations in this report address accessibility in the context of onboard battery recharging and not any other refueling method. This focus is in response to an immediate need for guidance and is not intended to endorse or reject any method of providing energy for PEV users.

Accessible Charging

The members of the PEV Collaborative are working toward the introduction of vehicles and infrastructure to enable PEVs to be used in the widest possible range of applications by anyone who wishes to use them. To that end, vehicles and infrastructure must be accessible to all users.

Unfortunately, because PEV use has been very limited until now, there is no broadly established public charging infrastructure. The focus, therefore, is to deploy an appropriate level of infrastructure to effectively meet the needs of new PEV owners. However, there also is no single, comprehensive guidance on what is needed to ensure that charging infrastructure is accessible to all users. This report attempts to fill that gap with guidance that includes standardized criteria for the placement of charging equipment. In preparing these recommendations, the PEV Collaborative relied on existing standards for

accessibility under the Americans with Disabilities Act (ADA)⁸, and the California Building Code (CBC), Title 24⁹. These standards address, among other things, the accessibility of fueling infrastructure, card readers, and parking. The recommendations in this report bring together the applicable federal and state standards into a comprehensive resource, and provide additional clarity where needed specific to PEV charging.

In order to achieve the goal of providing accessible charging, the most important concept to keep in mind is that a PEV charging station provides a charging service, rather than parking. While some PEV charging facilities also may provide parking, *parking* and *charging* are two distinct services – in much the same way that *parking* and *fueling* are two distinct services. In fact, the CBC provides separate standards for accessible parking and accessible fueling; the current standard for accessible fueling stations specifically includes electricity as a fuel.¹⁰ The accessible charging standards recommended in this report address accessibility of the charging infrastructure itself. When parking is specifically identified (for example with signage) as being part of the service provided, accessible parking standards also will need to be applied, in addition to the accessible charging standards. There are extensive standards, both federal and state, for accessibility of parking facilities.

Finally, it is important to recognize that individual organizations, whether public or private, may have their own internal policies regarding how they ensure that their services are accessible and meet federal and state accessibility standards. For example, the State of California has its own internal policy for the state’s Department of General Services regarding accessibility of its PEV fleet and charging facilities.¹¹ Such policies may address aspects of access or related issues that are specific to an individual organization in addition to the broader elements that the members of the PEV Collaborative considered. The recommendations in this report do not constitute legal advice, and are not intended to alter or supplant any standards or policies that an organization already may have in place.

Identifying, Locating, and Designating Charging Stations

Users of PEVs naturally will want to know where they can charge their vehicles. While maps (including interactive, online maps) are an important tool to locate charging stations, it is also important to clearly identify the stations themselves, and to provide signs that direct users to the stations. In addition, signs are needed to delineate how the charging stations are to be used (e.g., may they be used by any vehicle or only PEVs, must the PEV be actively charging, how long may the spot remain occupied).

Signs that are posted on public streets or highways must meet certain requirements. This is especially true of signs that guide, warn, or regulate traffic. These types of signs are considered “traffic control devices” and are governed by the Code of Federal Regulations (CFR), in the Manual on Uniform Traffic Control Devices (MUTCD).¹²

The MUTCD establishes the colors for signs (the background as well as the border, and any letters, arrows, or other symbols) based on the intended function of the sign. This is why, for example, all stop signs are red with a white border and white letters. It also establishes standards for size, shape, and placement of signs to ensure they are visible, legible, and enforceable. The standards vary to ensure that motorists can read them whether they are on a high-speed freeway or on a slower surface street.

Each state may request approval from the Federal Highway Administration (FHWA) for alternative signs through what is called the “experimentation process,” and each state may publish its own manual that specifies the signs used on roads of public travel in that state. In California, the CA MUTCD specifies standards for all traffic control signs, including any alternative signs approved by FHWA.¹³

States also have the option of requesting federal approval to use an alternative sign that FHWA already has approved for another state. Because the initial approval process is somewhat time consuming, this is a good option to expedite or streamline the introduction of a new sign, as well as to make signs more consistent and easier for motorists to recognize.

This report identifies the signs approved in the CA MUTCD related to PEV charging, and recommends additional signs (based on existing signs and guidelines) that will be needed to establish complete and enforceable standards of use for PEV charging stations. To the extent possible, where other jurisdictions have developed appropriate EV-related signs through their experimentation process with FHWA, this report recommends those signs be used uniformly in California.

Recommended Guidelines

Vehicle Parking

Vehicle Charging

Vehicle Signage

The PEV Collaborative reviewed draft recommendations from ongoing efforts in local communities and regions within California to identify criteria for accessible charging infrastructure. Key efforts reviewed include the *County of Sonoma Electric Vehicle Charging Station Program and Installation Guidelines* and the Bay Area Climate Collaborative's *Ready, Set, Charge, California! A Guide to EV-Ready Communities*. Other materials considered include work done by the States of Oregon and Washington to standardize their own PEV infrastructure installations. The following recommended guidelines are consistent with, and in certain instances are based on, the standards recommended or adopted through these efforts. These guidelines are intended to ensure that PEV infrastructure is accessible to all users, and that signs used to identify, locate, and/or designate PEV charging sites are clear and easy to understand and meet all applicable federal and state standards.

The following recommended guidelines distinguish between PEV *parking* and PEV *charging*. PEV parking is a parking spot preferentially provided for users of PEVs. A PEV parking spot provides the location to

park the vehicle and does not necessarily include charging. A PEV charging site provides the location where electric vehicle supply equipment (EVSE) is available for the purpose of charging the PEV. Because the services provided are different, the accessibility criteria for the spot will be different depending on whether the spot is for parking or charging. In order to distinguish between these PEV service sites, the site must be properly identified with clear and enforceable signs.

PEV parking and charging may be co-located in a single spot. If the spot provides both services, it must meet the minimum accessibility criteria for *both* parking and charging. There may be conflicts between the requirements, however. For example, accessible parking is required to be located on the shortest accessible route of travel to an accessible entrance to the building(s) served by the parking. However, at some sites the charging equipment, especially the cord when the equipment is in use, may impede the accessible route of travel to the building. In these circumstances the two services should not be co-located. If the EVSE, or the use of the EVSE, will interfere with the accessible parking, the EVSE should be installed in a separate space.

Accessible Electric Vehicle Parking

For the purposes of providing full and equal access, PEV parking should meet the same accessibility requirements as parking for other vehicles. The requirements for accessible parking are specified in the Americans with Disabilities Act (ADA) Accessibility Guidelines, by the California Building Code (CBC), and by local ordinance. The California Department of General Services (DGS) posted new requirements for accessible parking on May 2, 2011, including van-accessible parking ratios.¹⁴ Requirements typically address minimum ratios of accessible-to-standard parking, issues of location (including an accessible route of travel to accessible building entrances and exits), the dimensions and allowable percent grade of accessible spaces, signage, vertical clearance, and passenger loading zones.

Newly constructed parking facilities, and existing parking facilities that undergo alteration, must meet requirements for accessibility unless otherwise exempted. There are no additional accessibility requirements that specifically address the designation of parking for PEV purposes.

Accessible Electric Vehicle Charging

As stated previously, the service provided by a PEV charging facility is the charging of the vehicle battery. Accessibility considerations address the use of the EVSE charging device, as well as an accessible route of travel from the vehicle to the EVSE. The following recommended standards are derived from the standards for accessible buildings and associated spaces (Section 11B) and accessible card readers at fueling stations (Section 11C) in Title 24 of the CBC.

The recommendations also incorporate enhancements to address electric van accessibility in anticipation of such vehicles being available to the public at some point in the future. The enhancements are based on an internal policy developed by the State Architect in 1997 as “interim guidelines” for facilities under direct control of the California Department of General Services.¹⁵ The policy was never incorporated into the CBC, and explicitly provides that local jurisdictions may use it or they may develop their own “methods of administering current code requirements...or defining acceptable parameters when enforcing the California Building Standards Code.” The recommendations provided here are intended as a coherent interpretation and application of these different standards until such time as the CBC is changed to specifically address PEV charging.

The PEV Collaborative recommends standards for both newly constructed accessible charging, as well as the installation of chargers in existing facilities.

Installation with Construction of New Facilities

The following recommended standards would apply to PEV charging infrastructure that is installed at the time a new facility is constructed.

1. Accessible Public Charging (New Construction)

Unless access is restricted, the charging is considered to be available to the public at large, even if there is a charge for the service. Examples include charging sites available curbside, in designated areas in parking facilities, or in other areas that may be used by the public. Public access charging may be under either public or private ownership; the key factor is that members of the public can use the service.

- a. Accessible Curbside Charging (New Construction)** – Charging stations that are installed curbside, allowing access to vehicles adjacent to the flow of street traffic in the public right-of-way, are considered curbside charging. The following standards are recommended for new construction of streets with curbside charging stations. (Refer to Figures 2a and 2b). Charging stations that meet these criteria are considered to be accessible.
 - i. Location of charging station** – The charging station should be installed in the last space on the block (that is, the space immediately prior to the intersection in the direction of vehicle travel).
 - ii. Orientation of vehicle** – The vehicle should approach the charger on a diagonal or, if the street width and speed of traffic allows, perpendicular to the curb.
 - iii. Accessible aisle to EVSE** – An access aisle extending the full length of the charging station, with a minimum width of 3 feet (8 feet preferred), should be provided to the left of the diagonal or perpendicular space, between the charging space and the end of the block.
 - iv. Sidewalk clearance for pedestrian access** – A minimum of 4 feet of unobstructed pedestrian passage must be preserved between the EVSE and the nearest obstruction (building wall, fence, planter, vegetation, etc.).
 - v. Charger clearance** – The EVSE must be located a minimum of 24 inches clear from the face of the curb.

- vi. **Charger protection** – The EVSE must be protected by guard posts (bollards), or an equivalent protection mechanism, when the vehicle will approach the equipment either on a diagonal or perpendicular to the curb.
- vii. **Cord management** – Equipment with a retractable cord is preferred.
- viii. **Lighting and signs** – The space should have adequate lighting to operate the EVSE and to minimize hazards. The charging site should be clearly identified with signage that includes any restrictions on use, as well as contact information to report problems with the equipment.

Consistent with implementation of curbside parking, there is no recommended minimum number of “accessible” curbside charging spaces. The ability to provide accessible curbside charging will be highly dependent on the nature of the adjacent roadway use. The decision to include it is to be made on a case-specific basis with primary consideration being the safety of both motorists and users of the charging facility.

Figure 2a - New Construction Curbside

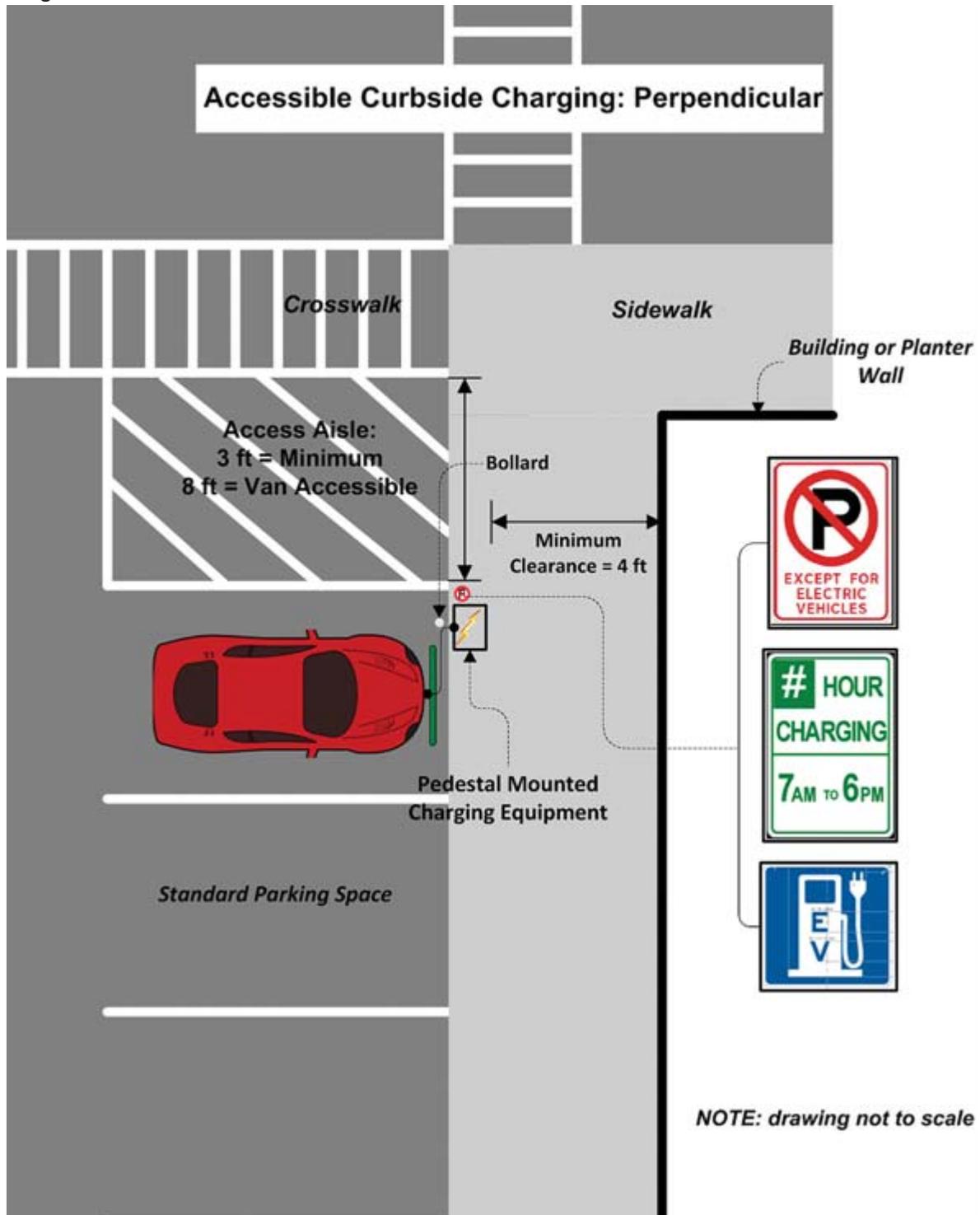
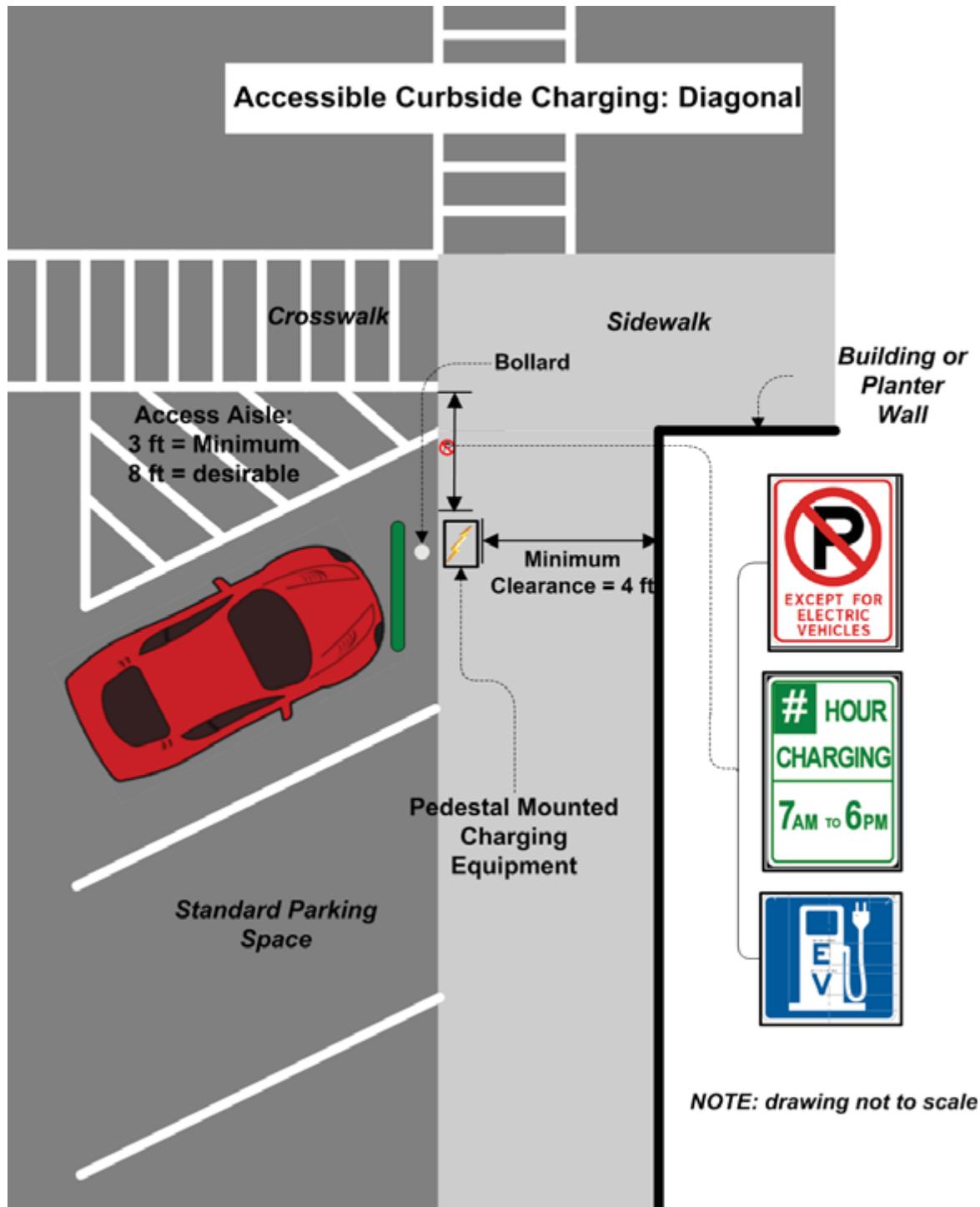


Figure 2b - New Construction Curbside



b. Accessible Offstreet Charging (New Construction)

Charging stations that are located in facilities that are not in the public right-of-way, such as designated fueling or parking facilities, are considered “offstreet charging.” The following standards are recommended for new construction of offstreet facilities with charging stations. (Refer to Figures 3a and 3b).

- i. **Location of EVSE** – Accessible charging stations should be installed in accordance with the requirements for accessible parking unless, due to inherent constraints of the site, the EVSE or its use will obstruct the accessible route of travel.
- ii. **Orientation of vehicle** – The vehicle should approach the charger on a diagonal or perpendicular to the EVSE.
- iii. **Accessible aisle to EVSE** – An access aisle, extending the full length of the charging station, with a minimum width of 3 feet should be provided on either side of the charging space, in addition to 9 feet required to accommodate the vehicle. The total width of accessible charging station space should be 12 feet.
- iv. **Van-accessible aisle to EVSE** – An access aisle, extending the full length of the charging station, with a minimum width of 8 feet, should be provided on the right of the charging space, in addition to 9 feet required to accommodate the vehicle. The total width of van-accessible charging station space should be 17 feet.
- v. **Accessible EVSE area** – The EVSE should be located within 9 inches of the center of a level, accessible area that is at least 30 inches by 48 inches (with the long side parallel to the face of the controls), and with a slope that does not exceed 2% grade in any direction.
- vi. **Charger protection** – The EVSE should be protected by guard posts, or an equivalent protection mechanism, on the side from which the vehicle will approach.
- vii. **Height of EVSE** – The highest operable part of the EVSE should not be more than 48 inches above the surface of the accessible EVSE Area.
- viii. **Cord management** – Equipment with a retractable cord is preferred.

- ix. **Lighting and signs** – The space should have adequate lighting to operate the EVSE and to minimize hazards. The charging site should be clearly identified with signage that includes any restrictions on use, as well as contact information to report problems with the equipment.
- x. **Minimum number of accessible spaces** – the first of every 25 charging stations should provide accessible charging. The first of every six accessible charging stations should have a van-accessible aisle to the EVSE (see iv below, under Accessible Offstreet Charging (Existing Facilities)). The first two card readers should be accessible.

Figure 3a: New Construction – Offstreet

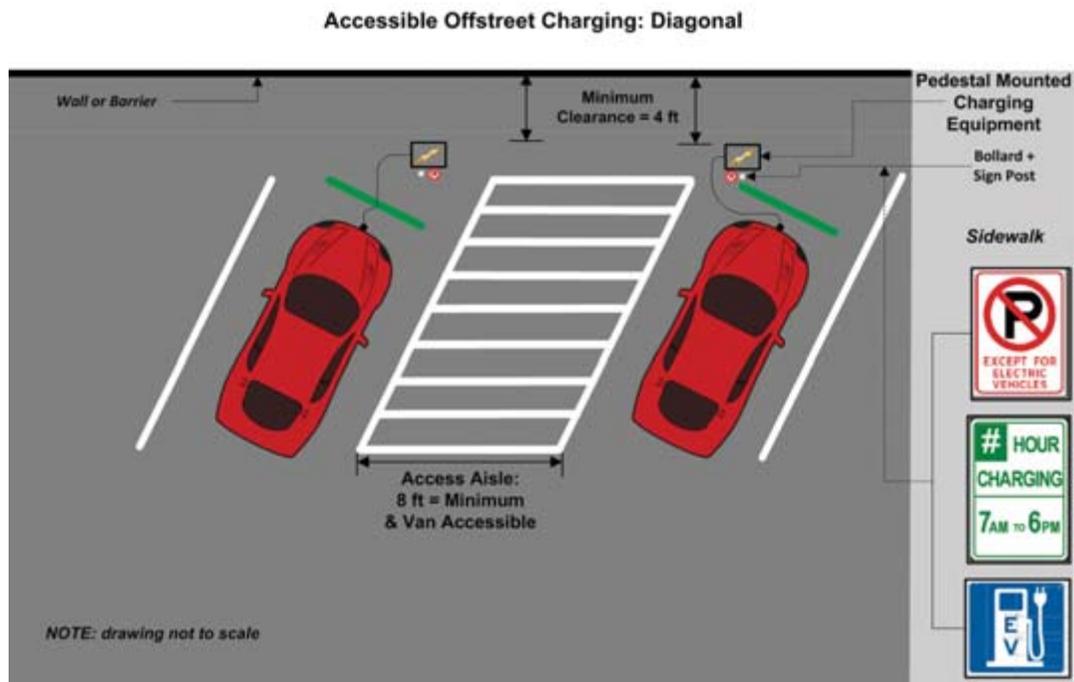
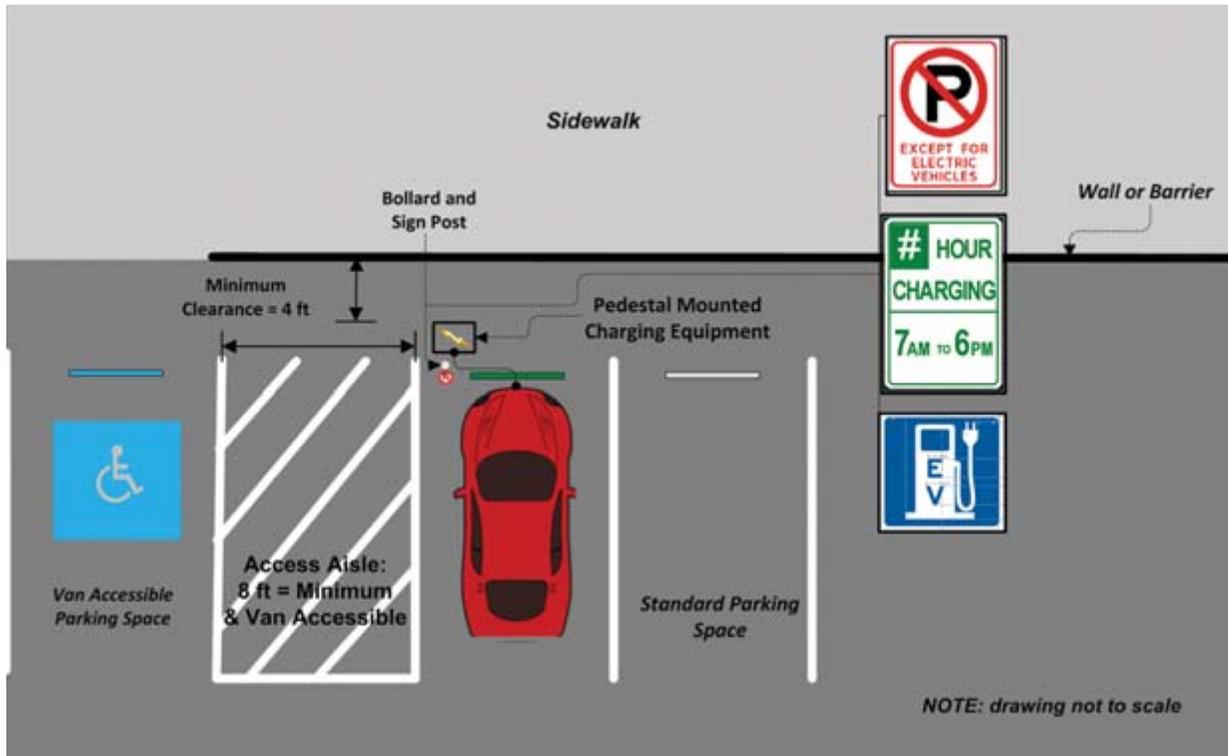


Figure 3b: New Construction – Offstreet

Accessible Offstreet Charging: Perpendicular



2. Accessible Restricted Access Charging (New Construction)

Charging is considered restricted access if it is posted with appropriate signage to exclude general public access, or to permit access only to specified users. Examples include public or private fleets, reserved parking, or parking associated with a residential dwelling.

- a. **Fleets** – New construction of facilities that will include restricted access charging should conform to the recommended standards for new construction with public access charging wherever possible, unless the nature of the use of the fleet vehicles is such that no vehicle in the fleet will be used by a person requiring disabled access.
- b. **Designated use** – New construction of facilities where charging is by designated use only should conform to the recommended standards for new construction with public access charging wherever possible, unless the designated use is such that the charging station will not be used by a person requiring disabled access.

- c. **Residential** – New construction of residential dwellings where PEV charging will be included may be required to provide accessible charging, for example in a multi-unit dwelling, as governed by Section 11A of the CBC. Installation of charging that conforms to the recommended standards for new construction with public access charging will ensure the new residential facilities have accessible charging stations.

Installation at Existing Facilities

1. Accessible Public Charging (Existing Facilities)

Unless access is restricted, charging is considered to be available to the public at large even if there is a charge for the service. Examples include charging sites available curbside, in designated areas in parking facilities, or other areas that may be used by the public. Public access charging may be under either public or private ownership; the key factor is that members of the public can use the service.

a. Accessible Curbside Charging (Existing Facilities)

Charging stations that are installed curbside, allowing access to vehicles adjacent to the flow of street traffic in the public right-of-way, are considered “curbside charging.” The following standards are recommended for installation of curbside charging stations on existing streets. Charging stations that meet these criteria are considered to be accessible. (Refer to Figures 4a, 4b, and 4c).

- i. **Location of charging station** – The charging station should be installed in the last space on the block (that is, the space immediately prior to the intersection in the direction of vehicle travel).
- ii. **Orientation of vehicle** – The approach of the vehicle will be determined by the orientation of the existing curbside parking. Diagonal or perpendicular spaces are preferred if they are available; however, parallel spaces may be used if other orientations are not available.
- iii. **Accessible aisle to EVSE** – An access aisle, extending the length of the space, with a minimum width of 3 feet should be provided to the left of the diagonal or perpendicular space, between the charging space and the end of the block. In a parallel orientation, if space is available, a 3-foot access aisle should be provided at either the front or rear of the space

- iv. **Sidewalk clearance for pedestrian access** – A minimum of 4 feet of unobstructed pedestrian passage must be preserved between the EVSE and the nearest obstruction (building wall, fence, planter, vegetation, etc.).
- v. **Charger clearance** – The EVSE must be located a minimum of 24 inches clear from the face of the curb.
- vi. **Charger protection** – The EVSE must be protected by guard posts (bollards), or an equivalent protection mechanism, when the vehicle will approach the equipment either on a diagonal or perpendicular to the curb. When the vehicle will approach from a parallel position, protection by guard post(s) is advisable but not required.
- vii. **Cord management** – Equipment with a retractable cord is preferred.
- viii. **Lighting and signs** – The space should have adequate lighting to operate the EVSE and to minimize hazards. The charging site should be clearly identified with signage that includes any restrictions on use, as well as contact information to report problems with the equipment

Figure 4a: Existing Facilities – Curbside

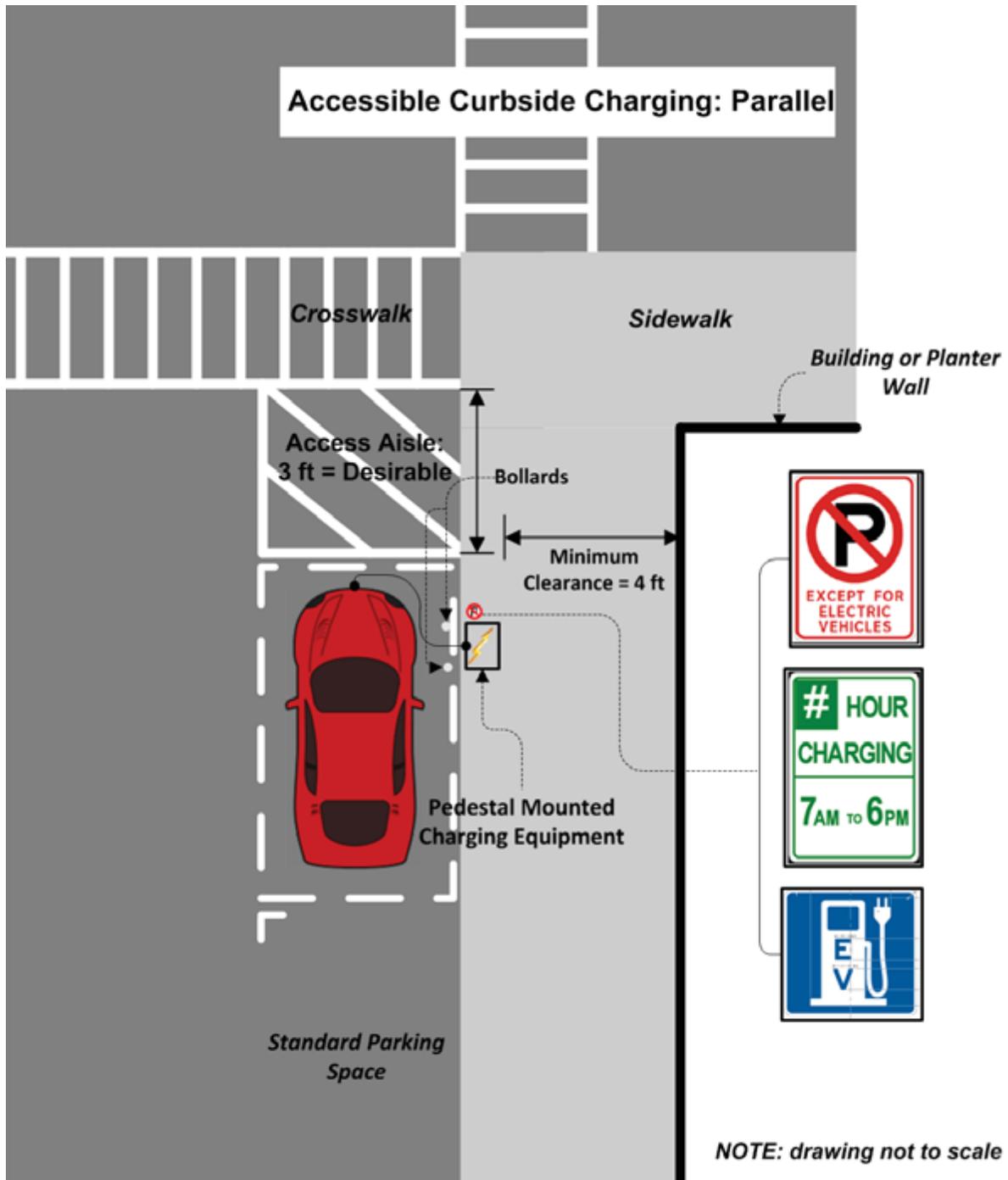


Figure 4b: Existing Facilities – Curbside

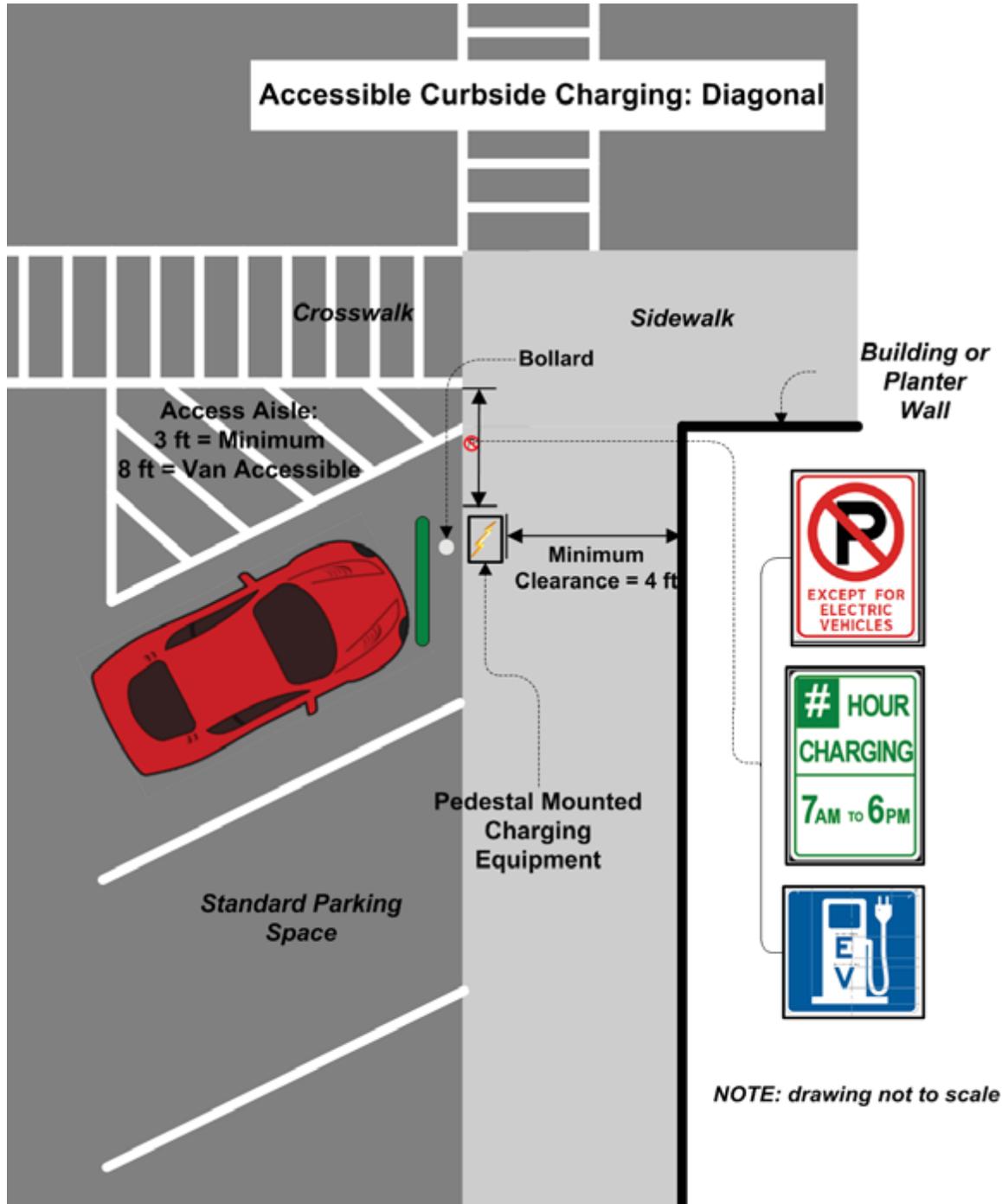
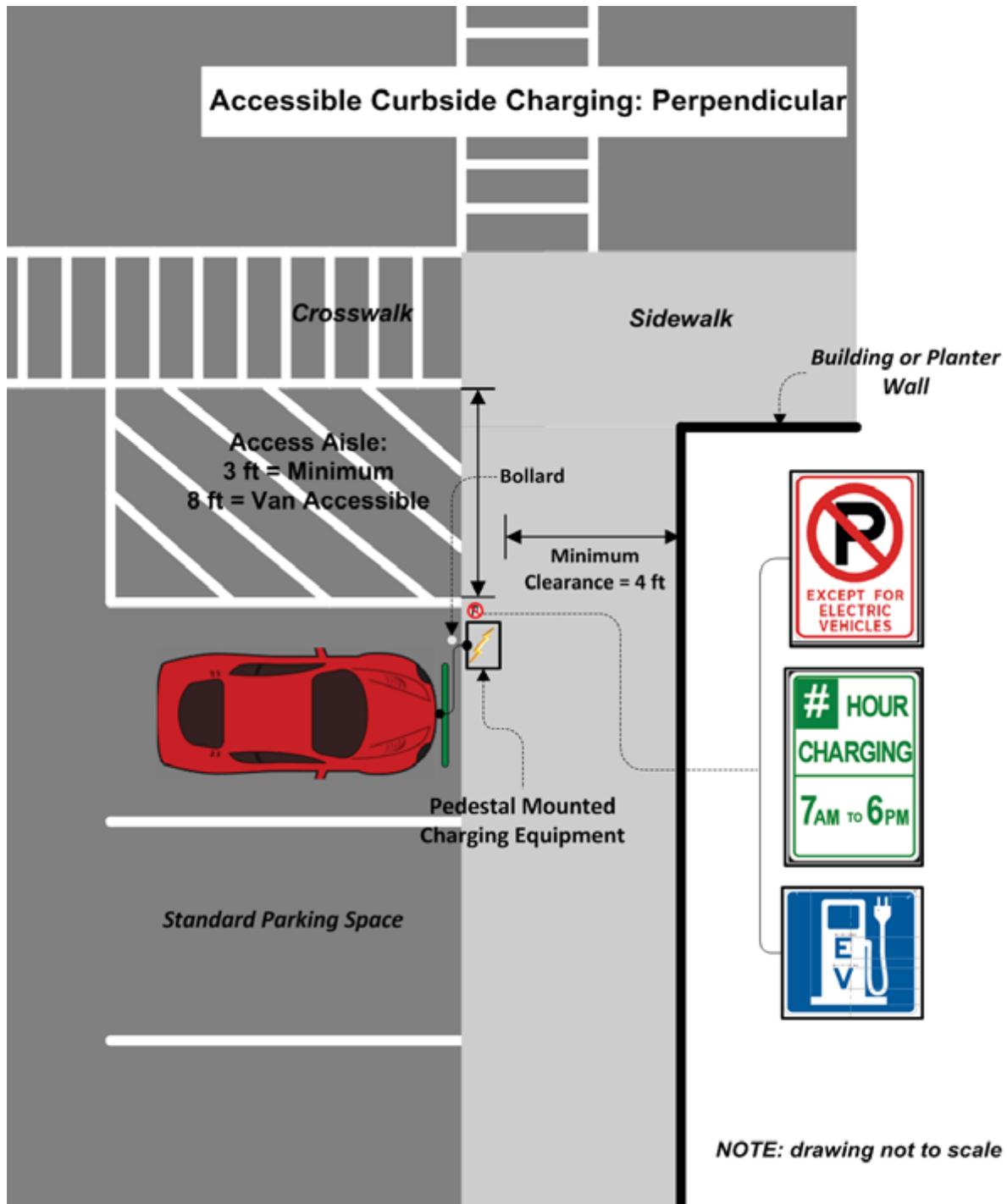


Figure 4c: Existing Facilities – Curbside



b. Accessible Offstreet Charging (Existing Facilities)

Charging stations that are located in facilities that are not in the public right-of-way, such as designated fueling or parking facilities, are considered “offstreet charging.” The following standards are recommended for installation of charging stations in existing offstreet facilities. (Refer to Figures 5a, 5b, and 5c).

- i. **Location of EVSE** – To the extent feasible, accessible charging stations should be installed in accordance with the requirements for accessible parking. Considerations to determine feasibility include the configuration or slope of the site, the location of the power supply, and the differential cost of incorporating fully accessible parking.
- ii. **Orientation of vehicle** – Preferably, the vehicle should approach the charger on a diagonal or perpendicular to the EVSE; however, a parallel configuration may be used, as dictated by the constraints of the site.
- iii. **Accessible aisle to EVSE** – An access aisle extending the length of the space from the vehicle to the EVSE, with a minimum width of 3 feet, should be provided on either side of the charging space. The total width of accessible charging station space should be 12 feet. The first of every 25 charging stations should have an accessible aisle to the EVSE.
- iv. **Van-accessible aisle to EVSE** – If feasible, an access aisle with a minimum width of 8 feet should be provided on the right of the charging space, in addition to 9 feet required to accommodate the vehicle. The total width of van-accessible charging station space should be 17 feet. If feasible, the first of every six accessible charging stations should have a van-accessible aisle to the EVSE.
- v. **Accessible EVSE area** – The EVSE should be located within 9 inches of the center of a level accessible area that is at least 30 inches by 48 inches (with the long side parallel to the face of the controls), and with a slope that does not exceed 2% grade in any direction.
- vi. **Charger protection** – The EVSE should be protected by guard posts, or an equivalent protection mechanism, on the side from which the vehicle will approach.
- vii. **Height of EVSE** – The highest operable part of the EVSE should not be more than 48 inches above the surface of the accessible EVSE area.

viii. **Cord management** – Equipment with a retractable cord is preferred.

ix. **Lighting and signs** – The space should have adequate lighting to operate the EVSE and to minimize hazards. The charging site should be clearly identified with signage that includes any restrictions on use as well as contact information to report problems with the equipment.

Figure 5a: Existing Facilities – Offstreet

Accessible Offstreet Charging: Diagonal

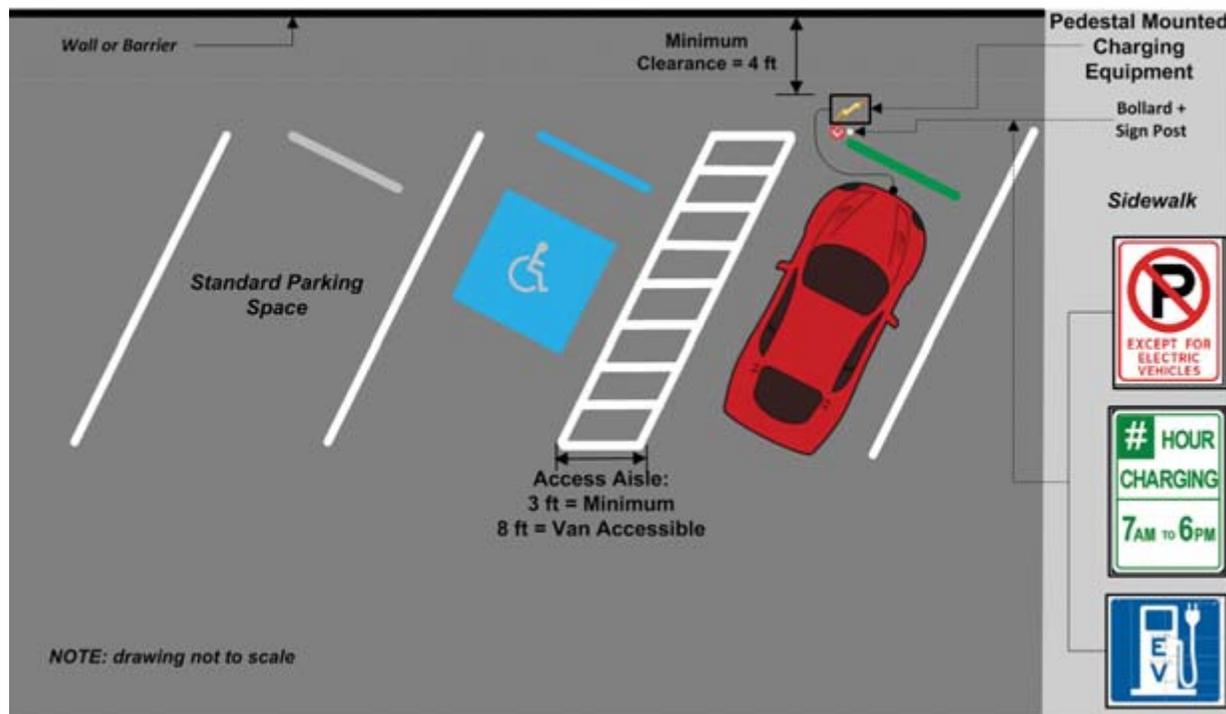


Figure 5b: Existing Facilities – Offstreet

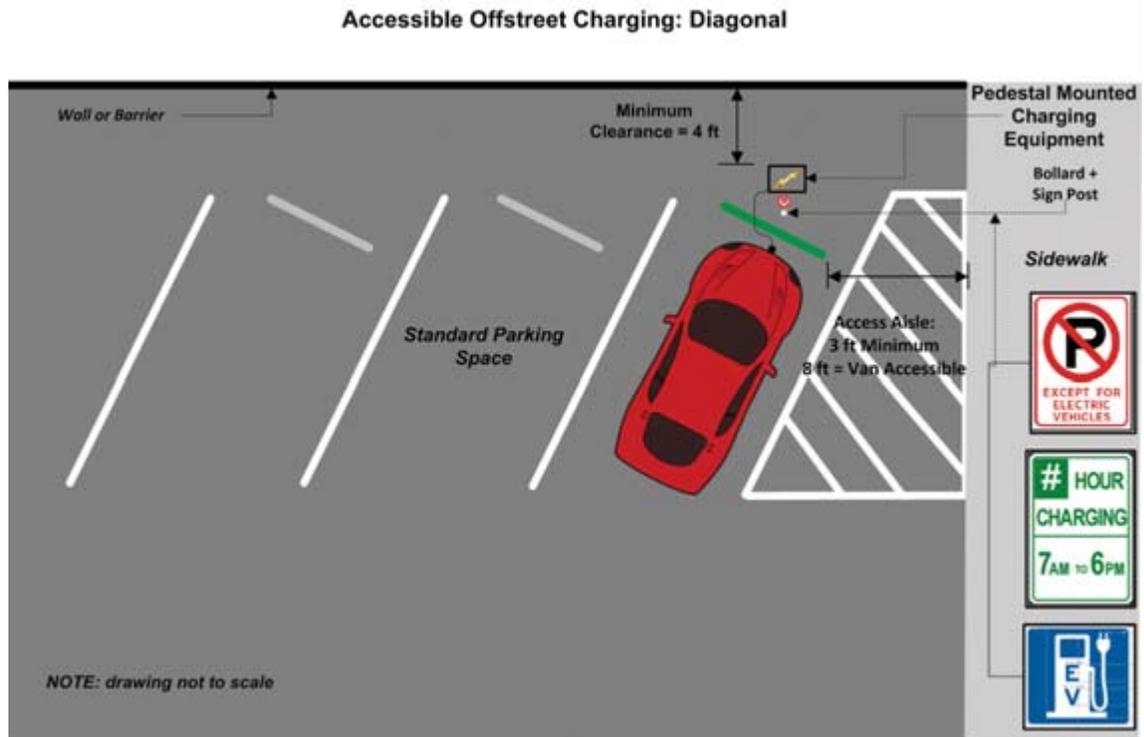


Figure 5c: Existing Facilities – Offstreet



2. Accessible Restricted Access Charging (Existing Facilities)

Charging is considered restricted access if it is posted with appropriate signage to exclude general public access or to permit access only to specified users. Examples include public or private service fleets, reserved parking, or parking associated with a residential dwelling.

- a. **Fleets** – To the extent feasible, installation of restricted access charging in existing facilities should conform to the recommended standards for public access charging in existing facilities, unless the nature of the use of the fleet vehicles is such that no vehicle in the fleet will be used by a person requiring disabled access.
- b. **Designated Use** – To the extent feasible, installation of designated use charging in existing facilities should conform to the recommended standards for public access charging in existing facilities, unless the designated use is such that the charging station will not be used by a person requiring disabled access.
- c. **Residential** – Installation of PEV charging in residential dwellings may require accessible charging (for example in a multi-unit dwelling, as governed by Section 11A of the CBC). Installation of charging that conforms to the recommended standards for existing facilities with public access charging may satisfy such requirements.

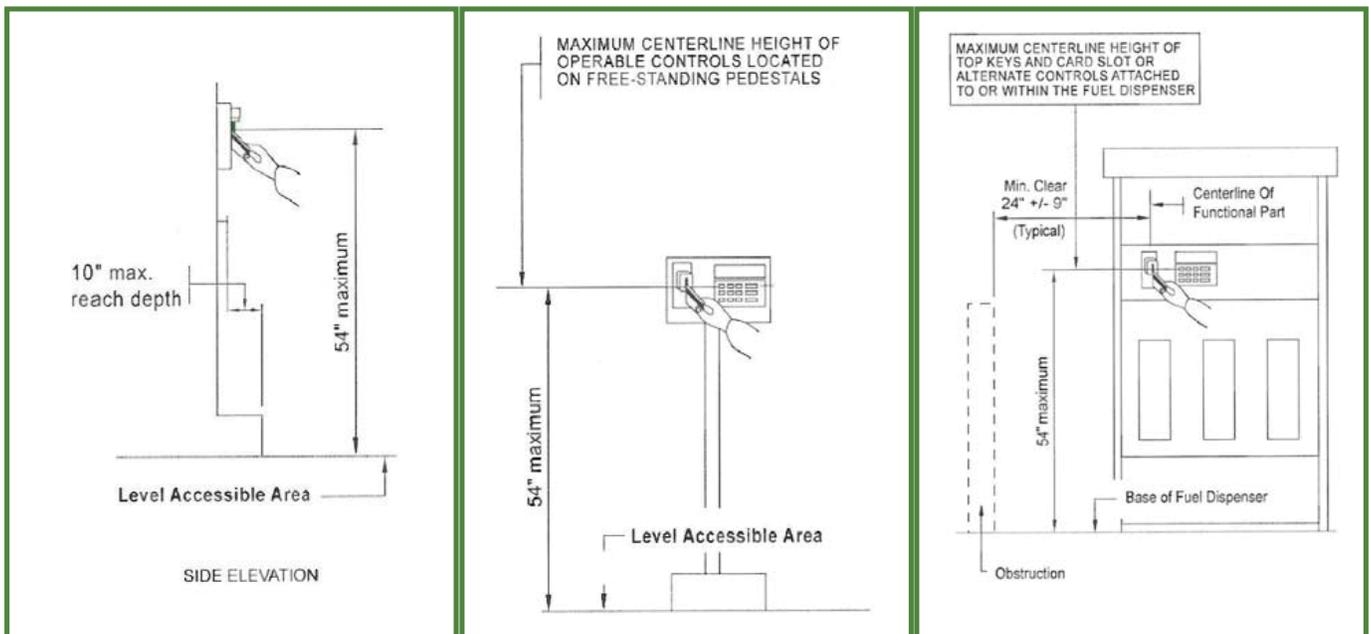
Installation of Accessible Card-reading Devices

The recommendations for the installation of accessible card-reading devices are the same for both new construction and existing facilities. Card-reading devices may be installed on a separate pedestal, or co-located with the EVSE. (Refer to Figure 6).

1. **Height of card reader** – The card-reading control function should be no more than 54 inches above the surface of the accessible EVSE area, if co-located with the EVSE. If the card-reading device is installed separately from the EVSE, the card-reading function should be no more than 54 inches above the surface of the accessible card-reading area.
2. **Accessible card-reading area** – The card-reading device must be located within 9 inches of the center of a level accessible area that is at least 30 inches by 48 inches, and with a slope that does not exceed 2% grade in any direction, with the long side parallel to the face of the controls.
3. **Reach to card-reading device** – The face of the card-reading device should be no more than 10 inches in plain view from the edge of the accessible card-reading area.

4. **Clearance to obstructions** – The centerline of the card-reader should have a minimum clearance of 24 inches, plus or minus 9 inches, to the nearest obstruction, excluding the EVSE and associated cords.
5. **Accessible card-reading access aisle** – If the card-reading device is co-located with the EVSE, the accessible EVSE access aisle also serves the card reader. If the card reader is installed separately from the EVSE, an access aisle with a minimum width of 3 feet from the EVSE to the card-reading device should be installed.
6. **Minimum number of accessible card-reading devices** – The first two card-reading devices at a charging station site should be accessible card-reading devices.

Figure 6: Accessible Card Reading Devices



Electric Vehicle Signage

The PEV Collaborative has identified two types of signs that will be needed to appropriately identify and regulate PEV charging stations: general service signs, and regulatory signs. General service signs include signs that identify the charging station, as well as signs that direct a motorist to a charging station. Regulatory signs permit or restrict the use of the charging station, similar to signs that prohibit or limit time for parking.

The signs recommended here are generally available in federal guidelines, are already approved in the CA MUTCD, or have been developed and submitted for approval by California or another jurisdiction. Where the signs already exist in the CA MUTCD or at the federal level, the identification number of the sign is provided. If a provisional sign is being referenced, the citation is given.

All signs used for traffic control must meet all of the requirements of the CA MUTCD, including requirements for retro-reflectivity and illumination, as well as the sizing, placement, and orientation specified for the situation into which the sign is being installed. These standards ensure that motorists will be able to read the signs. In some instances, these recommendations include size, placement, etc., in the description of the sign standard. The CA MUTCD also provides more specific information if required. Traffic control signs also must “be supported by statute, ordinances, or regulations,”¹⁶ and public agencies must ensure that appropriate underlying definitions and/or requirements are in place prior to placing these recommended signs. Some of these underlying provisions are or will be addressed in the CA MUTCD; others must be adopted at the local level.

Note: The PEV Collaborative submitted a comment letter to Caltrans committing to provide recommendations on signage for inclusion in the revisions to the 2010 CA MUTCD currently underway.¹⁷ Final comments will be provided following the completion of this document.

General Service Signs

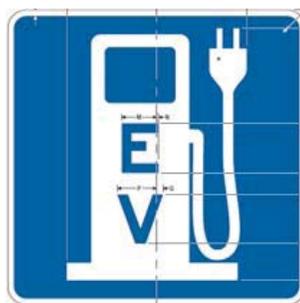
All general service signs must have white letters, arrows, symbols and borders on a blue background.¹⁸ Standard sizes also are specified. Currently approved general service signs specifically related to electric vehicle charging are shown in Figure 7.

Figure 7: Approved General Service Signs for Electric Vehicle Charging

| | | |
|---|---|---|
|  G66-21 (CA) |  D9-11bP |  D9-11b |
| <p>Site and Sizing</p> <p><i>Charging Station 12" x 12" 18" x 18" Conventional Road 24" x 24"</i></p> | <p>Site and Sizing</p> <p><i>Freeway 30" x 24" Expressway 30" x 24" Conventional Road 24" x 18"</i></p> | <p>Site and Sizing</p> <p><i>Freeway 30" x 30" Expressway 30" x 30" Conventional Road 24" x 24"</i></p> |

In addition to the approved signs shown above, the FHWA has issued interim approval for an alternate general service sign identifying electric vehicle charging, version D9-11b (see Figure 8, below). This interim approval allows the States of Oregon and Washington to use the alternate sign. Other jurisdictions may request authorization from FHWA to use the alternate sign until such time as it is included in the federal MUTCD and becomes generally available for use. The dimensions of the alternate sign are the same as specified for sign D9-11b (see Figure 7).

Figure 8: D9-11b (Alternate) EV Charging Symbol with Interim FHWA Approval



General service signs also are needed to direct motorists to charging stations. There are approved advance directional arrows that can be posted in combination with one of the identification signs for charging. Approved directional arrows are shown in Figure 9.

Figure 9: Approved Directional Arrows



Regulatory Signs

Regulatory signs regulate the driving and parking of vehicles on roadways and in parking areas. These signs follow international conventions on color coding and use standardized symbols. Signs that are generally permissive in nature (such as signs that allow parking for a certain amount of time) are green and black on a white background. Signs that are prohibitory in nature (such as no parking signs) are red and black on a white background. Regulatory signs for electric vehicle charging are needed to restrict access to charging stations and parking areas, or to limit the time of use.

Currently, the CA MUTCD has not approved any regulatory signs for electric vehicle charging, nor has the FHWA given any interim approvals; however, the States of Oregon and Washington are testing candidate regulatory signs. The experimentation process described in the CA MUTCD allows a local jurisdiction to request approval to use a test sign.

The PEV Collaborative supports the use of standardized signs to minimize confusion and provide the greatest ease of use for EV drivers. To this end, the PEV Collaborative recommends the use of the candidate signs currently being tested in Oregon and Washington, and that local jurisdictions request the use of those signs during the test period with the expectation that they ultimately will be approved at the federal level and become the uniform standard nationally. Examples of these recommended regulatory signs for electric vehicle charging are shown in Figure 10.

Figure 10: Recommended Regulatory Signs for Electric Vehicle Charging



The first sample sign is permissive, while the other two are prohibitory. Both types of signs should be placed immediately adjacent to the electric vehicle charging station. They should be at least 12 inches in width and 18 inches in height and installed as prescribed in the CA MUTCD and Title 24 of the CBC. Where both types of signs are posted at the same location, the prohibitory sign should be posted above the permissive sign. Regulatory signs also may be placed in conjunction with non-regulatory signs; in such cases, the regulatory signs should be placed above the non-regulatory signs.

In a typical installation, we anticipate that at least one blue general service sign will be needed to identify the space for “EV Charging.” Most spaces also will be designated “No Parking Except for Electric Vehicle Charging” with a red and black prohibitory sign. Many of the public charging spaces also will have a green sign permitting charging for some specified amount of time. The three signs should be arranged on a single signpost with the “No Parking” sign on top, the permissive time limit sign below it, and the “EV Charging” sign at the bottom. The jurisdiction also should post an informational sign on the EVSE that: 1) explains how to use the EVSE; 2) provides a number to call with problems; and 3) describes what constitutes “charging” for the purposes of using the space.

In order for the regulatory signs to be enforceable, they must be supported by local ordinances that specify any time limits, penalties, etc., and provide all of the necessary definitions. Key definitions include the terms “electric vehicle” and “charging.” Examples of the types of information that should be included in these definitions include:

- *Can the station be used by scooters and bicycles with battery assistance?*
- *Does there have to be active charging underway or can a fully charged vehicle connect and occupy the site?*

In October 2011, the Governor of California signed AB 475 (Butler) that restricts the use of spaces designated for EV charging to only those vehicles that have established a connection for electric charging purposes. The new law requires that the space be properly identified with a sign, posted in a visible spot adjacent to the space or at the entrance to a privately owned offstreet parking facility. The new law also provides that the owner of the space may have illegally parked vehicles removed if the removal is posted in accordance with the law.

Private property owners are not restricted in their choice of signs placed on their property, provided those signs do not impact the public right-of-way, as set forth in the CA MUTCD, or unless the signs are otherwise regulated by the local jurisdiction.

The California Vehicle Code (CVC) allows a local jurisdiction or a property owner to have a vehicle removed if it occupies a space in violation of the posted regulations. The CVC requires proper notification of vehicle owners through posting, as well as notice to local law enforcement.

Conclusions and Next Steps

The recommendations outlined above to establish accessible charging facilities and to develop the official, standardized signs needed to appropriately identify and manage the use of charging infrastructure are presented here to support the deployment of infrastructure in the most clear, efficient and effective way. The PEV Collaborative continues to gather information on other issues related to infrastructure, and is developing additional guidance and training materials as well. To the extent the need exists, the PEV Collaborative is committed to

prepare handbooks and/or case studies to further assist local governments, businesses, and the public as they undertake the installation and operation of electric vehicle infrastructure.

The PEV Collaborative fully anticipates that additional questions will arise regarding both accessibility and the types of signs that are needed. We are committed to revisit these questions as needed to support the overall goal of bringing the use of electric vehicles into the mainstream.

Definitions

The following definitions apply to key terms used in the recommendations in this report.

Access Aisle - An accessible pedestrian space adjacent to or between parking spaces that provides clearances in conformance with Chapters 11A and 11B of the California Building Code Title 24, Part 2, and the Americans with Disabilities Act.

Accessible Card-Reading Device - A card-reading device that meets the accessibility requirements of Chapter 11C of the California Building Code, and the Americans with Disabilities Act.

Accessible Electric Vehicle Charging Station - An electric vehicle charging station where the charger and vehicle inlet are approachable and usable by persons with disabilities in compliance with the California Building Code (Title 24), and the Americans with Disabilities Act, as set forth in the recommended standards in this report for installation of charging stations in new construction or in existing facilities.

Accessible Parking Space - A parking space where accessible parking is designated for vehicles displaying a Disabled Person (DP) placard or DP license plates in conformance with the California Building Code (Title 24), and the Americans with Disabilities Act.

Card-reading Device - A device installed to extract information from a magnetized strip on a card when the card is inserted into the device. The card may be a membership or identification card, a credit or debit card, or other card required to operate the EVSE. The card-reading device may be installed as part of the EVSE (co-located) or installed on a separate pillar.

Charger - An electrical component assembly or cluster of assemblies designed specifically to charge batteries or other energy storage devices on board an electric vehicle.

Charging - The connector from the charger is inserted into the electric vehicle inlet and electrical power is transferred for the purpose of recharging the batteries or other energy storage devices on board an electric vehicle. For the purposes of designating and limiting the use of charging stations, the entity with jurisdiction over the station must determine whether active transfer must be in progress, or whether the connection is sufficient.

Charging Levels - The standardized indicators of electrical force, or voltage, at which an electric vehicle's battery is recharged. Note that rated current (*) is 80% of circuit breaker size.

| | | | |
|------------|--|------------|---|
| AC Level 1 | 120V AC single phase current (12 amp*); power 1.44kw current (16 amp*); power 1.92kw | DC Level 1 | 200-450V DC rated current ≤ 80 amp rated power ≤ 19.2 kw |
| AC Level 2 | 240V AC single phase rated current ≤ 80 amp* rated power ≤ 19.2 kw | DC Level 2 | 200-450V DC rated current ≤ 200 amp rated power ≤ 90kw |
| AC Level 3 | To be determined AC single phase or three phase? | DC Level 3 | To be determined 200-600V DC rated current ≤ 400 amp? rated power ≤ 240 kw? |

Connector - A device that, by insertion into an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of charging and information exchange. This device is part of the electric vehicle coupler. (Electric Vehicle Connector, California Electric Code, article 625).

Electric Vehicle (EV) - Any motor vehicle registered to operate on California public roadways and operates, either partially or exclusively, on electrical energy from the grid, or an off-board source, that is stored on board for motive purpose. An electric vehicle includes, but is not limited to: (1) a battery electric vehicle; (2) a fuel cell electric vehicle; (3) a plug-in hybrid electric vehicle; (4) and a neighborhood electric vehicle.

Electric Vehicle Charging Station (EVCS) - The public or restricted space serviced by a charger including all signs, information, pavement surfaces, surface markings and protective equipment, where the transfer of electric energy occurs by conductive or inductive means between the charger and the battery or other energy storage device on board a stationary electric vehicle.

Electric Vehicle Charging Station Location - One or more electric vehicle charging stations located within a parking lot, fuel dispensing facility, public garage or private property.

Electric Vehicle Infrastructure (EVI) - Structures, machinery, and equipment necessary and integral to support an electric vehicle, including, but not limited to electric vehicle charging stations, chargers, and battery exchange stations.

Electric Vehicle Supply Equipment (EVSE) - The conductors, including the ungrounded, grounded, and equipment grounding conductors and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of delivering energy from the premises wiring to the electric vehicle. (California Electric Code, article 625).

Public Access Charging Station - An electric vehicle charging station that is generally available for use by members of the public. It may be publicly or privately owned, the hours of use may be limited, and the electricity may be offered for a fee or free of charge.

Restricted Access Charging Station - An electric vehicle charging station that is not generally available for public use. To be considered restricted, the restrictions on use must be properly posted with appropriate signs, and the restrictions must be supported with ordinances, rules, or policies adopted by an authorized agent and uniformly enforced. Examples of restricted access include charging stations that are available for use only by vehicles in a public or private fleet, are designated for use by specified users, or are located in private residences.

The following definitions are not specifically used in the recommendations in this report; however, they may be useful to create policies or rules needed to implement some of the recommendations. For example, if the use of a charging station is to be restricted to certain types of vehicles, the following definitions may be useful to identify such vehicle types.

Battery Electric Vehicle (BEV) - Any vehicle that operates solely by use of a battery or battery pack, or that is powered primarily through the use of an electric battery or battery pack but uses a flywheel or capacitor that stores energy produced by the electric motor or through regenerative braking to assist in vehicle operation.

Clean Air Vehicle Sticker - California law allows use of High Occupancy Vehicle (HOV) lanes with only one occupant when the vehicle displays a Clean Air Vehicle Sticker. A list of qualifying vehicles is provided on the California EPA's Air Resources Board website (<http://www.arb.ca.gov/msprog/carpool/carpool.htm>).

Clean Air Vehicle Parking Space - Any posted and/or marked parking space that identifies the use to be exclusively for the parking of a clean fuel vehicle as defined by the California Air Resources Board.

Clean Vehicle - Any clean fuel vehicle identified by the State of California as qualifying for the California Clean Vehicle Incentives program. Effective January 2011, there are two types of vehicles that qualify: Zero Emission Vehicles (ZEV) and Plug-in Hybrid Electric Vehicles (PHEV) that qualify as Enhanced Advanced Technology, Partial Zero Emission Vehicles (AT PZEV).

Electric Motorcycle - A battery electric vehicle having a seat or saddle for the use of the rider, designed to travel on not more than three wheels in contact with the ground, and is powered by an electric motor and produces zero emissions or pollution when stationary or operating.

Hybrid Electric Vehicle (HEV) - A type of hybrid vehicle which combines a conventional internal combustion engine (ICE) propulsion system with an electric propulsion system. The presence of the electric drive motor is intended to achieve better fuel economy than a conventional ICE.

Internal Combustion Engine Vehicle (ICE) - A vehicle with an engine that burns fuel within itself as a means of developing power.

Motorized Bicycle - A device that has fully operative pedals for propulsion by human power and has an electric motor that has a power output of not more than 1,000 watts and is incapable of propelling the device at a speed of more than 20 miles per hour on ground level. (California Vehicle Code [CVC] section 406).

Motorized Electric Scooter - Any two-wheeled device that has handlebars, a floorboard that is designed to be stood upon when riding, and is powered by an electric motor and produces zero emissions or pollution when stationary or operating. (CVC section 407.5 "Motorized Scooters").

Motorized Quadricycle and Motorized Tricycle - A motorized quadricycle is a four-wheeled device, and a motorized tricycle is a three-wheeled device, designed to carry not more than two persons, including the driver, and having either an electric motor or a motor with an automatic transmission developing less than two gross brake horsepower and capable of propelling the device at a maximum speed of not more than 30 miles per hour on level ground. The device shall be utilized only by a person who by reason of physical disability is otherwise unable to move about as a pedestrian or by a senior citizen as defined in section 13000 of the CVC. (CVC section 407).

Neighborhood Electric Vehicle (NEV) - An electrically powered, four-wheeled, self-propelled, low-speed vehicle whose speed attainable in one mile is more than 20 miles per hour and not more than 25 miles per hour on a paved level surface and has a gross vehicle weight of less than 3,000 pounds. (CVC section 385.5).

Non-Electric Vehicle - Any motor vehicle that does not meet the definition of "electric vehicle."

Plug-in Electric Vehicle (PEV) - A type of an electric vehicle, as defined above, that has the capability to plug-in and charge its battery from the electric grid. This includes both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEV).

Plug-In Hybrid Electric Vehicle (PHEV) - A hybrid electric vehicle with the capability to charge a battery from an off-vehicle electric energy source that cannot be connected or coupled to the vehicle in any manner while the vehicle is being driven.

Endnotes

¹ County of Sonoma, *Electric Vehicle Charging Station Program and Installation Guidelines* (2011), accessed January 18, 2012, http://www.sonoma-county.org/prmd/docs/misc/ev_prog_guidelines.pdf

² Bay Area Climate Collaborative, *Ready, Set, Charge, California! A Guide to EV-Ready Communities* (2011), accessed January 18, 2012, http://baclimate.org/images/stories/actionareas/ev/readysetcharge_evguidelines.pdf

³ California Plug-In Electric Vehicle Collaborative, *Taking Charge: Establishing California Leadership in the Plug-in Electric Vehicle Marketplace* (2010), 13, accessed January 18, 2012, http://www.evcollaborative.org/sites/all/themes/pev/files/docs/Taking_Charge_final2.pdf

⁴ *Ibid.*, 17.

⁵ California Air Resources Board: Based on proposed staff changes to the ZEV Regulation, November 2010.

⁶ California PEV Collaborative, *Taking Charge*, 21.

⁷ *Ibid.*, 21.

⁸ 28 C.F.R. Part 36.

⁹ See California Building Code (CBC) Title 24 chapters 11B and 11C.

¹⁰ CBC chapter 11C.

¹¹ Cal. Dept. of General Services, DSA Access Compliance Policies, "97-03: Interim Disabled Access Guidelines for Electric Vehicle Charging Stations" (2011).

¹² Federal Highway Administration, *Manual on Uniform Traffic Control Devices* (2009 edition), accessed January 18, 2012, <http://mutcd.fhwa.dot.gov/>

¹³ "California Manual on Uniform Traffic Control Devices Branch," Cal. Dept. of Transportation, accessed January 18, 2012, <http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/>

¹⁴ See "Initial Statement of Reasons for Proposed Building Standards of the State Architect – Access Compliance Concerning 2010 California Building Code (CBC) California Code of Regulations, Title 24, Part 2," Cal. Dept. of General Services, DSA-AC-01-10-ISOR-45d-Pt2.doc, available on the DGS website.

¹⁵ Cal. Dept. of General Services, DSA Access Compliance Policies, "97-03: Interim Disabled Access Guidelines for Electric Vehicle Charging Stations" (2011).

¹⁶ Cal. Dept. of Transportation, CA MUTCD 2010, chapter 2, section 1A.08.

¹⁷ "California MUTCD 2011 Draft Revisions," Cal. Dept. of Transportation, accessed January 18, 2012, http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2011_draftrevisions.htm

¹⁸ *Ibid.*, section 2I.02.



www.PEVCollaborative.org