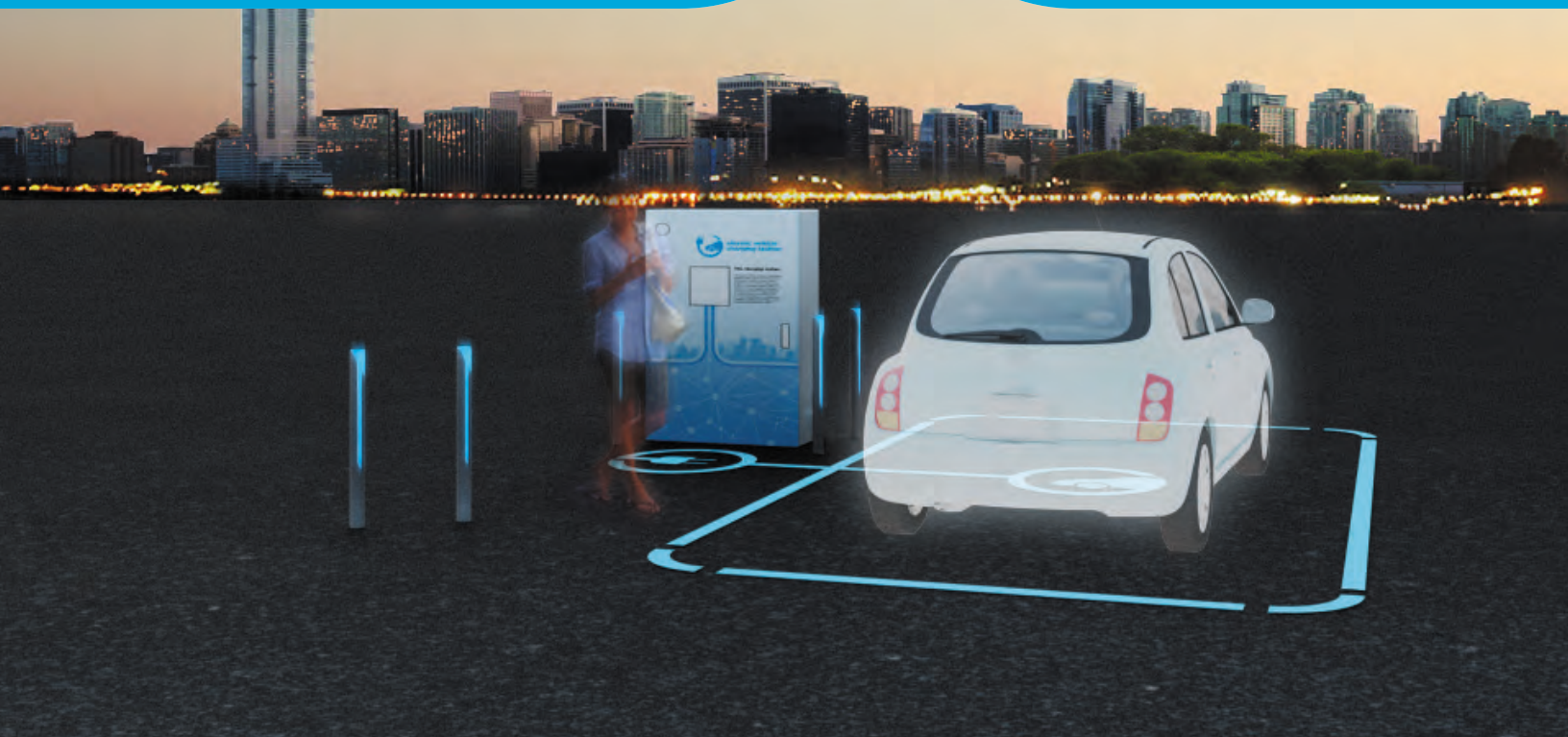
DESIGN GUIDELINES AND STANDARDS

BC PUBLIC ELECTRIC VEHICLE CHARGING STATIONS

Prepared for BC Hydro and the Province of BC
August, 2013

UBC TIPS LAB



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EV CHARGING
PRIMER

1.1 EV CHARGING PRIMER

Introduction

Electric Vehicles (EVs) are coming to the British Columbia marketplace, and represent an opportunity to decrease emissions from the transportation sector, by using BC's clean electricity supply Transportation in British Columbia accounts for almost 34% of CO2 and a significant portion of harmful criteria emissions. This is particularly true of the Fraser Valley air shed. The use of Electric Vehicles (EVs) can reduce transportation emissions through the use of BC's clean (hydro) electricity supply. EVs have the potential to make BC streets and neighbourhood air quality healthier by reducing harmful particulate and gaseous emissions associated with internal combustion engine vehicles (ICE).

Still, many people are still unfamiliar with EV capabilities, assuming they can't be considered a serious alternative to a gas vehicle. In fact, the range of vehicles and charging options available increasingly make EVs a viable option for any trip previously made with a gas vehicle. Installing charging stations in public locations is an important step to enhancing public perception of the viability of adopting EVs. Their frequent, highly visible presence helps to alleviate range anxiety, reassuring potential EV drivers that they'll find a place to charge when they need it. When public charging stations are installed as a robust network, they create confidence that charging is available, reliable, and convenient. At the same time, the public entity installing them can use them to communicate a commitment to innovation and sustainability.

EV Charging Levels

Three levels of charging are commonly available. These Design Guidelines address public Level 2 and DC Fast Charging.

1. Level 1: 120 Volt AC - a typical household outlet
   Up to 14 hours for a full charge, depending on the battery type

2. Level 2: 240 Volt AC - equivalent to a typical appliance outlet, requires charging station installation
   4 to 8 hours for a full charge, depending on the battery type

3. DC Fast Charging: 50 kW - requires charging station installation
   20-30 minutes for a full charge, but frequent use decreases battery life

DC Fast Chargers are currently the quickest way to recharge an EV (typically 25-30min), The DCFC appliance is a large industrial converter which accepts incoming AC power and converts it to DC voltages to feed directly into the vehicle battery systems. There are currently two competing standards for the type of connector to connect the DCFC appliance to the vehicle, these are:

- ChaDeMo (Japanese standard, with over 2000 installations, to date)
- SAE Combo (USA standard, just recently introduced, no installations to date)

Regardless of the connector type, the DCFC appliances need to be connected to a supply of AC power. The input power required varies depending on the make and model of DCFC unit. Some of the common AC input voltages and amperages are as follows:

- 208V, 156A, 3Ø
- 480V, 80A, 3Ø

Vehicle Options

Three types of EVs need to be plugged in to be charged, in contrast to conventional hybrids which generate a small amount of electricity on board through regenerative braking. The vehicles which would be served with the installation of public charging stations are the following:

1. PHEV: Plug-in Hybrid Electric Vehicle - powered by electric motor until battery charge is depleted, then switches to internal combustion engine
   Typical electric range: 20 km

2. PHEV-ER: Plug-in Hybrid Electric Vehicle - always powered by electric motor; when charge is low, on-board gas generator generates more electricity to power the electric motor
   Typical electric range: 50 km

3. BEV: Battery Electric Vehicle - always powered by electric motor, no gas backup
   Typical electric range: 100 km

Charging Equipment

Some Examples of Level 2 Charging Equipment

Some Examples of DC Fast Charging Equipment

1.2 STATION INSTALLATION PROCESS OVERVIEW

Process Overview

The following process overview is based on the Canadian EV Infrastructure Deployment Guideline (ECOtality North America, 2013). Thsi document can be acessed at

http://www.ceati.com/freepublications/0536_Web.pdf.

Planning the installation of an EV charging station requires coordination between a number of local groups including the site owner, governing authorities, utilities provider, and contractors. The following is a summary of the crucial steps involved in implementation of a new charging station:

- Station location planning
  - Assess potential sites based on the needs of stakeholders and EV charging station goals
- Contact the local utility
  - Ensure grid reliability
  - Verify the availability of the local transformer capacity
  - Ask for different energy cost quotes for the light, medium to heavy usage
  - Ask if they offer time of use rates
- Select a EV charging equipment vendor
- Consult with local governmental planning officials
- Detailed station design
- Select a contractor who will assess the installation site
  - Determine voltage and amperage requirements of selected charging equipment
  - Verify electrical capacity for additional load, recommending any necessary property or electricity service upgrades
  - If DC fast charger, determine if communication to the equipment is required
  - Estimate installation cost for installing charging equipment as per manufacturer guidelines
  - Obtain local permit for installation
  - Schedule the installation
  - Coordinate with local inspector to validate installation

In this document, chapters 2-4 focuses on station location and detailed station design steps of the overall process, while chapter 5 provides electrical design guidlines including general utility considerations and example scenarios. For additional information on remaining steps refer to the Canadian EV Infrastructure Deployment Guideline (ECOtality North America, 2013).

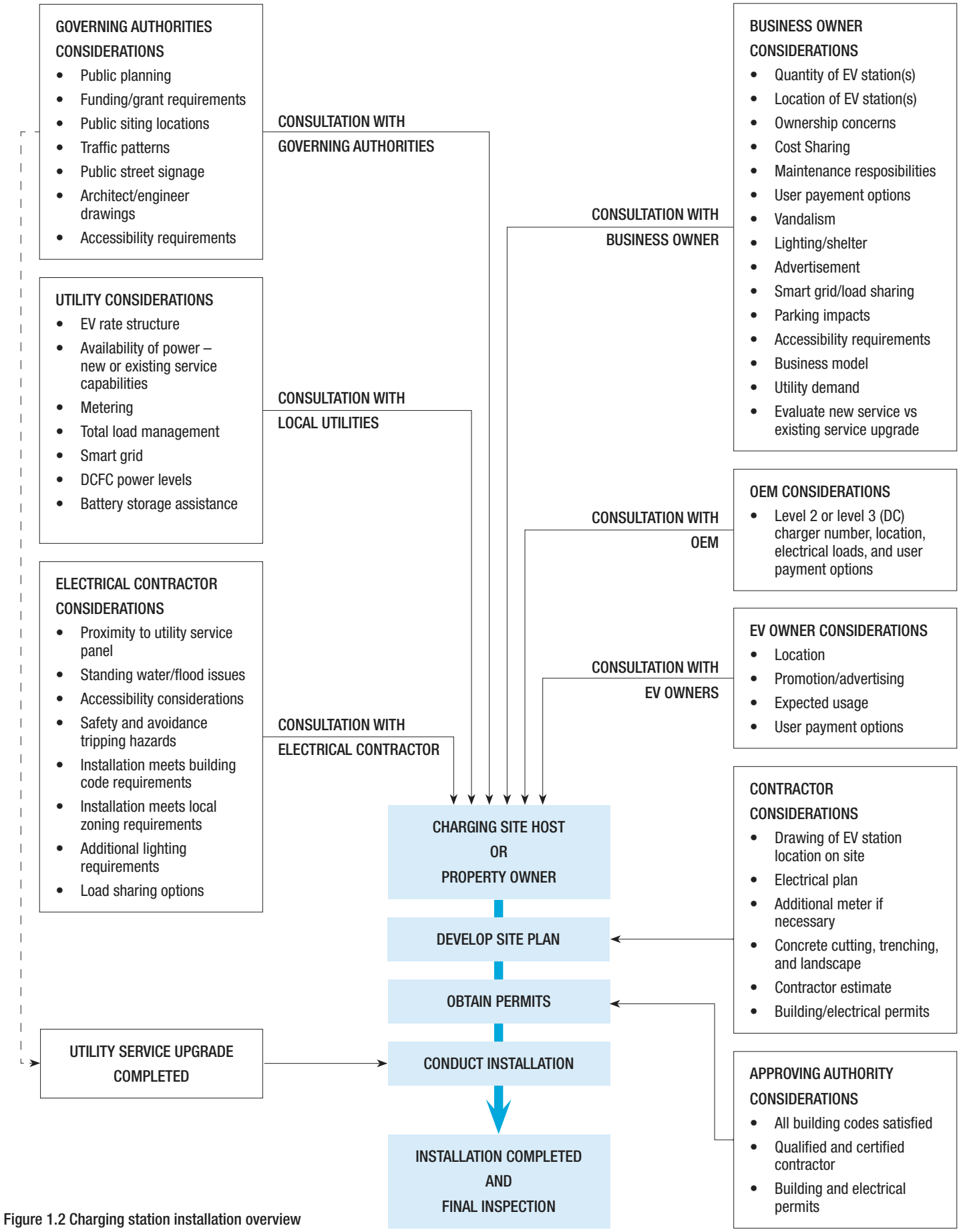


Figure 1.2 Charging station installation overview

2

STATION LOCATION
PROCESS

2.1 STATION LOCATION PLANNING

Objectives

The objectives for the public EV fast charging station network were derived through a planning and business lens, over a range of scales from the micro-urban scale of a parking space to the global scale of emissions reductions. These objectives attempt to address the concerns of all stakeholders, though some objectives may be more important to some stakeholders. For the framework that guides the station location process, the objectives have been prioritized over the course of deployment in the following order:

1. **Visibility:** Increase the public awareness and market profile of EVs, establish high-impact branding and contribute positive urban design in station locations.
2. **Convenience:** Provide service in obvious, well-signed locations, ensure short wait times, and provide a simple user interface.
3. **Cultural branding:** Position EVs as progressive, green, politically aware, and innovative, building on their ability to decrease GHG emissions and their appeal as a new technology.
4. **Reliability:** Provide robust maintenance and service support and prioritize consistency across different types of fast charging stations.
5. **Affordability (Consumer):** Maintain competitive rates through early phases of adoption, i.e. rates may fluctuate to remain competitive with gas prices.
6. **Operating cost (Utility or Service Provider):** Minimize operating costs through durable design and a simple user interface.
7. **Initial Cost (Utility, Service Provider, or Host):** Minimize installation costs through pre-fabricated or mass-customized units and standardized installation methods and working with financial institutions to provide favourable terms.
8. **Financial competitiveness (Host):** Work towards financial performance on highly valuable urban land, prioritize deployment as an add-on to existing business, consider locating stations on under-utilized or under-performing sites.
9. **Displacement of gas vehicles:** Ensure network robustness so that EVs are a clear alternative to gas vehicles rather than an additional mode of transport, increase market share to at least 15% of total vehicles to have a measurable impact on the purchase of gas vehicles.
10. **Energy use:** Continue to increase EV market share to magnify the impact of EVs which are one-to-one more efficient than gas vehicles, promote efficient driving patterns through network deployment, reduce the need for single occupant vehicles with emphasis on integrating with other forms of electrified transport, i.e. electric bikes, carsharing, buses, streetcars, light rail.

Station Types

The general approach to locating stations and the phasing of stations has been considered as a tiered network that will serve evolving objectives over time. At the beginning of the process, the main goal is to enhance visibility of the EV charging stations to foster public confidence, reduce range anxiety, and show support for the EV. After this first phase, more objectives come into play to bolster consumer

confidence through the reliability and affordability of the network. As the continuing good faith of early adopters will be crucial to promoting ongoing adoption, it may be important to prioritize stations that serve high concentrations of early adopters. As the network matures, full functionality, distributed throughout a cluster, will become the goal. Four types of stations have been designated, first enabling priority staging and ultimately working together as a complete network.

- Stage 1: Very Important Place Stations
- Stage 2: High Visibility Stations
- Stage 3: Early Adopter Stations
- Stage 4: Full Functionality Stations.

Very Important Place (VIP) Stations

The placement of VIP stations emphasizes the first three objectives.

- Visibility - raising the profile of the electric car
- Convenience - demonstrating that electric cars are simple to run and recharge
- Cultural Branding - to showcase the lifestyle brand of the electric car, increasing mass appeal and accelerating consumer desire

This does not preclude VIP stations from addressing the additional objectives that will unfold over time.

High Visibility Stations

As deployment is phased, high visibility stations would overlap with the tail end of VIP station deployment. As a result, they also play a large role in cultural branding, raising the profile of electric cars as a “must have” technology. They also emphasize the next three objectives, which will become more important over the course of electric vehicle adoption.

- Reliability - demonstrating that both the vehicles themselves and the infrastructure can be counted on for availability and smooth operation
- Affordability - demonstrating that an affordable fee-for-charging model makes the cars competitive
- Operating Cost - as infrastructure starts to be adopted by the private sector, showing that it has the potential to be an economically viable business

This does not preclude High Visibility stations from addressing the additional objectives that will unfold over time.

Early Adopter Stations

To cover gaps in high visibility station coverage in areas with high early adoption of electric vehicles. In this sense, early adopter stations are the first stage of the last phase, “full functionality”, which aims to provide a

mature network. Early adopter stations would emphasize the objectives at the tail end of high visibility stations (affordability, operating cost) while beginning to address the next objective.

- Initial cost - as adoption intensifies and technology evolves, the initial cost of installing fast-charging stations should decrease. This dovetails with intensive adoption among "early adopters."

Full Functionality Station

To achieve a mature fast charging network with full coverage. This dovetails with "early majority" and "late majority" adopters who are increasingly risk averse in their adoption of new technology. Over time, full functionality stations would address the final three long term objectives.

- Financial competitiveness - with widespread adoption and maturing business models, fast-charging infrastructure operators should be able to engage in this business profitably. At this point, risk averse operators would be convinced to take part in the market along with the risk averse consumers.
- Displacement of Gas Vehicles - widespread adoption would start to have a measurable impact on the car market, displacing gas vehicles and reducing greenhouse gas emissions (if clean electricity is used) due to electric vehicle's proven convenience, reliability, cost savings, and environmental benefits
- Energy Use - urban impact of electric vehicle infrastructure would start to take shape as a place-based strategy emphasizes lower overall vehicle use

This stage will likely be the most difficult in which to identify distinct station locations. Geographic distribution as well as 'gateway' locations, such as airports, ferry terminals, and major highway entrances to urban areas should be considered here. However, it remains important to locate these stations near complementary activities, so that additional opportunities are available over the length of charging.

2.2 + 2.3 EV Toolkits

The EV Toolkits on the following pages provide a guide to locating fast charging stations in urban areas and on highways. Following these steps in light of local regulations, economic considerations, and planning goals should result in favorable station locations. However, given the early stages of EV adoption, unforeseen issues may arise. These guides are conceived of as living documents to be revised in response to stakeholder feedback.

STATION LOCATION PROCESS

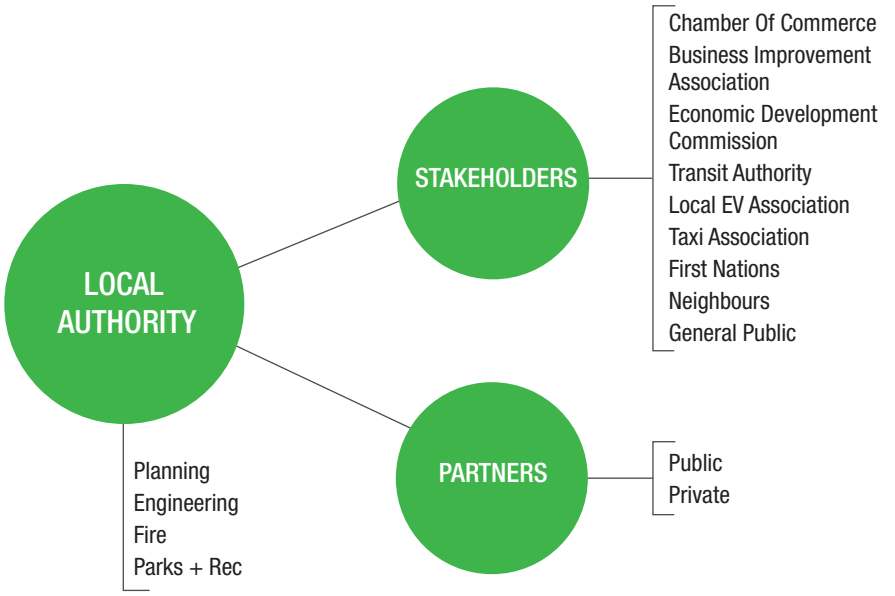
CITY & TOWN SCALE

This document will guide you, the Local Authority, through the process of situating Electric Vehicle Fast Charging Stations in your city or town. At certain stages in the process it will be important to consult with Stakeholders and Partners.

The process has been broken down into 7 steps to facilitate your work. The steps start at a large scale and continually eliminate less desirable sites through planning, engineering, economic and social filters to assist you in obtaining a prioritized list of preferred sites.

As you move through the process, be sure to consult the *Guide to the Station Location Process*; it contains definitions and useful information to clarify terminology, processes and considerations.

KEY RELATIONSHIPS

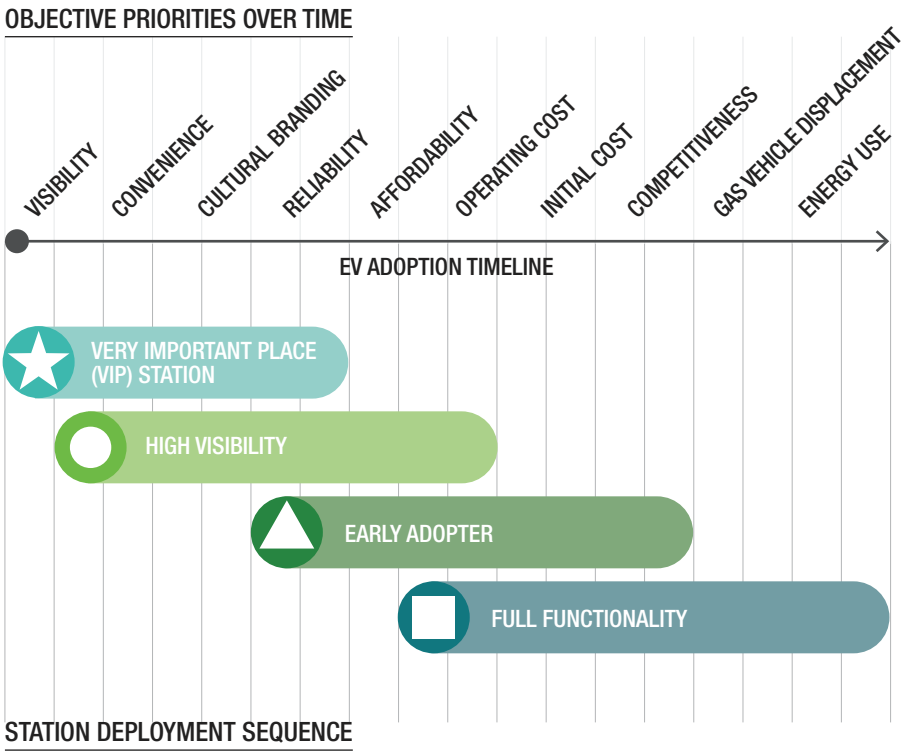


ACTION	OUTCOME
1 REVIEW THE FRAMEWORK	UNDERSTAND PRIORITY OBJECTIVES AND STATION LOCATIONS
2 MAP TARGET LOCATIONS	DETERMINE AREAS WITHIN WHICH TO LOCATE STATIONS
3 CONSIDER THE SITE SCALE	DETERMINE A RANGE OF SITES TO EVALUATE AGAINST CONSTRAINTS
4 EVALUATE CONSTRAINTS	DETERMINE WHETHER THE SITES MEET MINIMUM REQUIREMENTS
5 CONSIDER ECONOMICS	DETERMINE THE ECONOMIC FEASIBILITY OF THE SITES
6 CONSIDER PLANNING	DETERMINE THE PLANNING VIABILITY OF THE SITES
7 EVALUATE DESIRABILITY	DEVELOP A PRIORITIZED LIST OF SITES FOR IMPLEMENTATION

1 REVIEW THE FRAMEWORK

The framework for deploying Electric Vehicle Fast Charging Stations consists of a series of time prioritized objectives and a series of station types. Starting from the left, the foremost concerns upon immediate deployment are Visibility, Convenience, Cultural Branding and Reliability (please see the *Guide to the Station Location Process* for specific definitions).

All Fast Charging Station network deployments should start with Very Important Place (VIP) and High Visibility Stations. Appropriate locations for these stations will be determined through the mapping processes undertaken in Step 2. Again, please see the *Guide to the Station Location Process* for descriptions of the station typologies.



2 MAP TARGET LOCATIONS

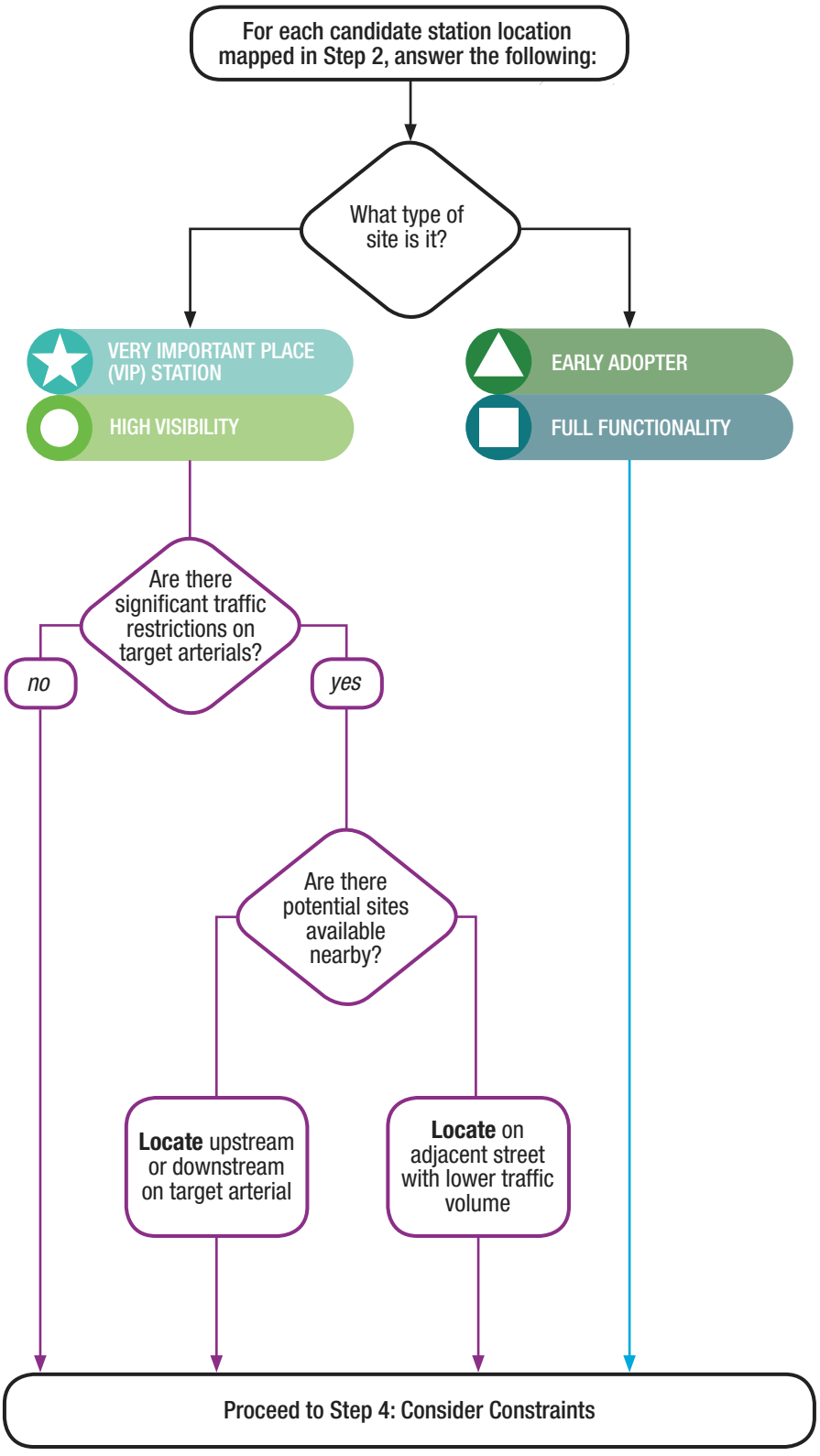
The first step in the Station Location Process is to Map Station Locations. In order for a network of Electric Vehicle Fast Charging Stations to function properly, a series of 4 station types have been identified that work together to meet the goals of the deployment.

Identifying preferred locations for these stations is accomplished by overlaying map data and identifying relevant intersections of the key factors listed to the right. The types should be mapped in order of priority deployment to ensure the end result of a fully functional network. Using the chart at right, identify locations for each station type by evaluating the relevant factors in relation to each other.

TARGET LOCATIONS	MAP OVERLAYS
VERY IMPORTANT PLACE (VIP) STATION	Tourist Attractions Commercial Density
HIGH VISIBILITY	Commercial Density High Traffic Volume
EARLY ADOPTER	Commercial Density High Traffic Volume Hybrid Ownership Density
FULL FUNCTIONALITY	Commercial Density High Traffic Volume Population Density

3 CONSIDER THE SITE SCALE

Once target locations have been identified for the deployment of Fast Charging Stations, use this flow chart to determine the finer grained location or site. In this step of the process the urban context is considered.



4 EVALUATE CONSTRAINTS

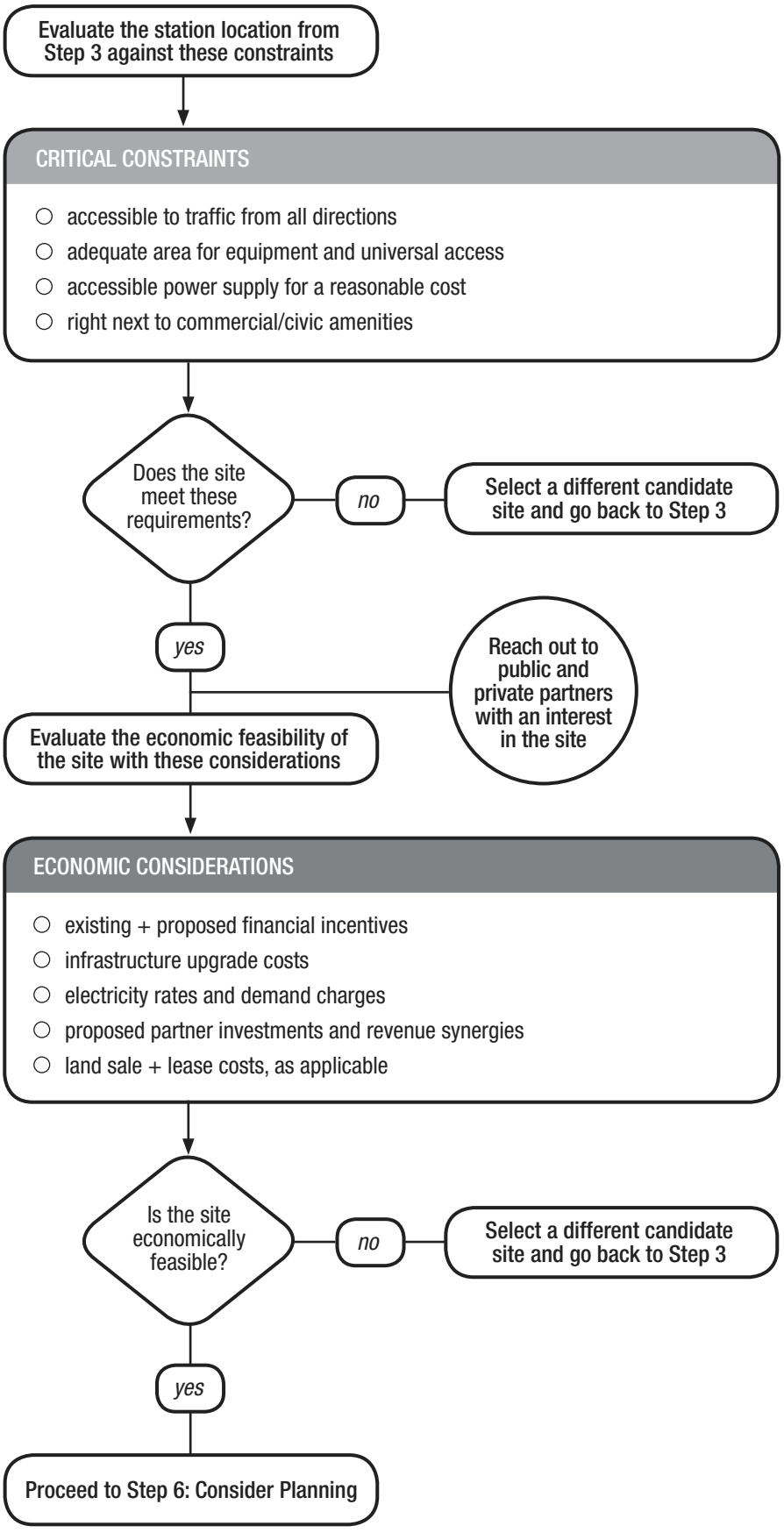
With a more defined site selected for the station, consider this series of critical constraints required for a functional station. It is vital that a candidate site meet all of the constraints in the flowchart at right in order to be a suitable location.

If a target site does not meet the constraints, select a new site and return to Step 3 to determine a new location.

5 CONSIDER ECONOMICS

If the site meets all of the Critical Constraints, gauge the economic feasibility of the site using the considerations in the chart at right.

If a candidate site is not economically feasible, select a new a site and return to Step 3 to determine a new location.



6 CONSIDER COMMUNITY

Once the site has met all of the Critical Constraints and been identified as economically feasible, Community Planning Considerations must be taken in account.

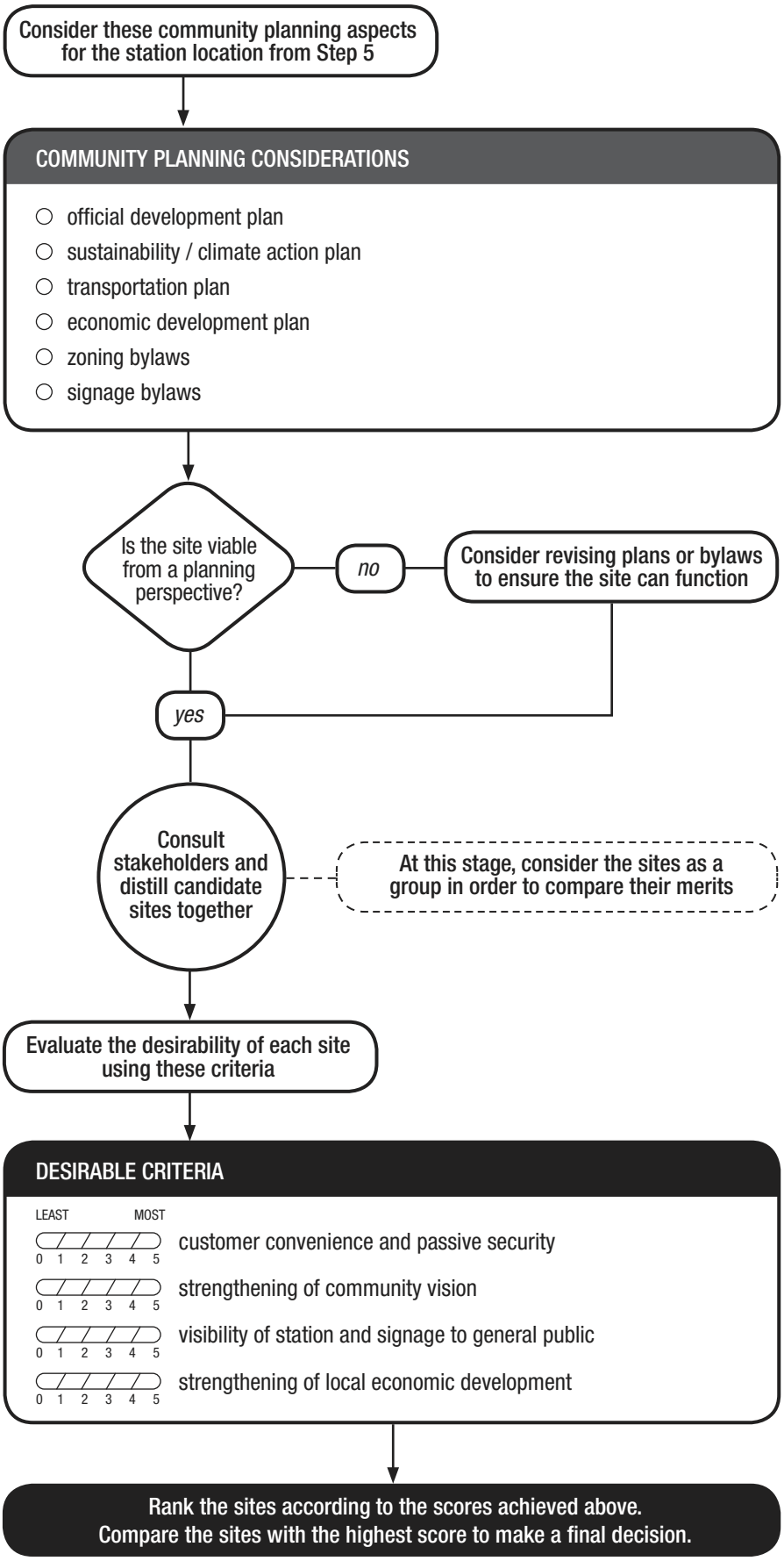
If the site is viable from a planning perspective, proceed to the final step to Evaluate Desirability. If the site is not considered viable consider revising plans or bylaws to ensure the site can function.

7 EVALUATE DESIRABILITY

Once a site has been specifically located and meets all of the constraints and considerations, it must be evaluated according to its desirability in order to place it in a priority ranking among all of your candidate sites.

At this stage it is important to consider public and private partnerships that may allow the site to benefit from a productive relationship. Gather stakeholder input and consider the site using the criteria at right.

Score the candidate sites based on the Desirable Criteria. Rank the sites according to the scores they attain and compare those with the highest scores to reach final decisions on implementation.



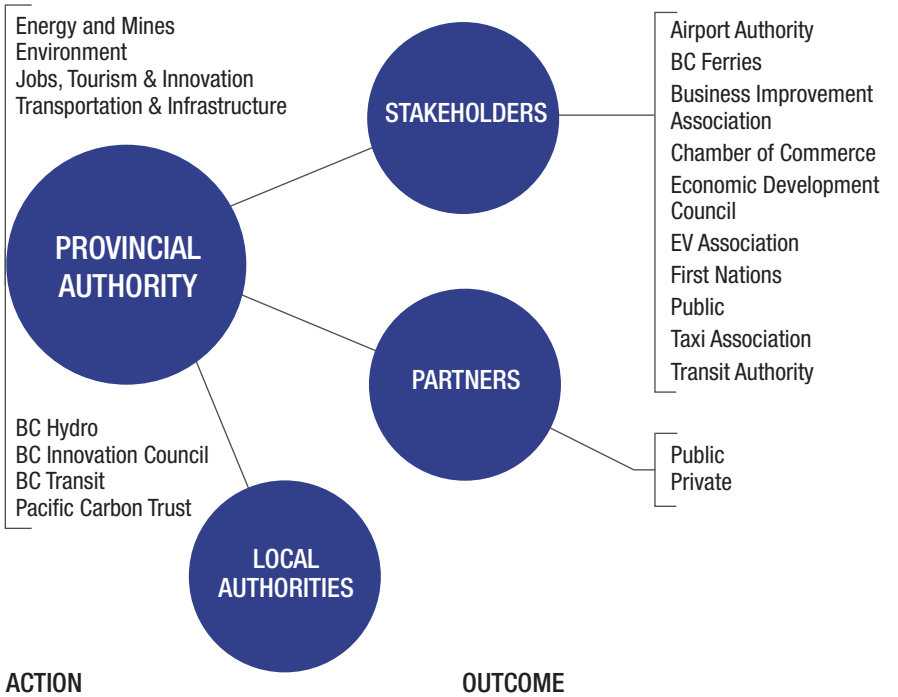
STATION LOCATION PROCESS
HIGHWAY SCALE

This document will guide you, the Provincial Authority, through the process of situating Electric Vehicle Fast Charging Stations throughout your jurisdiction. At certain stages in the process it will be important to consult with Local Authorities, Stakeholders and Partners.

The process has been broken down into 7 steps to facilitate your work. The steps start at a large scale and continually refine through more detailed considerations to assist you in obtaining a prioritized list of station sites.

As you move through the process, be sure to consult the *Guide to the Station Location Process*; it contains definitions and useful information to clarify terminology, processes and considerations.

KEY RELATIONSHIPS



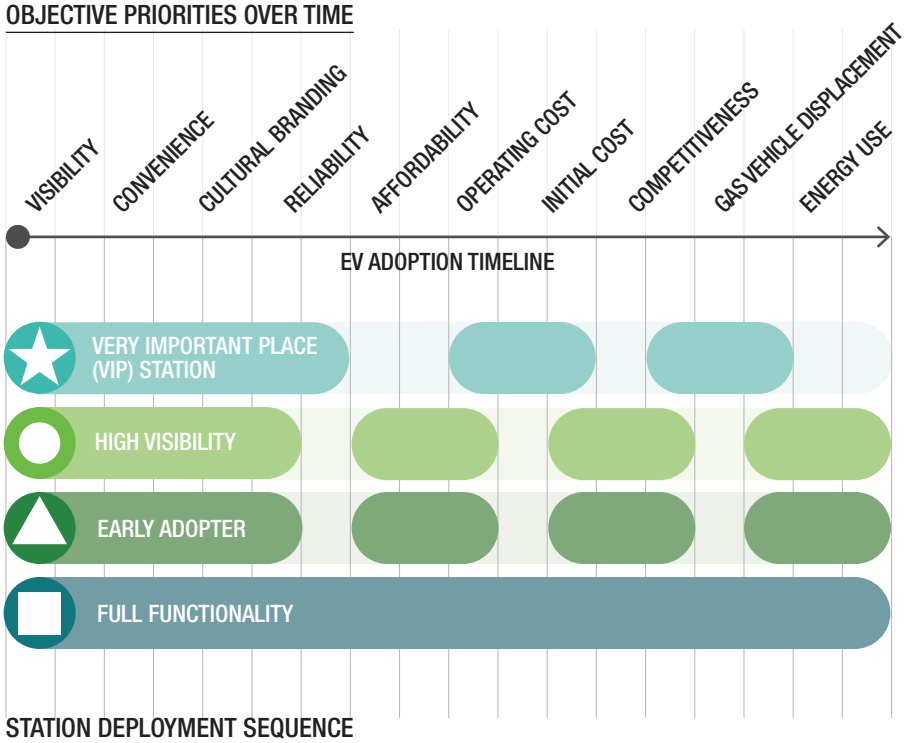
ACTION	OUTCOME
1 REVIEW THE FRAMEWORK	UNDERSTAND PRIORITY OBJECTIVES AND STATION TYPOLOGIES
2 MAP TARGET LOCATIONS	DETERMINE SITE AREAS WITHIN WHICH TO LOCATE STATIONS
3 CONSIDER THE SITE SCALE	DETERMINE A RANGE OF SITES TO EVALUATE WITH CONSTRAINTS
4 EVALUATE CONSTRAINTS	DETERMINE WHETHER THE SITES MEETS MINIMUM REQUIREMENTS
5 CONSIDER ECONOMICS	DETERMINE THE ECONOMIC FEASIBILITY OF THE SITES
6 CONSIDER PLANNING	DETERMINE THE PLANNING VIABILITY OF THE SITES
7 EVALUATE DESIRABILITY	DEVELOP A LIST OF PRIORITIZED SITES FOR IMPLEMENTATION

1 REVIEW THE FRAMEWORK

The framework for deploying Electric Vehicle Fast Charging Stations consists of a series of time prioritized objectives and a series of station typologies. Starting from the left, the foremost concerns upon immediate deployment are Visibility, Convenience, Cultural Branding and Reliability (please see the *Guide to the Station Location Process* for specific definitions).

If electric vehicle range is not accommodated along highways, the vehicles become useless. As a result, the "full functionality" phase is critical for corridors and must be introduced immediately. The prioritized objectives are relevant but more of them must be addressed at once.

OBJECTIVE PRIORITIES OVER TIME

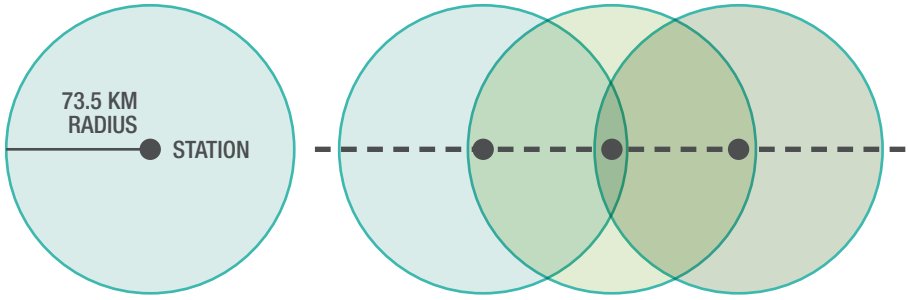


2 MAP TARGET LOCATIONS

The first step in the Station Location Process is to Map Station Locations. In order for a highway network of Electric Vehicle Fast Charging Stations to function properly, the range of the vehicles themselves must be taken into account.

Using a range of 73.5 km, plot stations along the highway such that the ranges overlap (please see the *Guide to the Station Location Process* for information on range determination). Stations should be located to meet not only the range requirements of the vehicles but also the expectations of a highway driver.

RANGE MAPPING

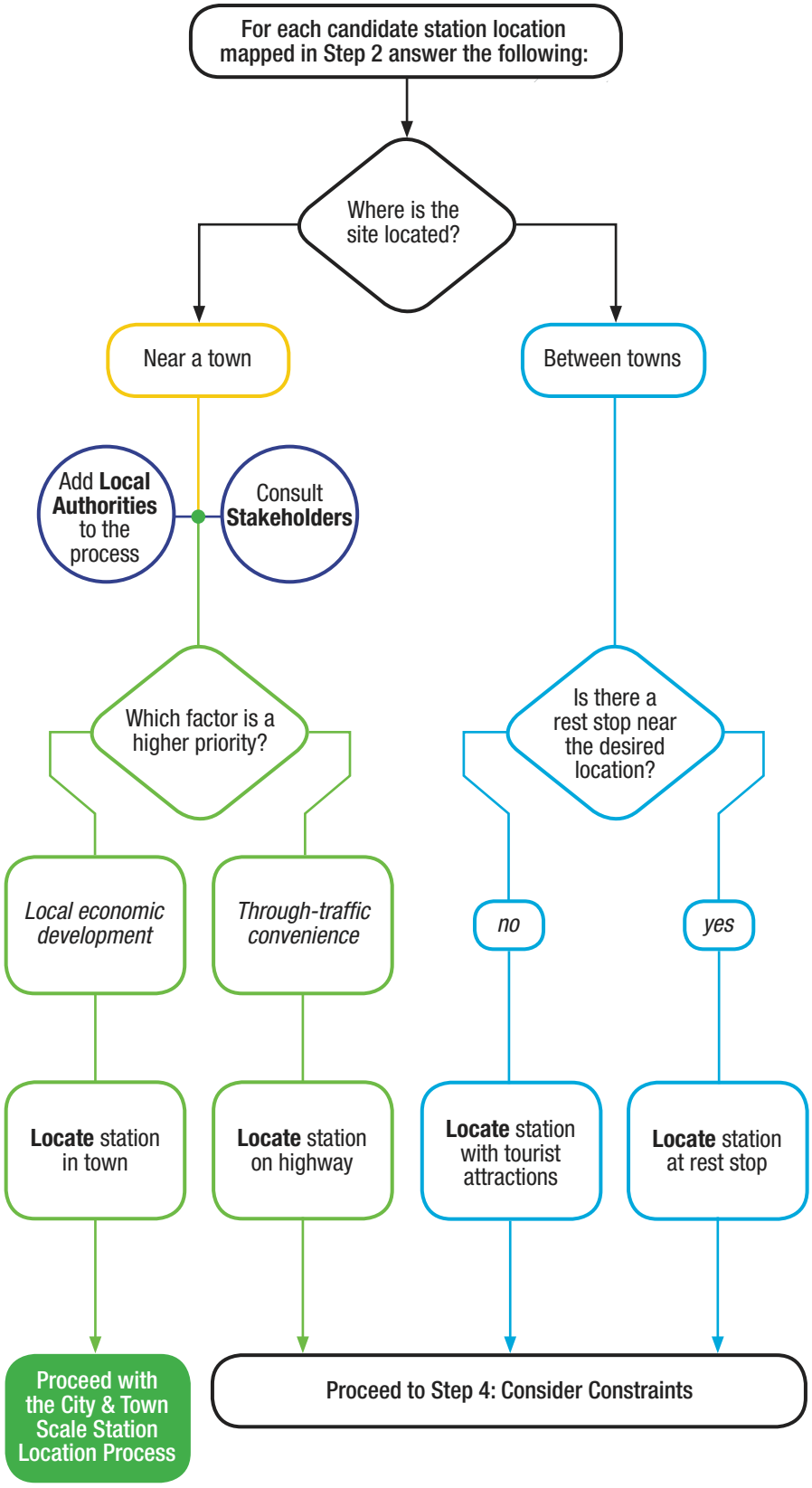


Example of a single station plotting

Stations plotted along a route such that each 73.5 Km radius overlaps with the station before and after

3 CONSIDER THE SITE SCALE

Once target locations have been identified for the deployment of Fast Charging Stations, use this flow chart to determine the finer grained location or site.



4 EVALUATE CONSTRAINTS

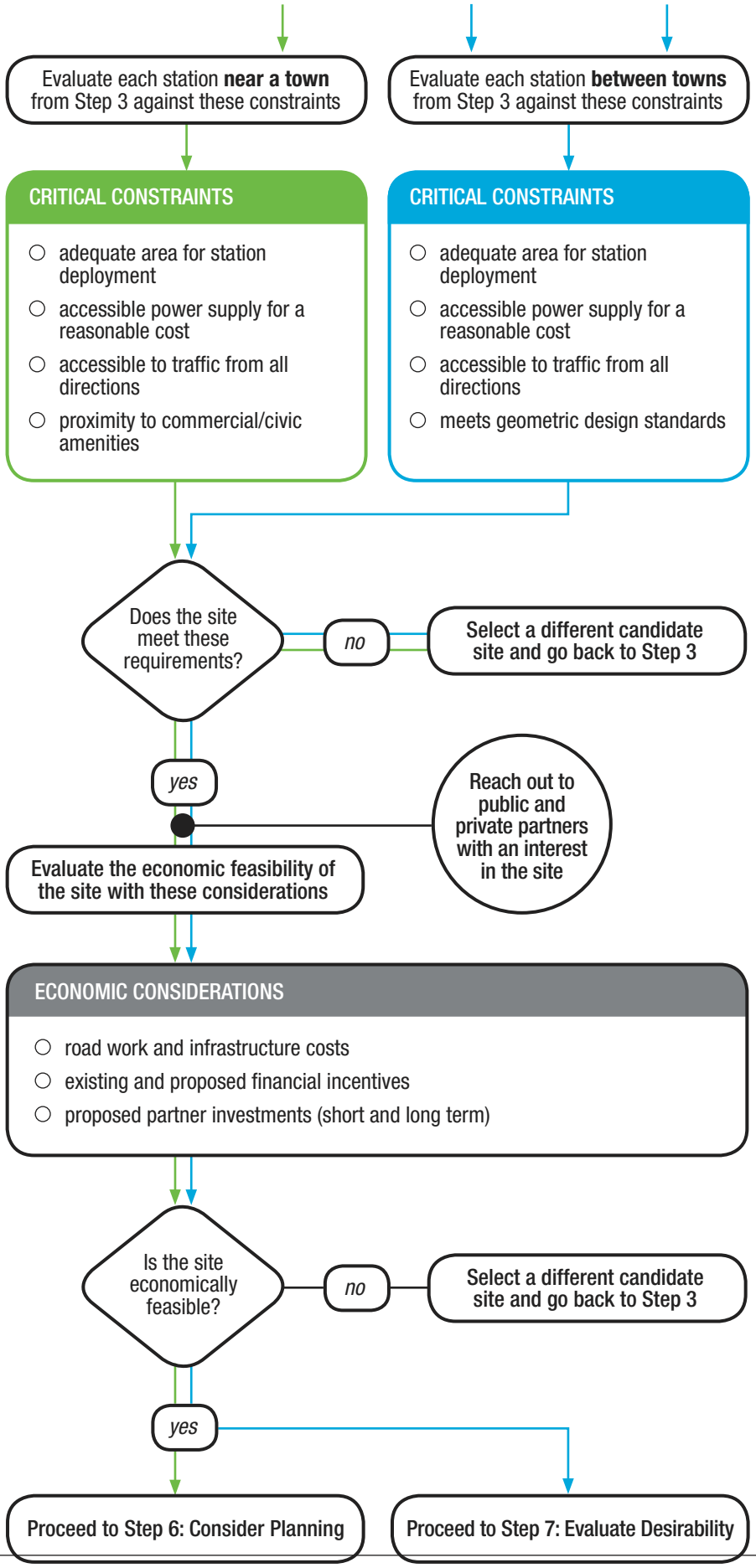
With a more defined site selected for the station, consider a series of critical constraints necessary for the optimal functioning of the station. It is vital that a candidate site meet all of the constraints in the flowchart at right in order to be a suitable location.

If a candidate site does not meet the constraints, select a new site and return to Step 3 to determine a new location. Resubmit new sites in this flowchart of constraints until a potential site is deemed appropriate for desirability evaluation.

5 CONSIDER ECONOMICS

If the site meets all of the Critical Constraints, gauge the economic feasibility of the site using the considerations in the chart at right.

If a candidate site is not economically feasible, select a new a site and return to Step 3 to determine a new location.



6 CONSIDER PLANNING

Once the site has met all of the Critical Constraints and been identified as economically feasible, Planning Considerations must be taken in account.

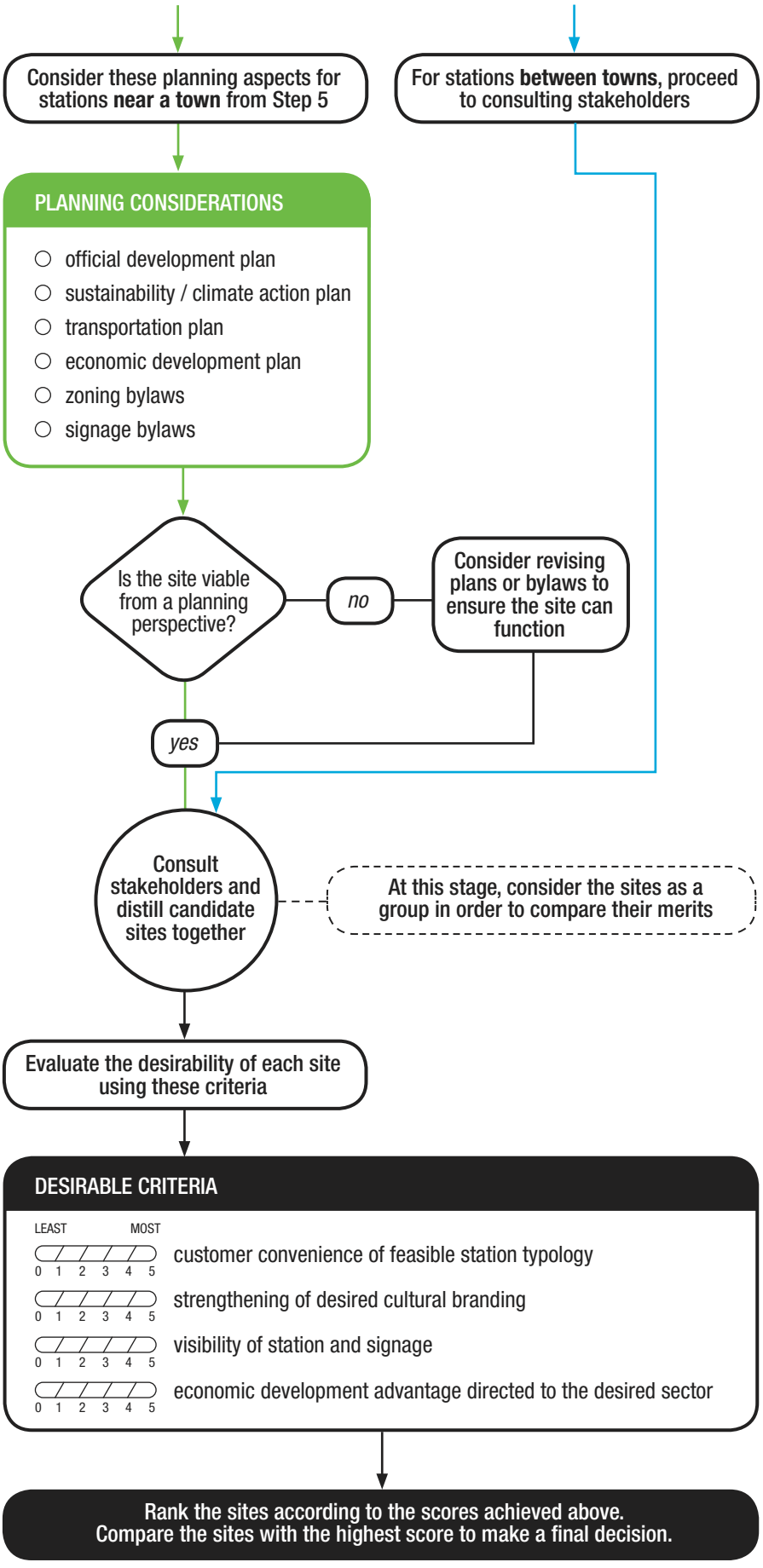
If the site is viable from a planning perspective, proceed to the final step to Evaluate Desirability. If the site is not considered viable consider revisions plans or bylaws to ensure the site can function.

7 EVALUATE DESIRABILITY

Once a site has been specifically located and meets all of the constraints and considerations, it must be evaluated according to its desirability in order to place it in a priority ranking among all of your candidate sites.

Gather stakeholder input and consider the site using the criteria at right.

Score the candidate sites based on the Desirable Criteria. Rank the sites according to the scores they attain and compare those with the highest scores to reach final decisions on implementation.



STATION LOCATION PROCESS
LEVEL 2 CHARGING

This document will guide you, the Local Authority, through the process of situating Level 2 Electric Vehicle Charging Stations in your local jurisdiction. During the process it will be beneficial to consult with interested Public and Private Proponents.

The process has been broken down into 5 steps to facilitate your work. The first step entails reviewing the Level 2 Framework, its objectives and priorities. In Step 2, a series of mapping exercises will guide you through selecting locations in your local jurisdiction. Step 3 provides instructions to narrow the selected locations to achieve an appropriate distribution. Step 4 provides instructions for identifying the best Charging Station sites within your selected locations. The Evaluation Flowchart in Step 5 is a tool for refining site selections should you identify multiple site options.

ACTION	OUTCOME
1 REVIEW THE FRAMEWORK	UNDERSTAND PRIORITY OBJECTIVES AND DEPLOYMENT STRATEGY
2 MAP TARGET LOCATIONS	DETERMINE POTENTIAL STATION LOCATIONS
3 EVALUATE LOCATIONS	REFINE TARGET STATION LOCATIONS THROUGH ANALYSIS
4 CONSIDER THE LOCATION TYPE	DETERMINE LOCATION TYPE AND IDENTIFY TARGET SITES
5 EVALUATION FLOWCHART	REFINE TARGET SITES USING A SET OF DEFINED CRITERIA

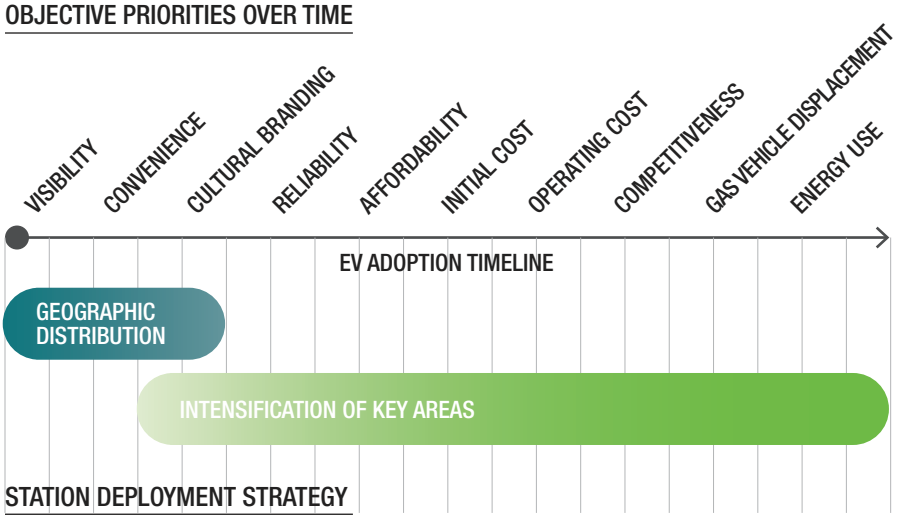
As you move through the process, be sure to consult the *Guide to the Station Location Process* at the back of this document; it contains definitions and useful information that clarifies terminology, processes and considerations.

Also consult the B.C. Charging Infrastructure Guidelines, available at www.pluginbc.ca on the 'Resources' page, which provide detailed technical and siting information.

1 REVIEW THE FRAMEWORK

The framework for deploying Level 2 Electric Vehicle Charging Stations makes the equitable distribution of a network of stations across a local jurisdiction its foremost priority. Once distribution is achieved, the framework seeks to intensify EV charging access in busy areas in order to enhance visibility, convenience and cultural branding. The framework moves toward the goal of developing an omnipresent EV support system to encourage increased EV adoption and use.

OBJECTIVE PRIORITIES OVER TIME



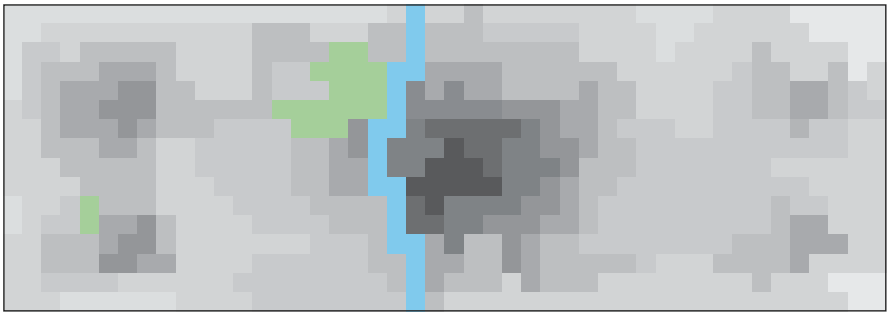
STATION DEPLOYMENT STRATEGY

2 MAP TARGET LOCATIONS

The process of mapping target locations for Level 2 Charging Stations is divided into five steps. Each step is described as well as applied to a fictional town called EVille to assist you through the process.

A. MAP POPULATION DENSITY

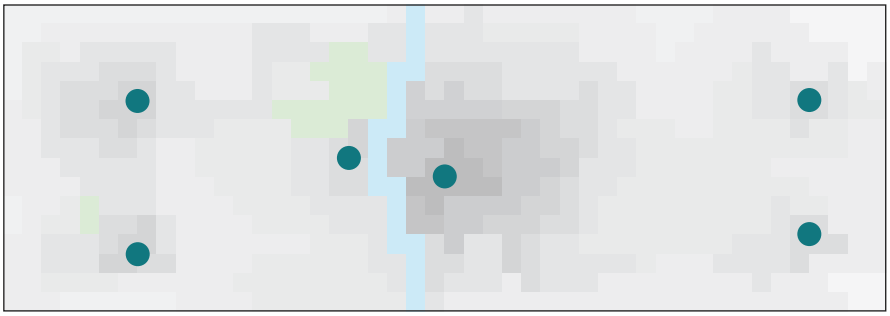
If available, map population density for your local jurisdiction. Population density will serve as a base comparison layer for other information and assist in determining the most suitable locations for Level 2 Charging Stations.



This is EVille, an example town with a population of 80,000 inhabitants roughly concentrated in six major neighbourhoods. It has a dense downtown with a large park northwest of the core and a major river that crosses the town North-South.

B. MAP COMMUNITY CENTRES

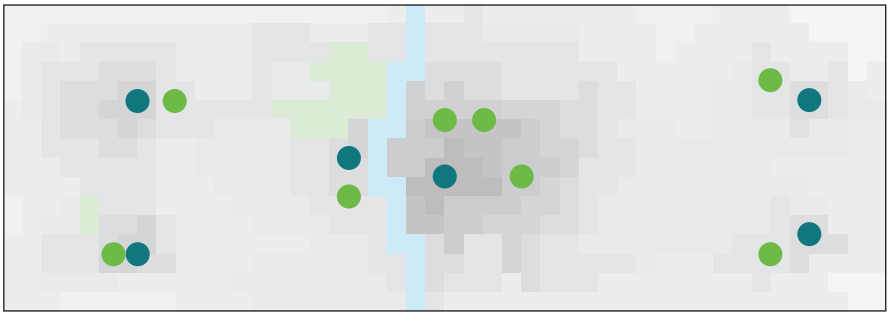
A Community Centre is a public location where members of a community gather for group activities. They are often equitably distributed and have dedicated parking, so they are excellent locations to accomplish geographic distribution of Level 2 Charging Stations. Sports facilities also belong in this category.



The Community Centres in EVille are located in each of the six neighbourhoods providing a well distributed starting point for the network.

C. MAP COMMERCIAL DISTRICTS / MALLS

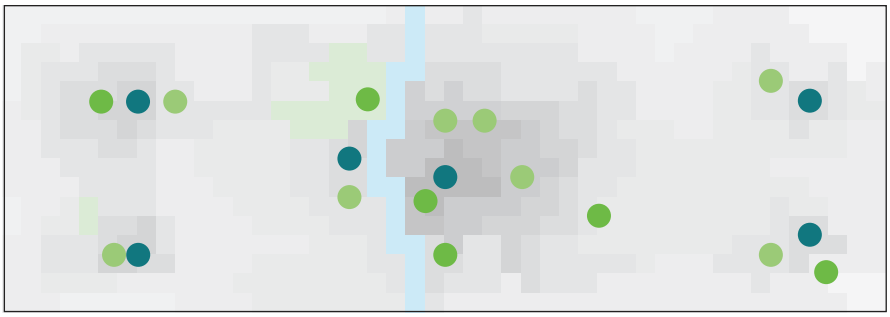
Map commercial districts, malls and major shopping centres to identify potential areas of intensification. Commercial Districts are areas of high commercial activity recognized in your local jurisdiction. Malls and shopping centres are large groupings of commercial businesses, typically accompanied by extensive parking.



Each of the neighbourhoods has a main commercial street. Downtown has several major commercial districts.

D. MAP OTHER PUBLIC ATTRACTIONS, AMENITIES OR INSTITUTIONS, PARK AND RIDE LOCATIONS AND PUBLIC PARKADES

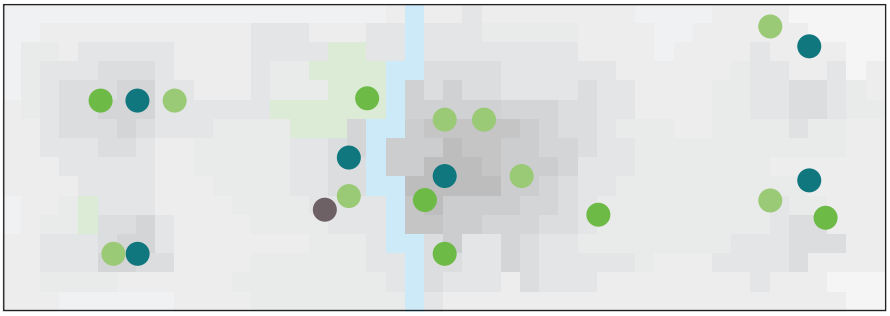
Public Attractions, Amenities or Institutions include city and town halls or libraries, museums, theatres, post-secondary institutions, hospitals and public recreation destinations such as parks or beaches. A Park and Ride is a civic parking location with the express purpose of connecting to public transportation systems. Any other transfer points between transportation modes (i.e. a light rail station) that may be relevant should also be mapped in this stage.



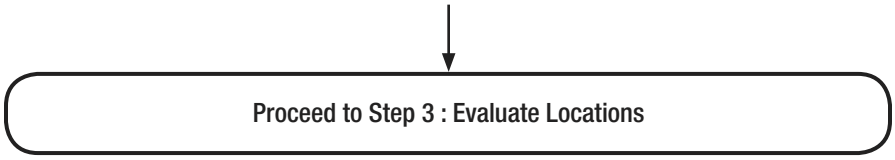
EVille has a major attraction in its largest park as well as several other prominent public attractions and institutions throughout the town.

E. MAP EXISTING EV CHARGING STATIONS

Only map existing EV charging stations that are publicly accessible during normal business hours.



EVille has one existing EV charging station at a local grocer.



3 EVALUATE LOCATIONS

Prior to narrowing station locations bring relevant planning considerations to the discussion and assess whether, and in what capacity, any of the official plans for your community will affect station locations.

A. IDENTIFY CLUSTERS FOR EVALUATION

Identify clusters of stations that are too close to each other given the population density of the surrounding area.

B. PERFORM A COMPARATIVE ANALYSIS

Evaluate each cluster by assessing its locations against relevant municipal planning policy and the Desirable Criteria. Rank the locations to determine the strongest one within the cluster. A suggested guideline for frequency is 1 station for every 10,000 people. If your population is small but geographically dispersed, this frequency may increase.

C. CONSULT WITH STAKEHOLDERS

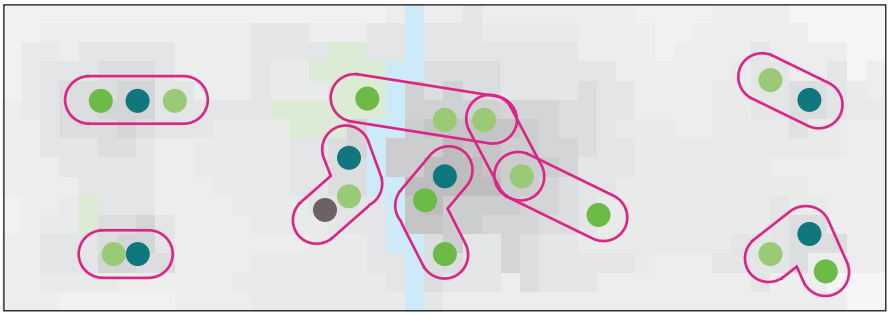
Approach owners and / or operators of the locations deemed desirable to determine their level of interest in partnering with you. A lack of interest may remove a location from consideration and require a return to Step B for reevaluation of the cluster locations.

D. REMOVE REDUNDANT LOCATIONS AND ENSURE DIVERSITY OF NETWORK

Remove the weakest candidates from each cluster until the appropriate location frequency is achieved. Try to maintain a diverse mixture of location types. Consider areas where multiple charging units would be useful. Remember that adding a second unit to one location will require removing one from another location. With the network of locations established, proceed to Step 4.

PLANNING CONSIDERATIONS

- ○ official community plan
- ○ transportation plan
- ○ sustainability plan
- ○ economic development plan



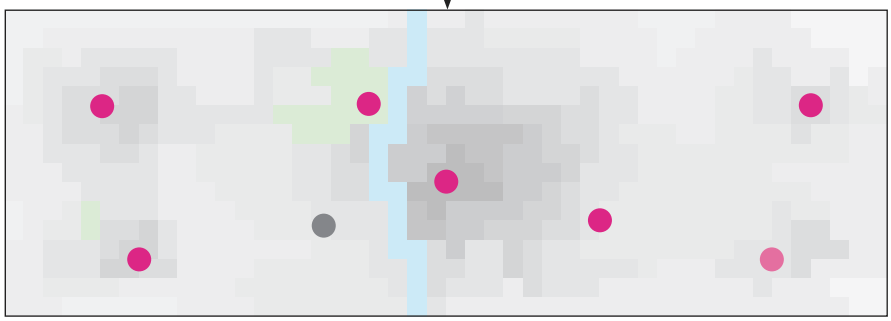
A series of clusters are identified in the EVille mapping. Some of the clusters overlap, requiring an informed discretionary decision as to how best to compare potential locations.

DESIRABLE CRITERIA

LEAST MOST

- intensity of use (0 1 2 3 4 5)
- visibility (0 1 2 3 4 5)
- economic development advantage directed to the desired sector (0 1 2 3 4 5)
- proximity to activities for charging duration (1 – 4 hours) (0 1 2 3 4 5)
- vehicle access to site (0 1 2 3 4 5)

Reach out to owners and / or operators of the desirable locations

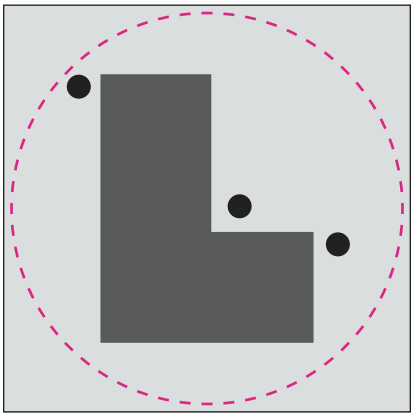


With EVille's population of 80,000 a total of 8 Level 2 Charging Stations are estimated to be required. Through analysis, a combination of Community Centres, Commercial Districts and Public Attractions and Institutions are selected as final locations.

4 CONSIDER THE LOCATION TYPE

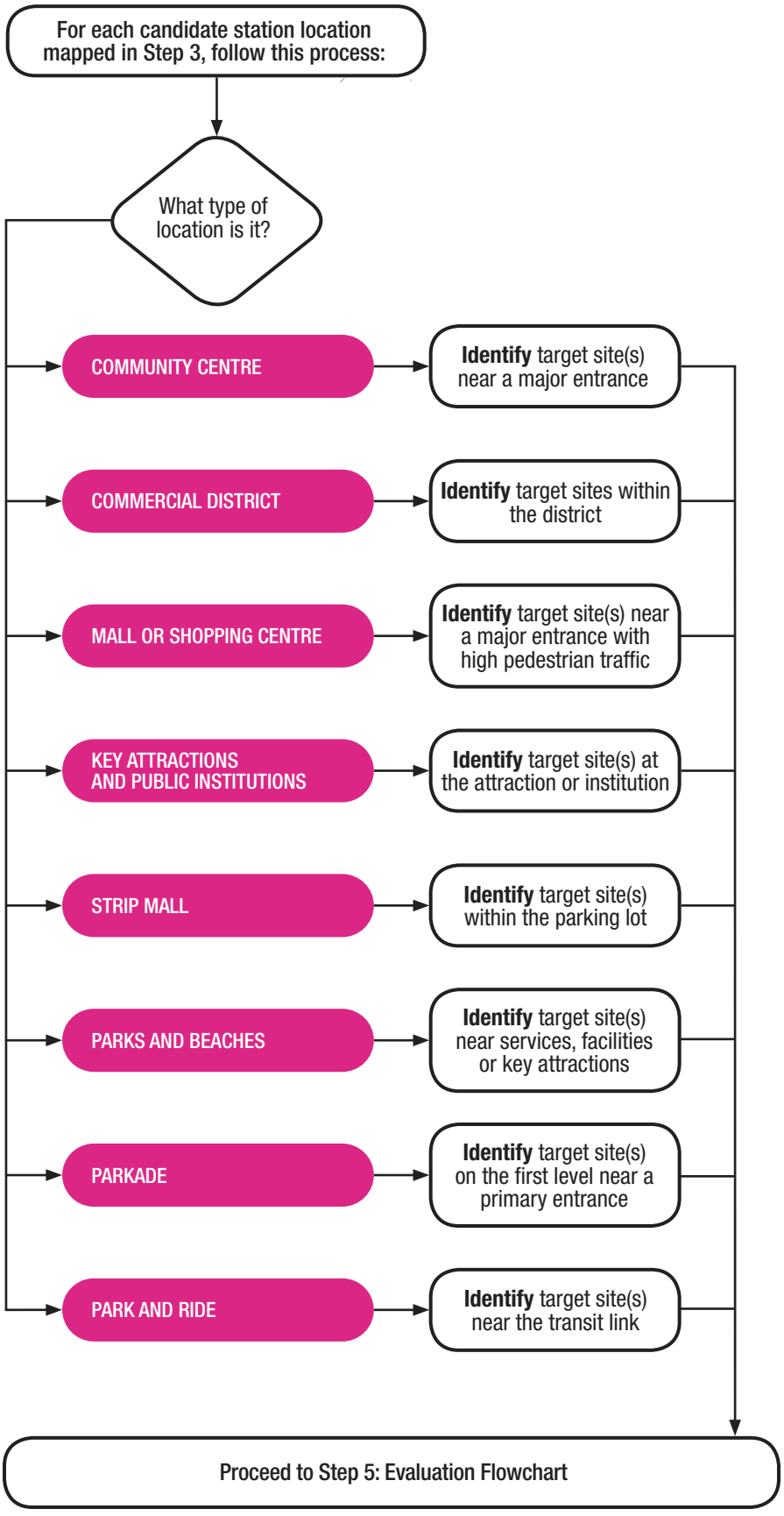
Once target locations have been identified for the deployment of Level 2 Charging Stations, use this flow chart to review directions for developing candidate sites. If at any time during the process multiple competing sites make selection difficult, submit the sites to the Evaluation Flowchart in Step 5 for clarification.

In the diagram below, the relationship between a location and its sites is clarified. The dashed circle indicates the location, for example, a Community Centre. Each of the black dots represents a target site, in this case, near a major entrance.



● Target site

– – Location boundary



5 EVALUATION FLOWCHART

A. CRITICAL CONSTRAINTS

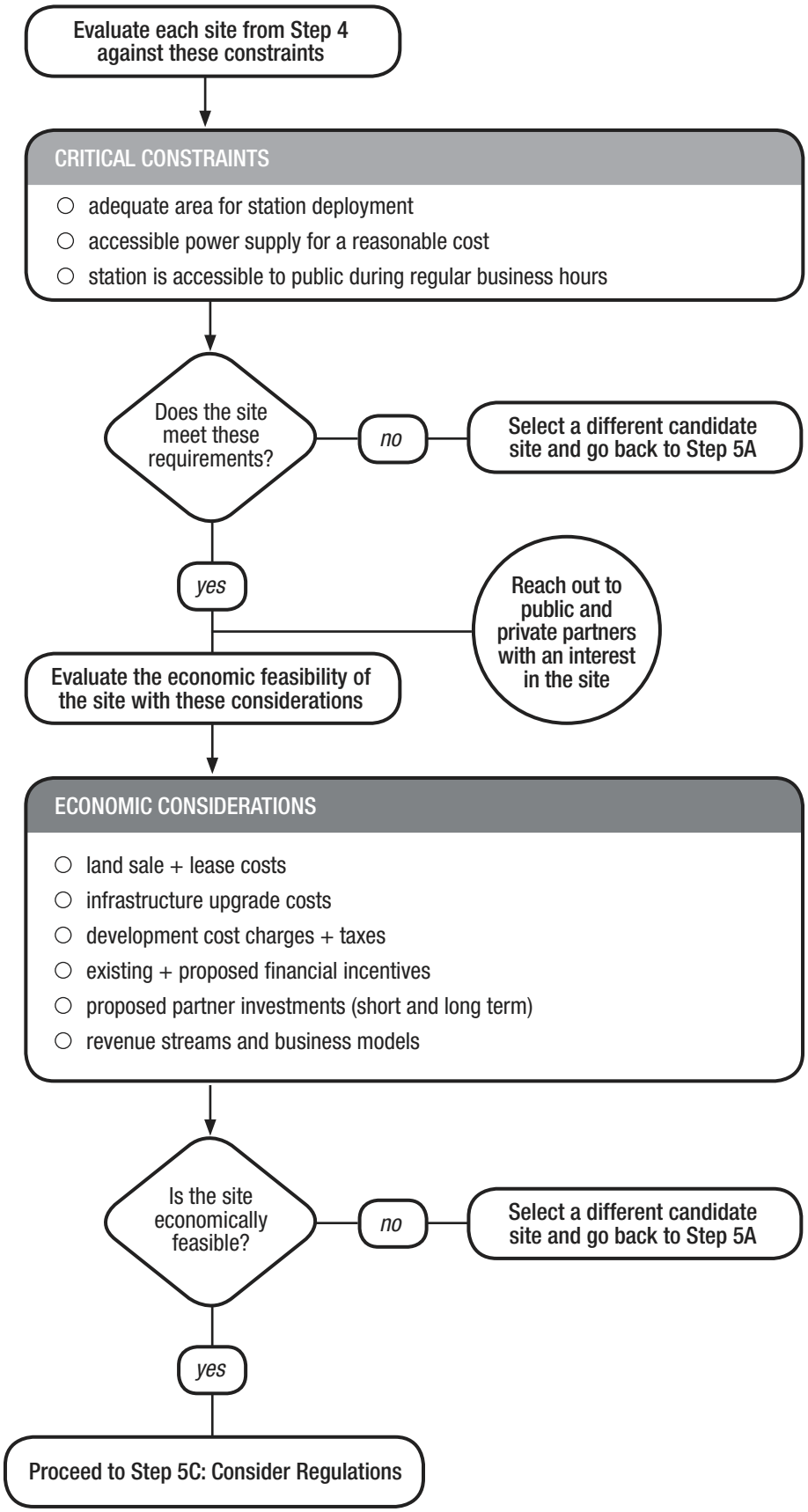
With a more defined site selected for the station, consider this series of critical constraints required for a functional station. It is vital that a candidate site meet all three constraints in the flowchart at right in order to be a suitable location.

If a target site does not meet the constraints, select a new site and come back to this step.

B. CONSIDER ECONOMICS

If the site meets all three Critical Constraints, gauge the economic feasibility of the site, in light of your budget, using the considerations in the chart at right.

If a candidate site is not economically feasible, select a new site and return to Step 5A.



C. CONSIDER LOCAL REGULATIONS

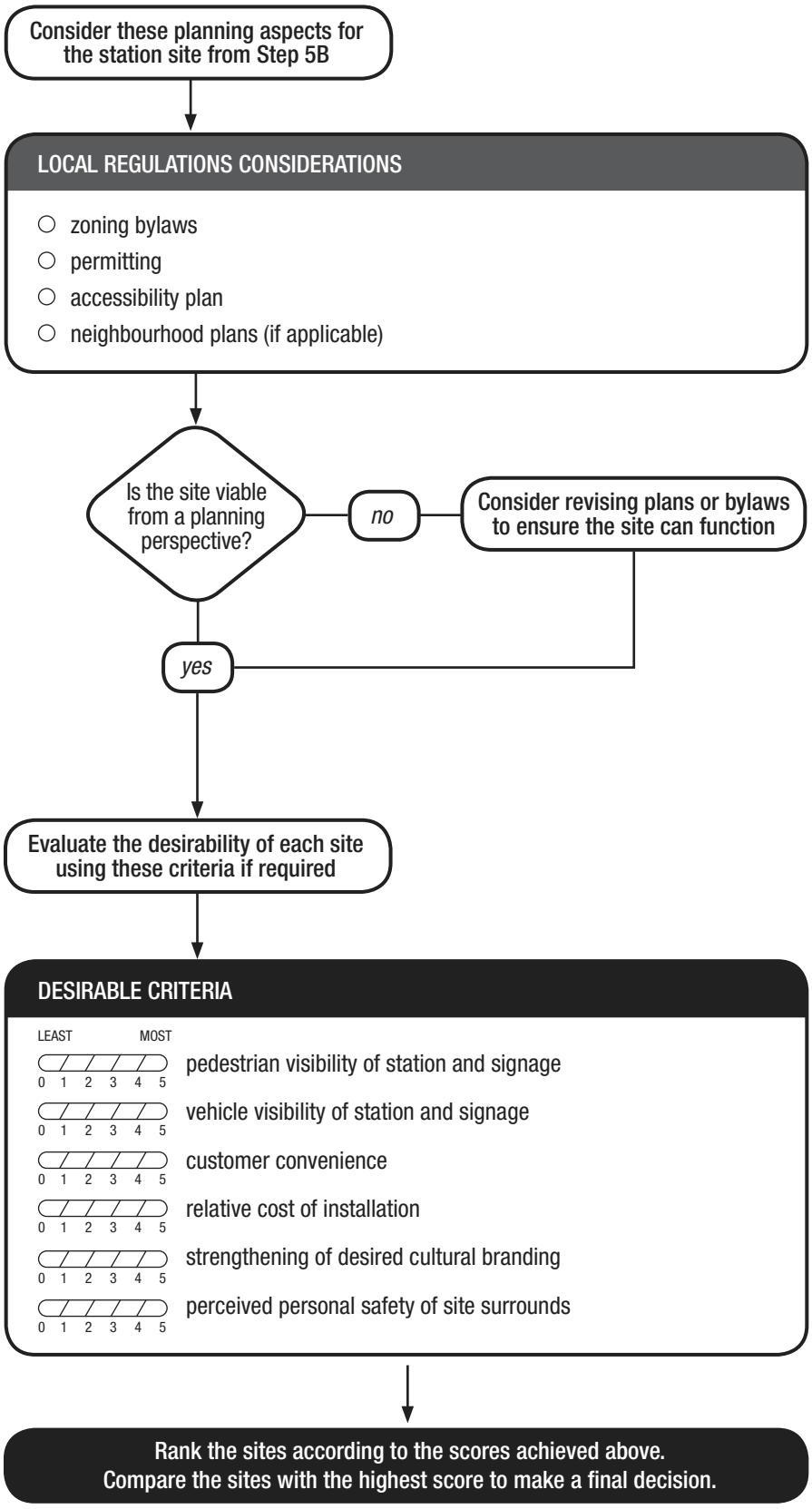
Once the site has met all of the Critical Constraints and has been identified as economically feasible, Local Regulations must be taken into account.

If the site is viable from a regulation perspective, proceed to the final step to Evaluate Desirability. If the site is not viable, consider revising plans or bylaws to allow the site to function.

D. EVALUATE DESIRABILITY

Once a site has been specifically located and meets all of the constraints and considerations, it can be evaluated according to its desirability in order to place it in a priority ranking amongst your candidate sites, if there is more than one.

Score the candidate sites based on the Desirable Criteria. Rank the sites according to the scores they attain and compare those with the highest scores to reach final decisions on implementation.



3

FAST CHARGING STATION
DESIGN GUIDELINES

ABCD
DESIGN GUIDELINES OVERVIEW

An Overview of an Electric Vehicle Station Design Process

EV charging stations will typically be installed on one of the following three types of sites.

A Parking Lot

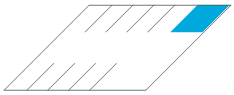
B Parkade

C Curbside

Steps may be modified or omitted as necessary. However, for each of the three station types the sequence on the next page should be followed.

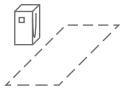
ABCD

DESIGN GUIDELINES OVERVIEW



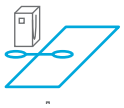
0 Station Location On Existing Site

Determine the best location for installing charging stations on the site.



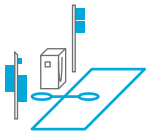
1 Station Configuration

Determine the configuration of parking area charger box, bollards, and wheel stops.



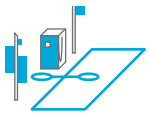
2 Pavement Marking Placement

Determine the pavement marking placement based on station configuration.



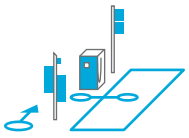
3 Information Board Placement

Determine the placement of the information boards and regulatory signage.



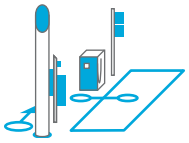
4 Charger Box Vinyl Wrap

Determine graphics for the charger box.



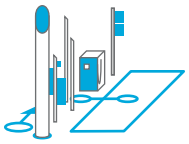
5 Wayfinding

Determine additional paint markings / signage required for wayfinding.



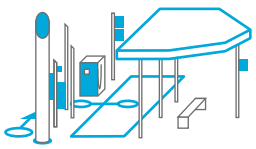
6 Beacon Placement

Add beacon.



7 Network Pole Placement

Add network poles.



8 Additional Station Accessories

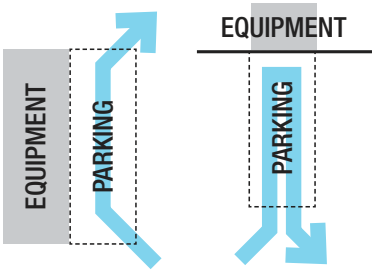
Add seating and canopy.

ABCD
SITE TYPE OVERVIEW

A Parking Lot

Parking lots are frequently selected for EV charging stations, however it is important to dedicate adequate space in the parking lot so that the station is highly visible for both vehicular and pedestrian passersby. It is especially important to address the pedestrian scale in this car-oriented environment.

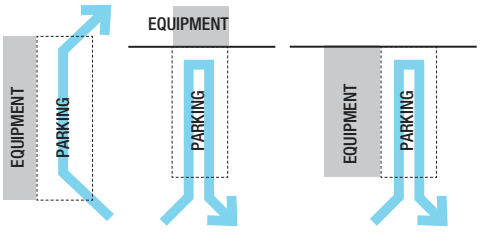
The charging station layout includes four typical stalls to allow for a pull-through configuration with universal access. Installing the equipment zone in a flat space is a simple way to provide universal access, avoiding the curb work otherwise required. The length of the space also allows medium duty vehicles to recharge.



B Parkade

As a car-oriented environment with an accessible electrical supply, parkades are also a frequent choice for EV charging stations.

In this setting, the preferred layouts are typically in-and-out configurations with universal access. However, in some cases, it may be possible to apply a pull-through configuration to a parkade. The ceiling heights in parkades typically prohibit access by medium duty vehicles, so that type of use is not provided for in the parkade layouts.



C Curbside

With broad public visibility for both pedestrian and vehicular passersby, curbsides in high traffic areas are an ideal location for EV charging stations. The preferred layout require two end to end parking stalls for easy pull in and out access. This length also allows for medium duty vehicles to recharge.

D Constrained and Irregular Sites

It is strongly recommended that you locate your charging station on a site with sufficient space to fully execute the peferred station layouts. However, in the case of unavoidable constraints in size or shape, the design guidelines may be adapted to suite the particular conditions of your site.

ABCD

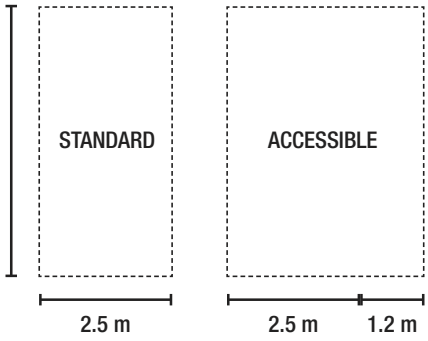
STATION LOCATION ON EXISTING SITE

Station Location on Existing Site

Now that a site has been identified - parking lot, parkade, or curbside - the next step is to choose the optimal location on the site for installing electric vehicle charging station(s). In order to facilitate station installation, maintenance, and public use, consider the following points:

1 Universal Access and General Parking Stall Considerations

Not only is universal access public policy, it is a standard component of good design. Whenever possible, EV charging stations should be universally accessible as part of the effort to facilitate EVs as a mainstream driving option. Universal access requires a 1.2 meter wide access aisle in addition to a standard 2.5 meter parking stall for a total width of 3.7 meters. One central access aisle can serve two parking stalls. In non-curbide layouts, the access aisle is not designated separately; the 3.7 meter width is included in every layout, making this truly 'universal' rather than a special provision.



Keeping the equipment zone on a flat surface contiguous with the parking space also facilitates universal access. However, in any situation with the charging equipment on a curb, whether curbside, in a parkade or parking lot, curb ramps are recommended.

2 Proximity to Site Entrance

Positioning EV charging stations at the entrance of a site may maximize its visibility, however consider the following before making this decision:

- A frequently vacant station may give a poor impression of EV adoption
- Placing charging stations in preferred parking locations near the facility entrance may frustrate some non-EV drivers
- Often the facility entrance is located far from the electrical source; this will increase the cost of station installation

3 Equipment Protection

Site specific circumstances must be considered when locating your charging stations.

Flood Zones - If the site is in a flood prone area, the station must be located above the designated flood elevation (DFE). This could mean locating a station at one end of a parking lot or on the third floor of a parkade. If below the DFE, wet flood proofing or dry flood proofing features must be implemented on the site in order to protect the charging station equipment.

Snow Zones - If the site is in a snow zone, station components may be covered with snow making it invisible to snow plow operators and users. Locate the station in an area which facilitates snow clearing and where cords can be appropriately secured (on wall or overhead) to prevent a tripping hazard or being damaged by snow plows.

Indoor/Outdoor - If the site is outdoors, the station equipment must be rated for outdoor use. Check with the equipment manufacturer for details.

4 Utilities

Due to the intermittant use and large energy draw of DC fast chargers it is important to consult with the local utilities to determine the best option for providing power to the station. The main options - from an host site power source or from an independent BC hydro transformer - are described in detail in Chapter 5, Electrical Design Guidelines. To avoid an increase to a host site's rate structure a new service drop may be considered. Locating the charging station close to the power source will decrease the cost of trenching and wiring.

5 Lighting Considerations

Although most sites will have existing lighting, additional lighting may be installed to improve user experience and station visibility. As site conditions vary, each station should be evaluated independently for additional lighting requirements.

6 Vandalism Considerations

Refer to CPTED (Crime Prevention Through Environmental Design).

A
PARKING LOT DESIGN GUIDELINES

A1 Station Configuration

For the first two steps, refer to Figure A1.1.

1. Determine the type, number, and sequence of charging stations on your site.
In the case of multiple charging stations, it is recommended that you place the stations beside each other at the end of a parking row.

2. Determine parking space(s) size.
For optimal station configuration, designate 4 typical parking spaces for each fast charger and 1 typical parking space for each level two charger.

For the next three steps, refer to Figure A1.2.

3. Determine midline of parking area(s).

4. Place fast charger(s) and bollards.
Place the fast charger 300 mm off the side of the accessible parking area and 1500 mm from the midline. Place the bollard nearest the 'pull out' area 150 mm x 150 mm off of the back corner further from the parking area. Place the bollard nearest the centre of the 'parking area length' on the midline of the parking area,offset 150 mm off of the fast charger.

5. Place level two charger(s), bollards, and wheel stops.

Place the level two charger(s) on the centre line, at the end of each stall. Set the level two chargers 'back to back', perpindicular to the parking area length. Allow adequate space between the two chargers for optimum use. Place the bollards 150 mm x 150 mm off the corners of the level two chargers (similar to the fast charger). Place the wheel stop 500 mm from the level 2 chargers.

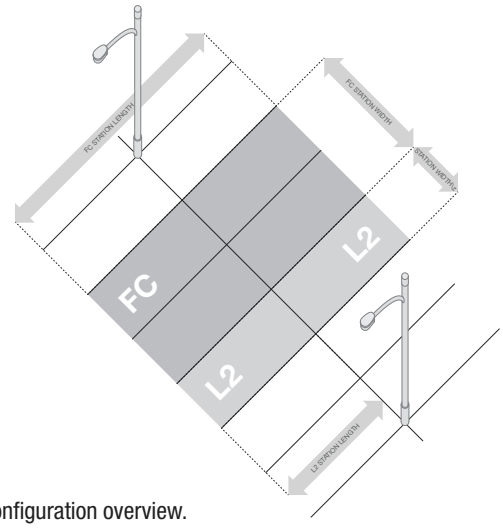


Figure A1.1 Station configuration overview.

Access Notes:
If the site does not have existing parking spaces then you must define the dimensions of the parking space. We recommend a typical parking space of 2.7 m x 5.5 m (non-accessible) or 3.7 m x 5.5 m (accessible); otherwise please refer to your local bylaws for guidelines.

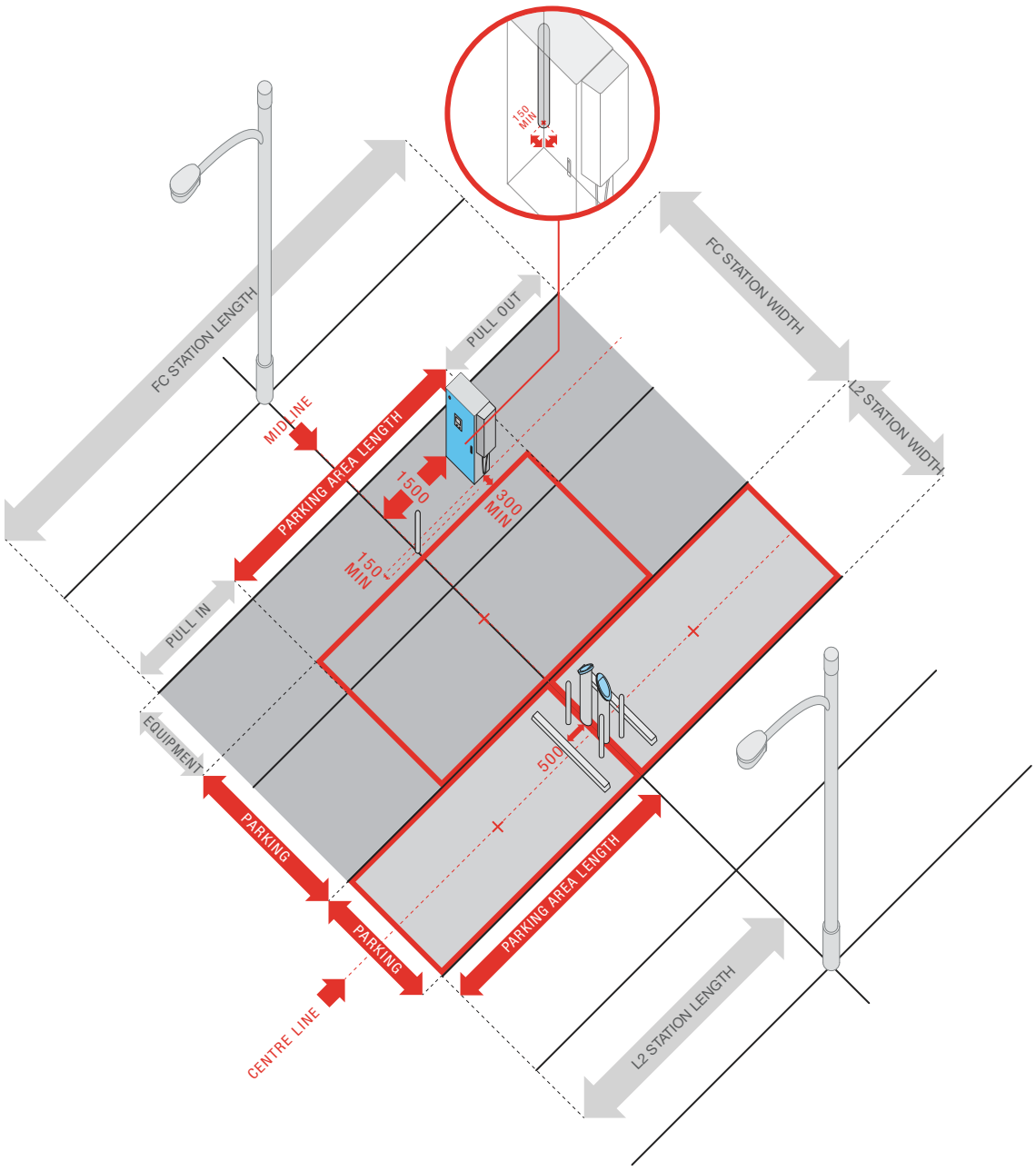


Figure A1.2 Station configuration details.

A
PARKING LOT DESIGN GUIDELINES

A2 Pavement Marking Placement

For details on all steps, refer to Appendix Section - 2.1 - Pavement markings for parking lot.

For this step, refer to Figure A2.1.

1. Wide Boundary Lines
Wide boundary lines mark the extents of the charging station and indicate the direction of vehicle entry/ exit. Apply the parking lot markings parallel to the path of the vehicle in order to define parking lot pull through or pull in / back out style stalls.

Fast Charging Stations Only.
For these next 4 steps, refer to Figure A2.1.

2. Parking Area Box
Place the rounded corner detail at the four corners of the parking area box. Connect the corner details with a typical line.

3. Plug Icon
Place the Plug Icon in relation to the charger. Only one plug icon per charger should be used.

4. Car Icon
Place Car Icon in relation to the Plug Icon and the parking area markings.

5. Connect Icons
Connect the Plug Icon and Car Icon with a typical line.

Level Two Charging Stations Only.
For these next two steps refer to Figure A2.1.

6. Place Logo
Place the logo in the centre of the stall.

7. Paint Wheel Stop
Paint the wheel stops the same blue as the pavement markings.

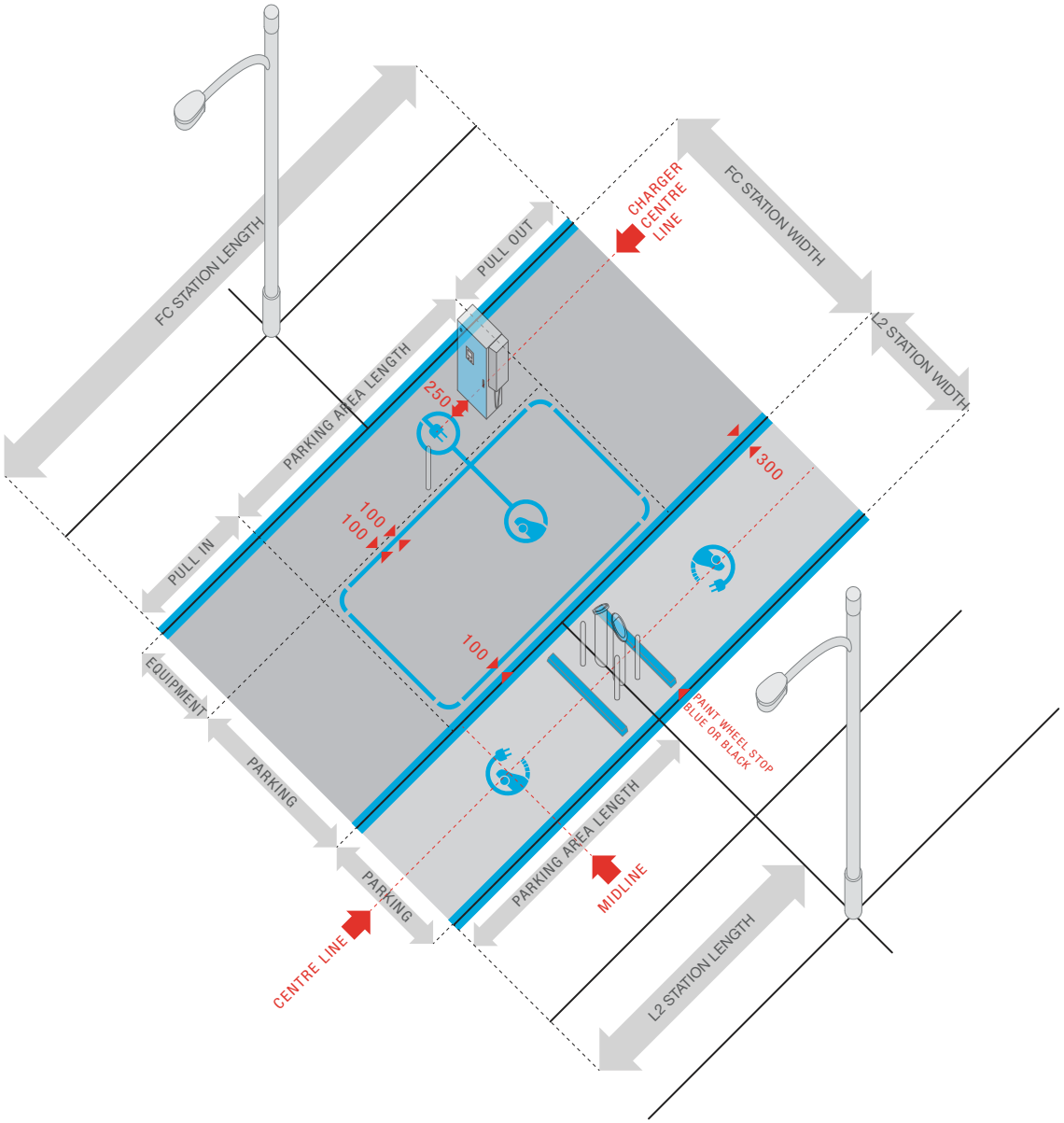


Figure A2.1 Full station pavement markings.

A
PARKING LOT DESIGN GUIDELINES

A3 Signage Placement

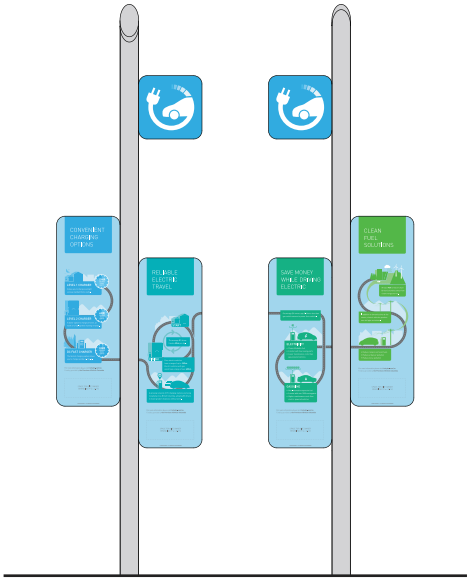


Figure A3.1 Information Sign Front and Back

Information Signage *(Refer to Figure A3.1)*
These four information panels, developed by Powertech and approved by the Province of BC, provide a consistent message across all of the EV charging stations. The panels are intended to be double-sided when affixed to a pole. Where possible, use network poles (refer to section A7) for this application. An area is provided on each panel for host branding if desired, and for the branding still under development for the DC Fast Charging stations. Each panel is 305 mm x 915 mm.

Regulatory Signage *(Refer to Figure A3.2)*
The Ministry of Transportation and Infrastructure (MOTI) has approved EV charging station signage for three purposes: highway service signs, in-town wayfinding signs, and EV parking space signs. Each of the signs approved by MOTI is available in three sizes depending on the location of the signage: local road / low speed, arterial / expressway, and freeway. At the charging stations, the signage should be installed on a standard galvanized steel sign pole.

For the following three steps, refer to Figures A3.3.

Fast Charging Stations Only.

1. Place Information Signage
Place the information sign on the midline, aligned with the back bollard. The signs on the information pole should be set perpendicular to the wide boundary lines.

2. Place Regulatory Signage
Place the regulatory signage pole 150 mm x 150 mm off of the back corner of the fast charger nearest the parking area. The signs on the regulatory signage pole should be set perpendicular to the wide boundary lines.

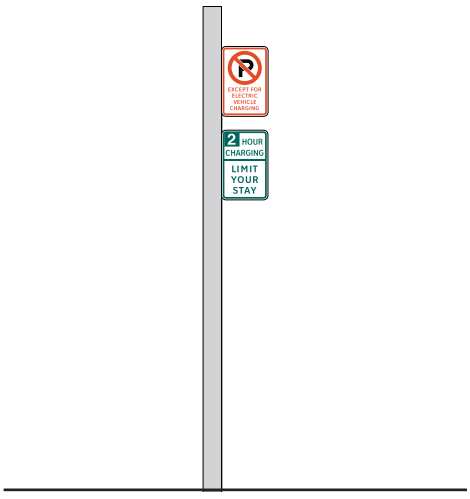


Figure A3.2 Regulatory Sign

Refer to Appendix Section - 2.7 - Regulatory Sign

Level 2 Charging Stations Only.

3. Place Regulatory Signage
Place the regulatory signage pole at the mid point between two of the bollards. The regulatory sign aligns with the center of the level two stall and the bollards. If two level two stations sit back to back, one regulatory signage pole will suffice as long as the signs are double sided and visible from both stalls. The signs on the regulatory signage pole should be set perpendicular to the wide boundary lines.

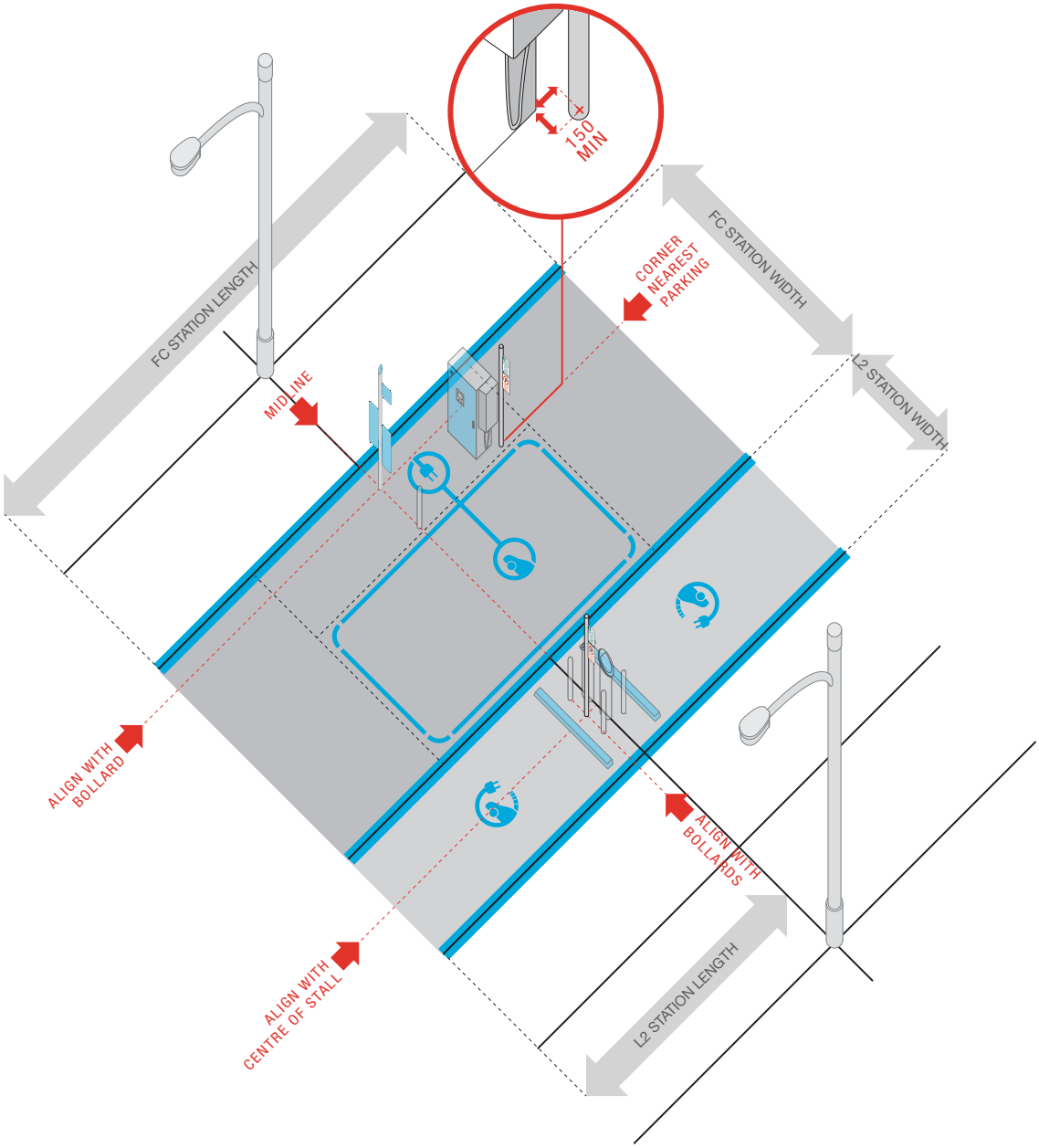


Figure A3.3 Full station pavement markings.

A4 Charger Box Vinyl Wrap

For this step refer to Figures A4.1-A4.4.

1. Fast Charger Vinyl Wrap

Vinyl decals which are placed on one or both sides of the fast charger serve to communicate and reinforce the consistency of the BC electric vehicle initiative to passersby and station users. The vinyl decals are configured differently to accommodate each fast charger model. When ordering, specify the fast charger model to ensure the provided decals fit properly.

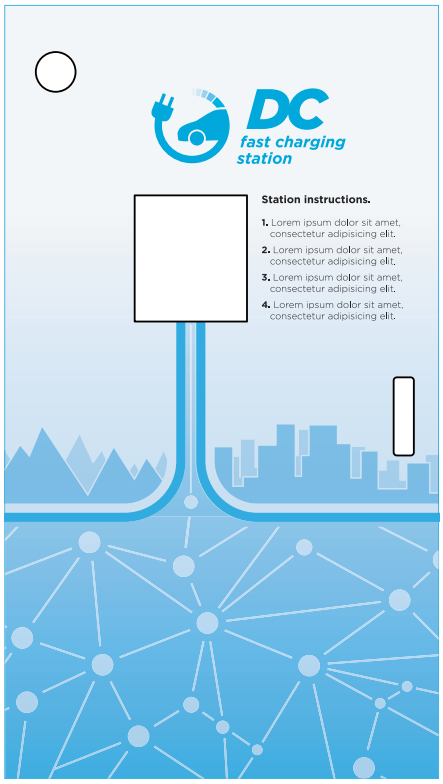


Figure A4.1 Fast Charger Front Vinyl Wrap.

Figure A4.2 Fast Charger Back Vinyl Wrap.

Charger Box Vinyl Wrap

Figure A4.3 Fast Charger Front Vinyl Wrap.

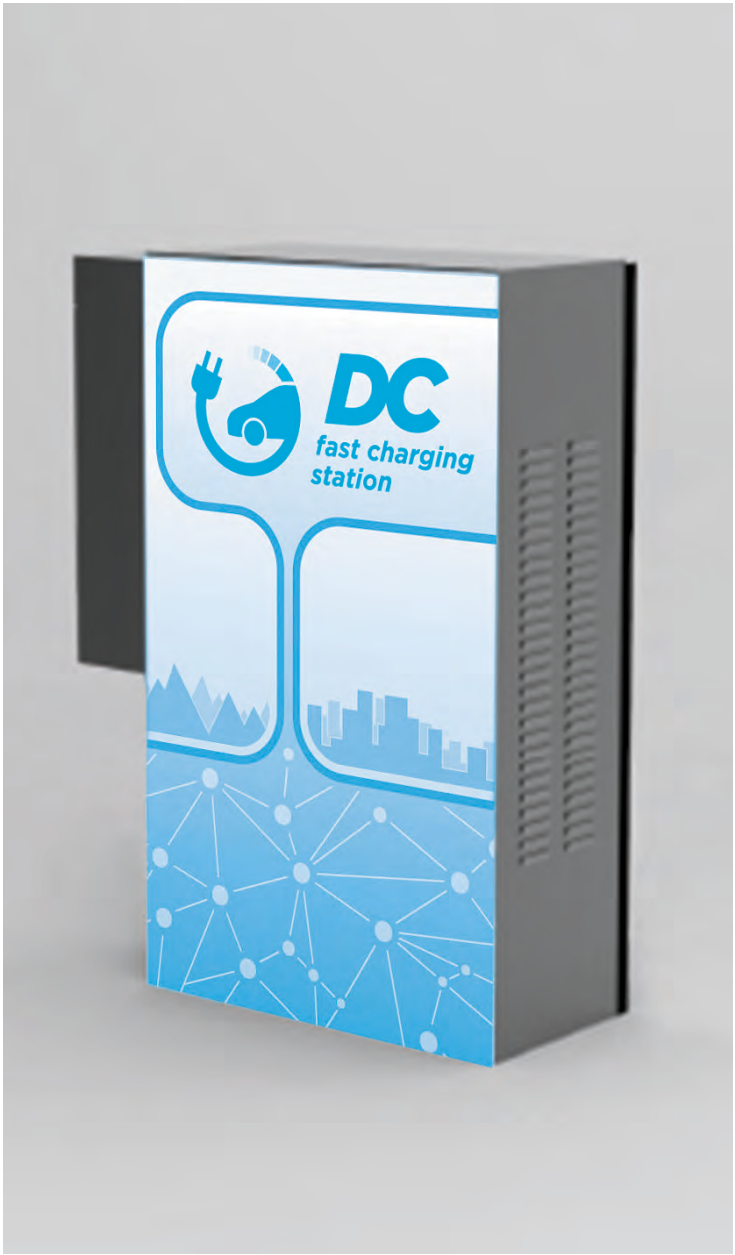


Figure A4.4 Fast Charger Back Vinyl Wrap.

A5 Wayfinding

1. Directional Arrows as Wayfinding *(Refer to Figure A5.1 and A5.2)*

Directional arrows with lines and icons are helpful to direct drivers within a parking lot or parkade if the station is not immediately visible from the entrance.

For this step refer to Figures A5.2.

1. Wayfinding Arrows Best Practices

Sparingly place wayfinding arrows whenever the location of the station might not be immediately apparent.

Wayfinding arrows must be placed in the centre of the travel path. Usually the travel path is the right lane on a two way path, or the entire lane in case of a one way path. The travel path is indicated by the light green fill in Figure A5.2.

Place wayfinding arrows at each turning point (see TP1, TP2. and TP3 in Figure A5.1). DO NOT place wayfinding arrows directly in front fast charging stations or level 2 stations. Excess arrows may cause confusion.

Place an EV charging station logo at the base of the first 'entrance' arrow.

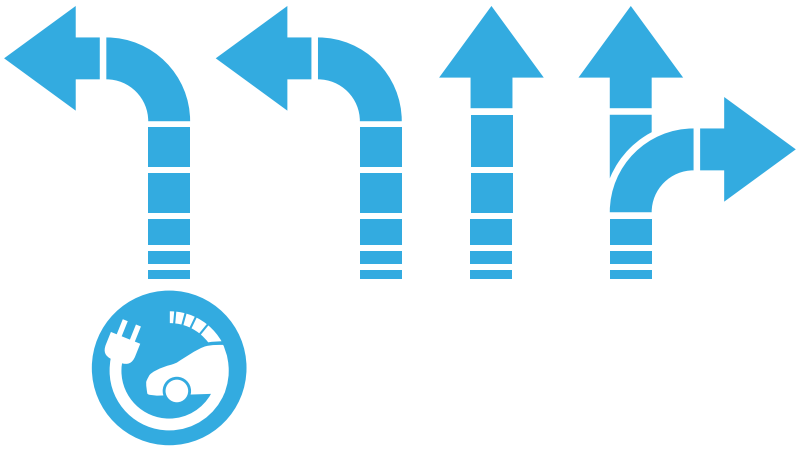


Figure A5.1 Wayfinding Pavement Markings - Entrance Left, Left , Straight, Right or Straight

A5 Wayfinding

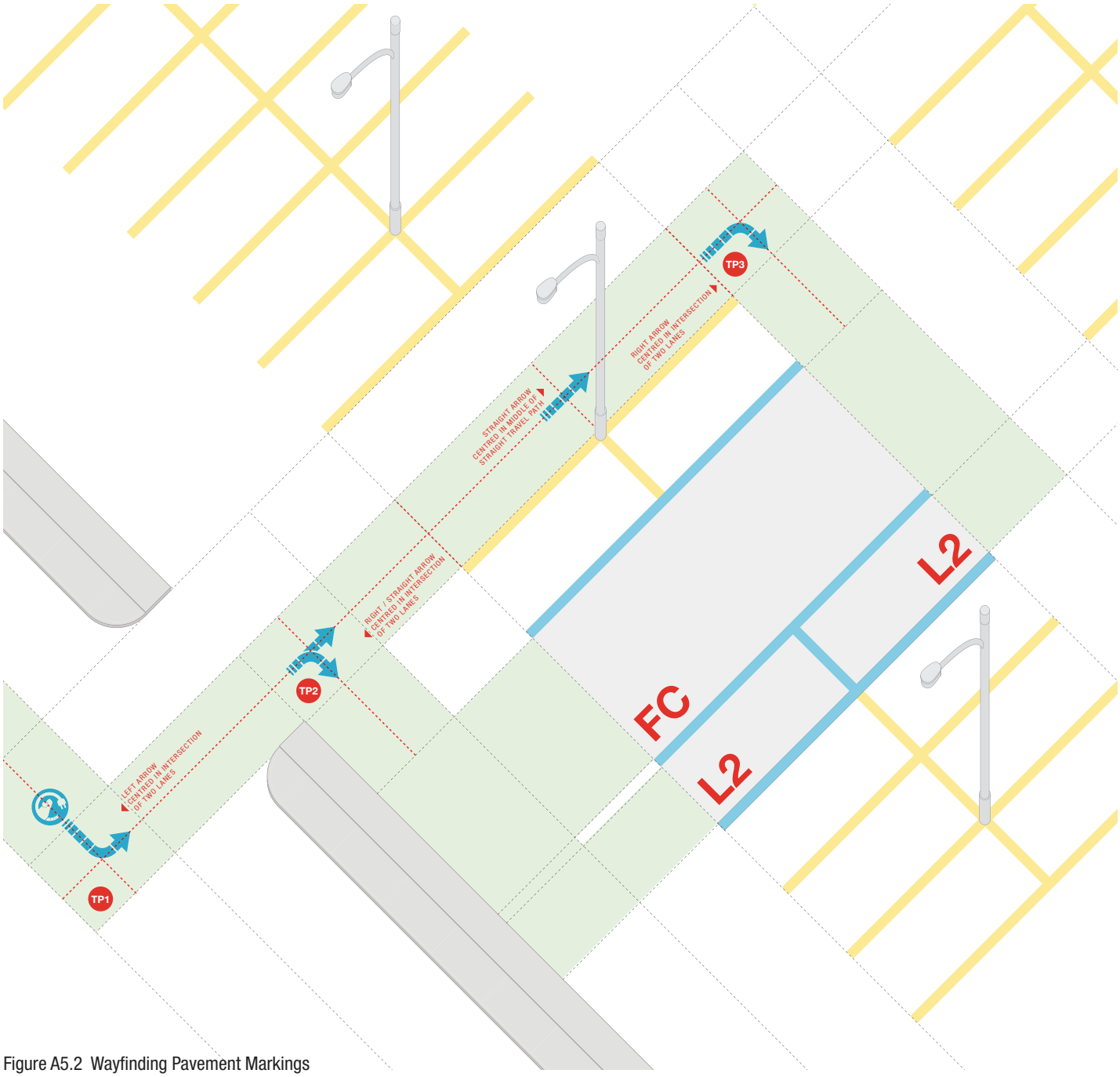


Figure A5.2 Wayfinding Pavement Markings

A6 Beacon placement

Figure A6.1 Beacon

Refer to Appendix Section - 2.8- Beacon for details.

Beacon:

At 5 meters tall, and visible from a distance while driving at speed, the 'beacon' is designed to be the major signage element consistent across every EV charging station. Designed with the appropriate steel gauge, the pole withstands vehicle impact similar to a typical bollard. LED strip lights along the top and bottom meters offer the possibility of a steady glow or interactive lighting which could be designed to respond to vehicle charging or the presence of occupants at the station. The half-pole protruding at the top provides a surface for a logo, front and back, which will be visible from a distance. Optionally, information panels can be integrated with the beacon as a vinyl wrap.

For this step, refer to Figure A6.2.

Fast Charging Stations Only.

1. Position Beacon
Place the beacon in line with centre of the fast charger. Place the beacon at the midpoint of the 'pull in area' (the midpoint between the end of the parking area markings and the end of the entire station).

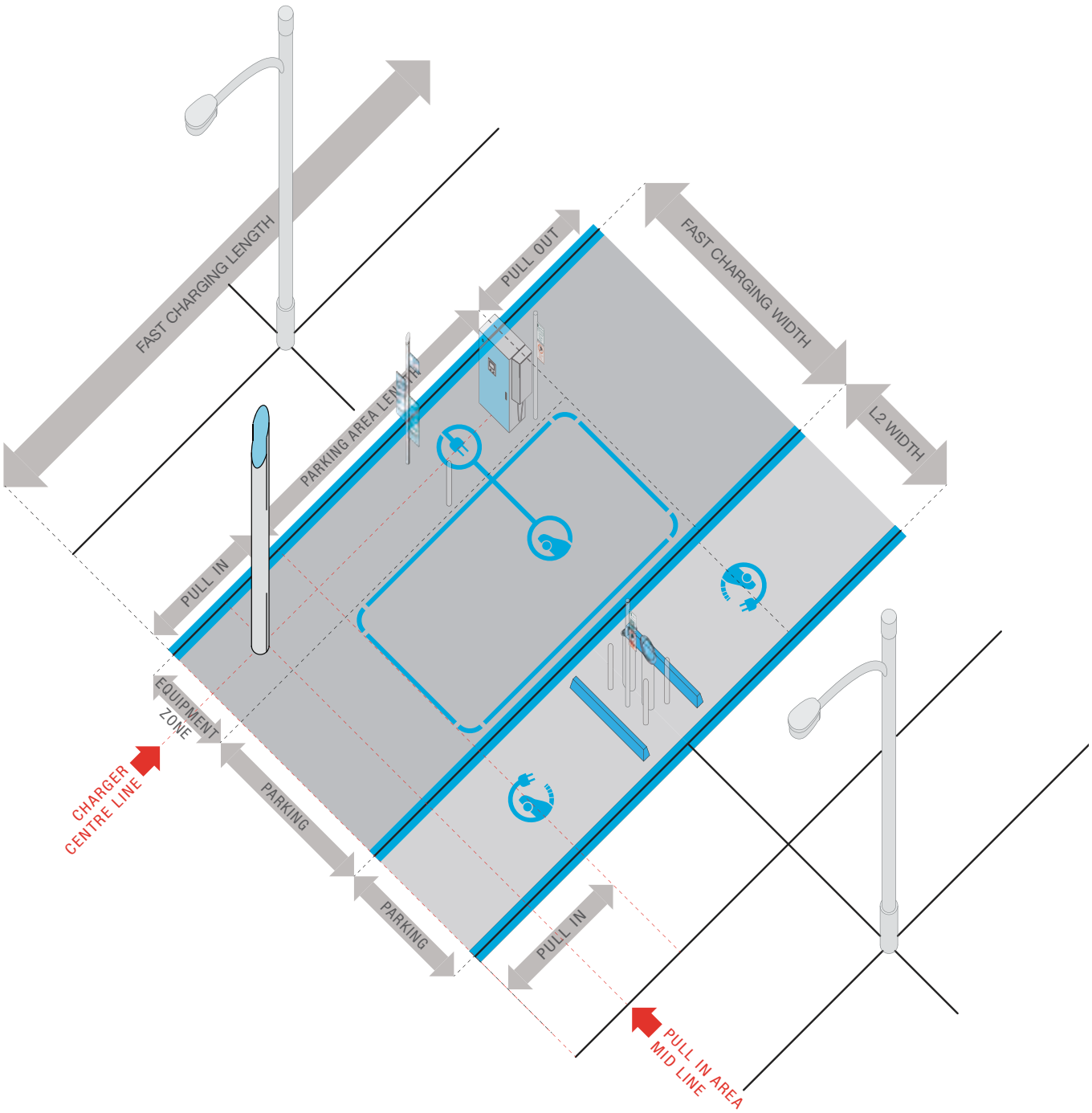


Figure A6.2 Beacon Placement

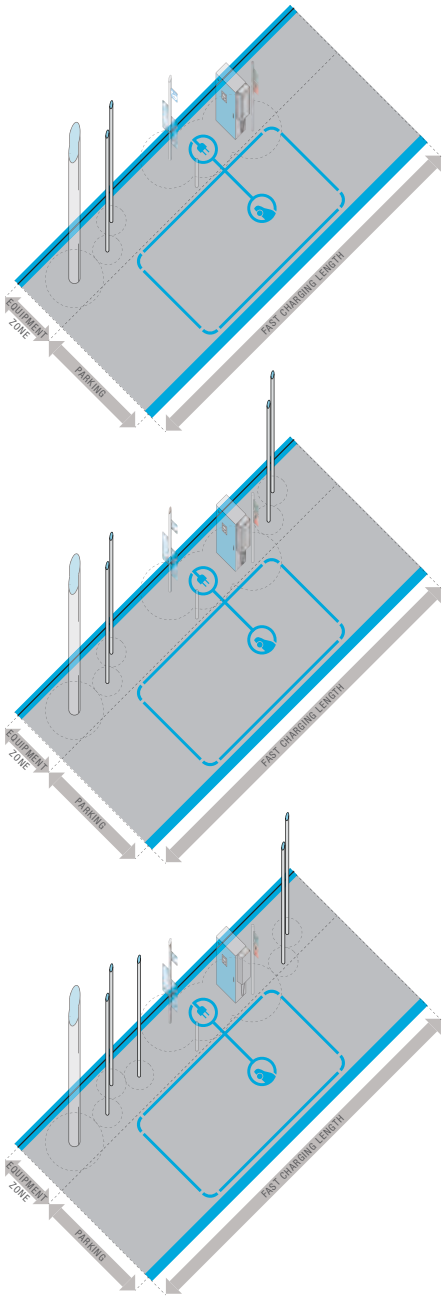


Figure A7.1 Network Pole Placement

A7 Network Pole Placement

Installed in conjunction with the beacon, network poles create a small-scale network at each station, related to the large-scale network across the province. These poles should be used for installation of the information signage.

Refer to Appendix Sections - 2.5 & 2.6 - Network Poles for details.

Fast Charging Stations Only.

For the next two steps, refer to Figure A7.3.

1. Network Pole Clusters

Place the network poles in groups of 2 or 3 in a non-linear pattern. For a group of 3 network poles the first two poles 1000 mm apart at a 45 degree angle and the third pole at a 30 degree angle from the second pole (angles measured from the fast charging station length.) For a pair of network poles, set the poles 1000 mm apart at an angle of 45 degrees (angles measured from the fast charging station length.)

2. Network Pole Cluster Placement

The aforementioned network pole clusters need to be placed in an area where they will not interfere with any vehicle movement, the beacon, the information signage, the regulatory signage, or the fast charger. There must be at least 1500 mm between the network pole cluster and the nearest station element (the beacon, the information signage, the regulatory signage, the fast charger, of the parking / pull through zone.) Align the network pole cluster with one other element in the charging station (in Figure A7.3, the clusters are aligned with the beacon and the regulatory signage.) This ensures a 'spatial relationship' between the network poles and other elements while still maintaining a 'dynamic network' aesthetic.

For the next step, refer to Figure A7.2.

3. Network Pole Heights

To elaborate on the concept of a 'dynamic network', the network poles are varied heights. The network poles should recede in height in increments of 250 mm towards the centre point of the charging station. The tallest network pole in the configuration will be the same height as the information signage pole.

For this note, refer to Figure A7.1.

Note: Variation in Network Pole Configuration

The above rules ensure that the network poles will provide a dynamic sculptural element to the charging station regardless of the shape or size of the station.

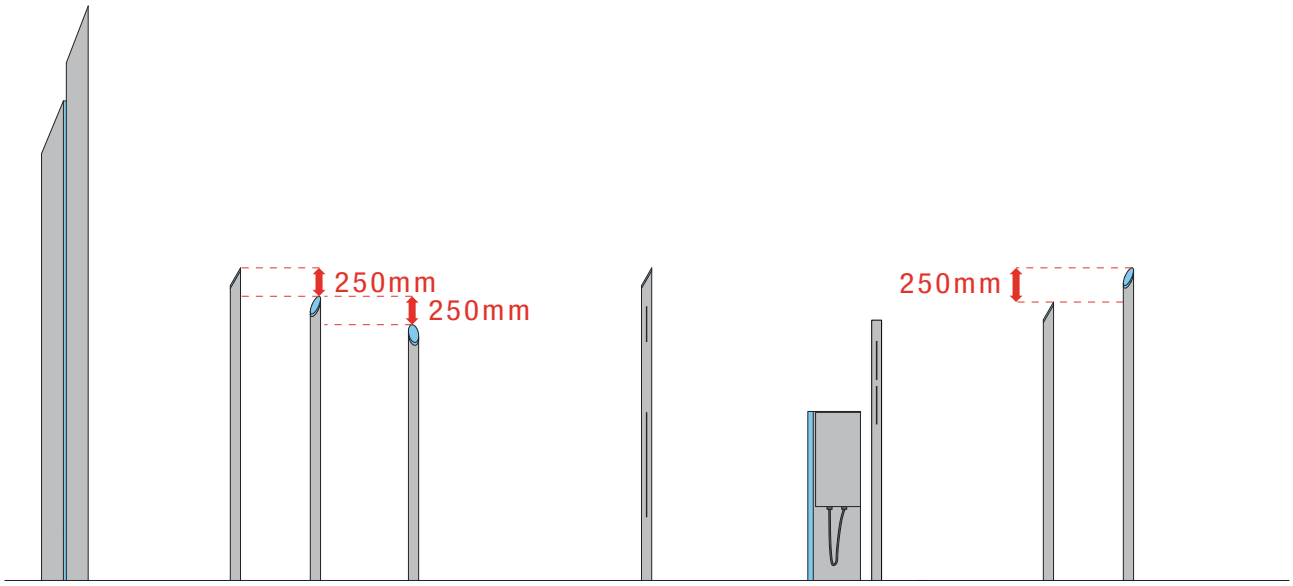


Figure A7.2 Network Pole Height Variations

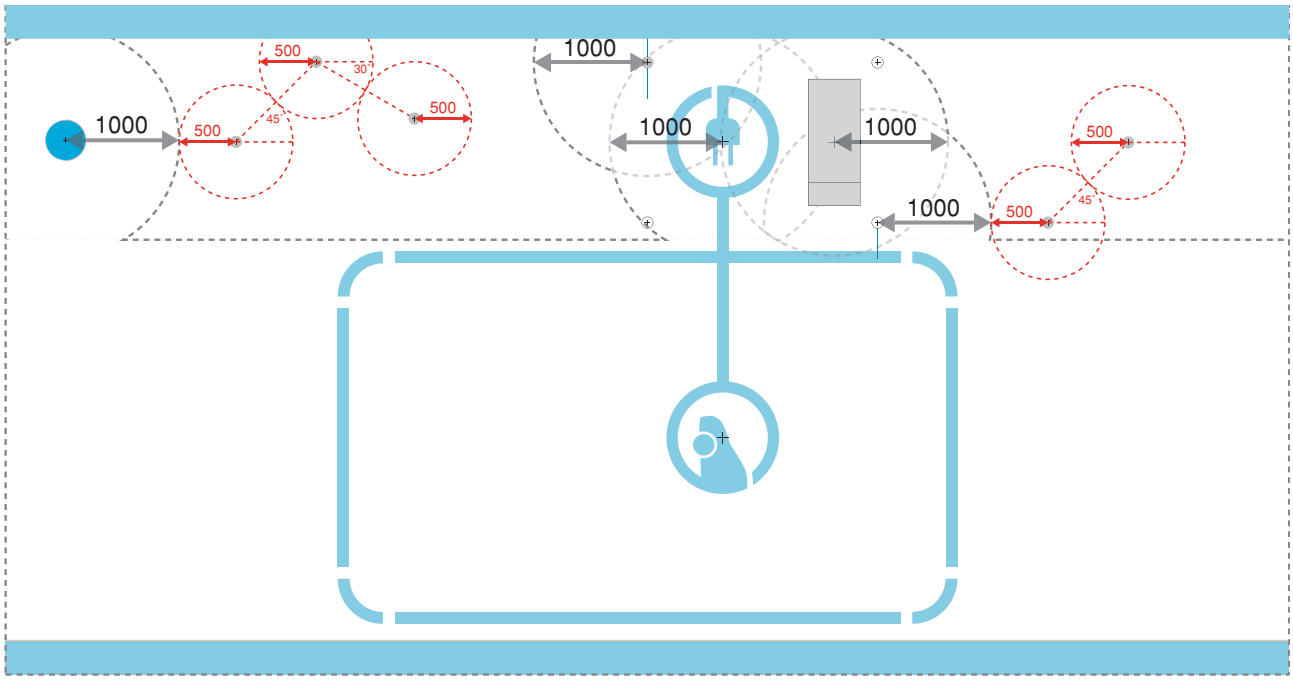


Figure A7.3 Network Pole Placement

B
PARKADE DESIGN GUIDELINES

B1 Station Configuration

For the first two steps, refer to Figure B1.1.

1. Determine the type, number, and sequence of charging stations on your site.
In the case of multiple charging stations, it is recommended that you place the stations beside each other at the end of a parking row.

2. Determine parking space(s) size.
Allocate 4 typical parking spaces for each fast charger and 1 typical parking space for each level two charger.

For the next three steps, refer to Figure B1.2.

3. Determine midline of parking area(s).

4. Place fast charger(s) and bollards.
Place the fast charger 300 mm off the side of the accessible parking area and 1500 mm from the midline. Place the bollards nearest the 'pull out' area 150 mm x 150 mm off of the back corners further from the parking area. Place the bollards nearest the centre of the 'parking area length' on the midline of the parking area,aligned wit the back bollards.

5. Place level two charger(s), bollards, and wheel stop(s).
Place the level two charger(s) on the centre line, at the end of each stall. Set the level two chargers 'back to back', perpindicular to the parking area length. Allow adequate space between the two chargers for optimum use. Place the bollards 150 mm x 150 mm off the corners of the level two chargers (similar to the fast charger). Place the wheel stop 500 mm from the level 2 chargers.

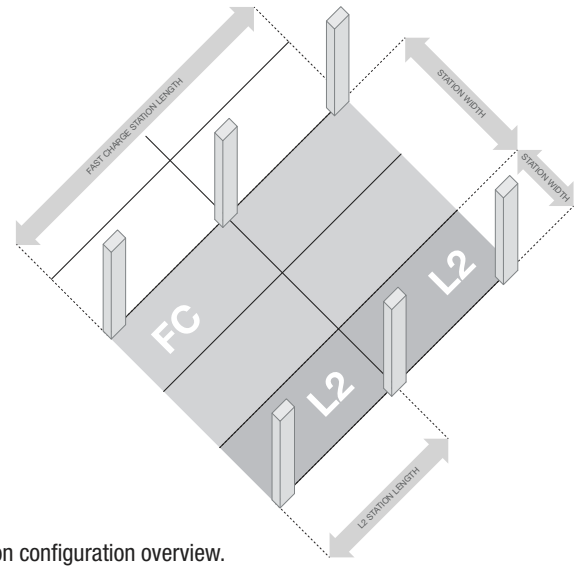


Figure A1.1 Station configuration overview.

Access Notes:
If the site does not have existing parking spaces then you must define the dimensions of the parking space. We recommend a typical parking space of 2.7 m x 5.5 m (non-accessible) or 3.7 m x 5.5 m (accessible); otherwise please refer to your local bylaws for guidelines.

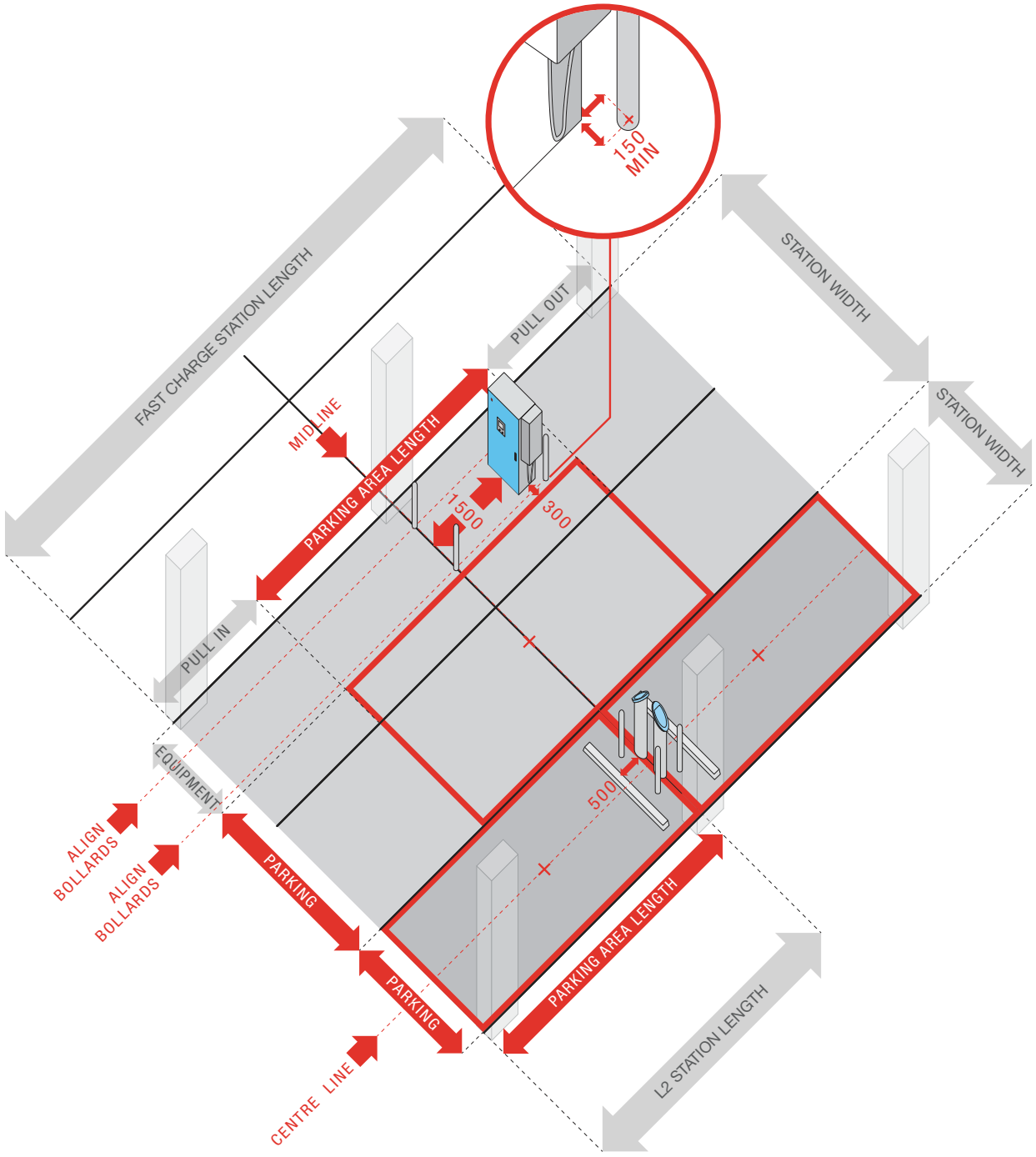


Figure A1.2 Station configuration details.

B
PARKADE DESIGN GUIDELINES

B2 Pavement Marking Placement

Refer to Appendix Section - 2.2 - Pavement markings for parkade for details.

For the first step, refer to Figure B2.1.

1. Wide Boundary Lines
Wide boundary lines mark the extents of the charging station and indicate the direction of vehicle entry/ exit. Apply the parking lot markings parallel to the path of the vehicle in order to define parking lot pull through or pull in / back out style stalls.

Fast Charging Stations Only.

For these next 4 steps, refer to Figure B2.1.

2. Parking Area Box
Place the corner detail at the four corners of the parking area box. Connect the corner details with a typical line.

3. Plug Icon
Place the Plug Icon in relation to the charger. Only one plug icon per charger should be used.

4. Car Icon
Place Car Icon in relation to the Plug Icon and the parking area markings.

5. Connect Icons
Connect the Plug Icon and Car Icon with a typical line.

Level Two Charging Stations Only.

For this next step refer to Figure B2.1.

6. Place Logo
Place the logo in the centre of the stall.

7. Paint Wheel Stop
Paint the wheel stops the same blue as the pavement markings.

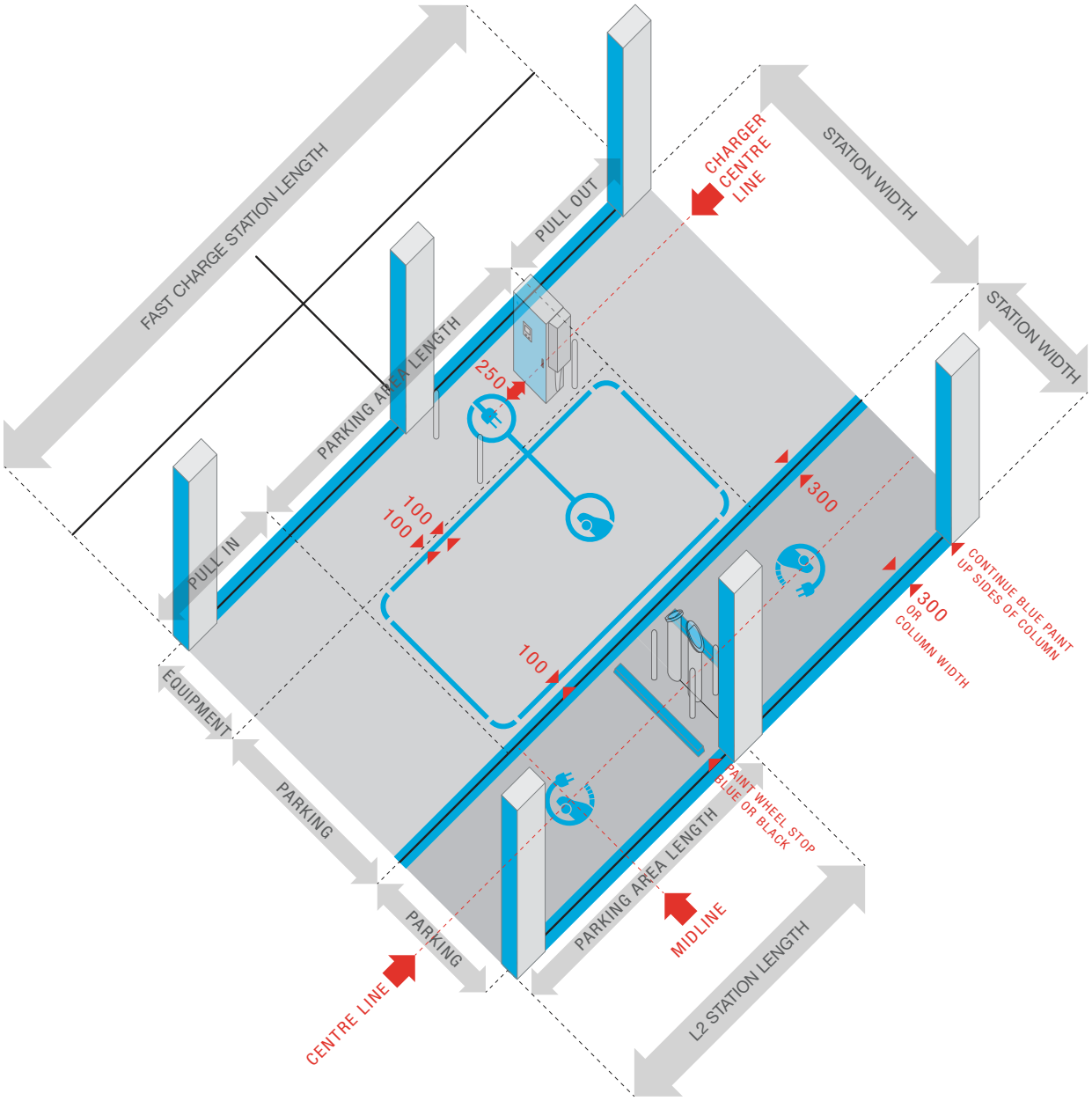


Figure B2.1 Full station pavement markings.

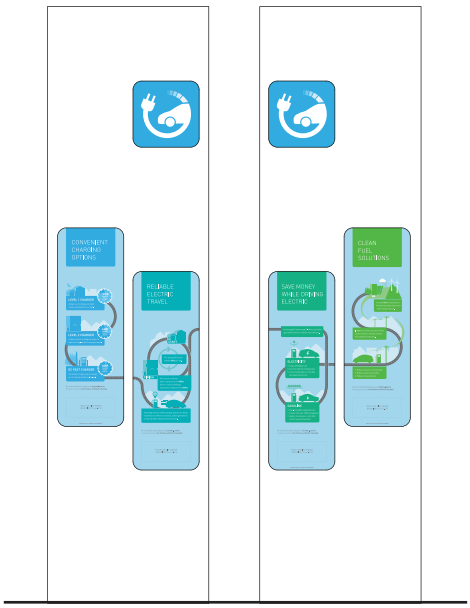


Figure B3.1 Information Signage

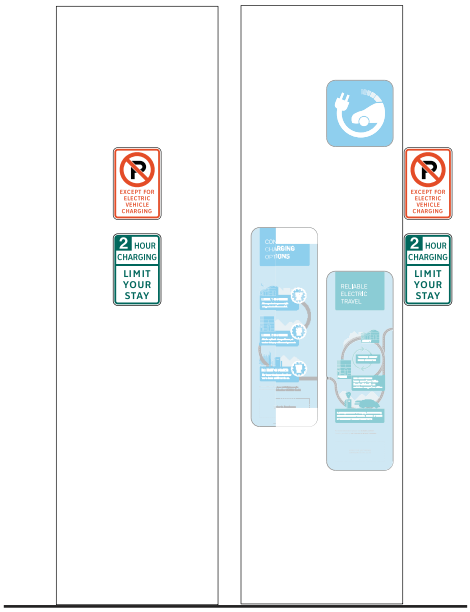


Figure B3.2 Regulatory Signage

B3 Signage Placement

Information Signage *(Refer to Figure B3.1)*
These four information panels, developed by Powertech and approved by the Province of BC, provide a consistent message across all of the EV charging stations. The panels are intended to be double-sided when affixed to a network pole, but in the case of a parkade, they should be affixed as single-sided panels to adjacent surfaces. An area is provided on each panel for host branding if desired and for the branding still under development for the DC Fast Charging stations. Each panel is 305 mm x 915mm.

Regulatory Signage *(Refer to Figure B3.2)*
The Ministry of Transportation and Infrastructure (MOTI) has approved EV charging station signage for three purposes: highway service signs, in-town wayfinding signs, and EV parking space signs. Each of the signs approved by MOTI is available in three sizes depending on the location of the signage: local road / low speed, arterial / expressway, and freeway.

For the following three steps, refer to Figures B3.3.

Fast Charging Stations Only.

1. Place Information Signage
Place the information signage on surfaces immediately surrounding the station such as on columns or walls. If there are no surfaces immediately surrounding the station, place the information signage at the entrance to the parkade in an area that is highly visible and accessible to pedestrians.

2. Place Regulatory Signage
Place the regulatory signage on surfaces immediately surrounding the station such as columns or walls. The signs must be within the station extents and clearly visible from the parking area.

Level 2 Charging Stations Only.

3. Place Regulatory Signage
Place the regulatory signage on surfaces immediately surrounding the station such as columns or walls. The signs must be within the station extents and clearly visible from the parking area.

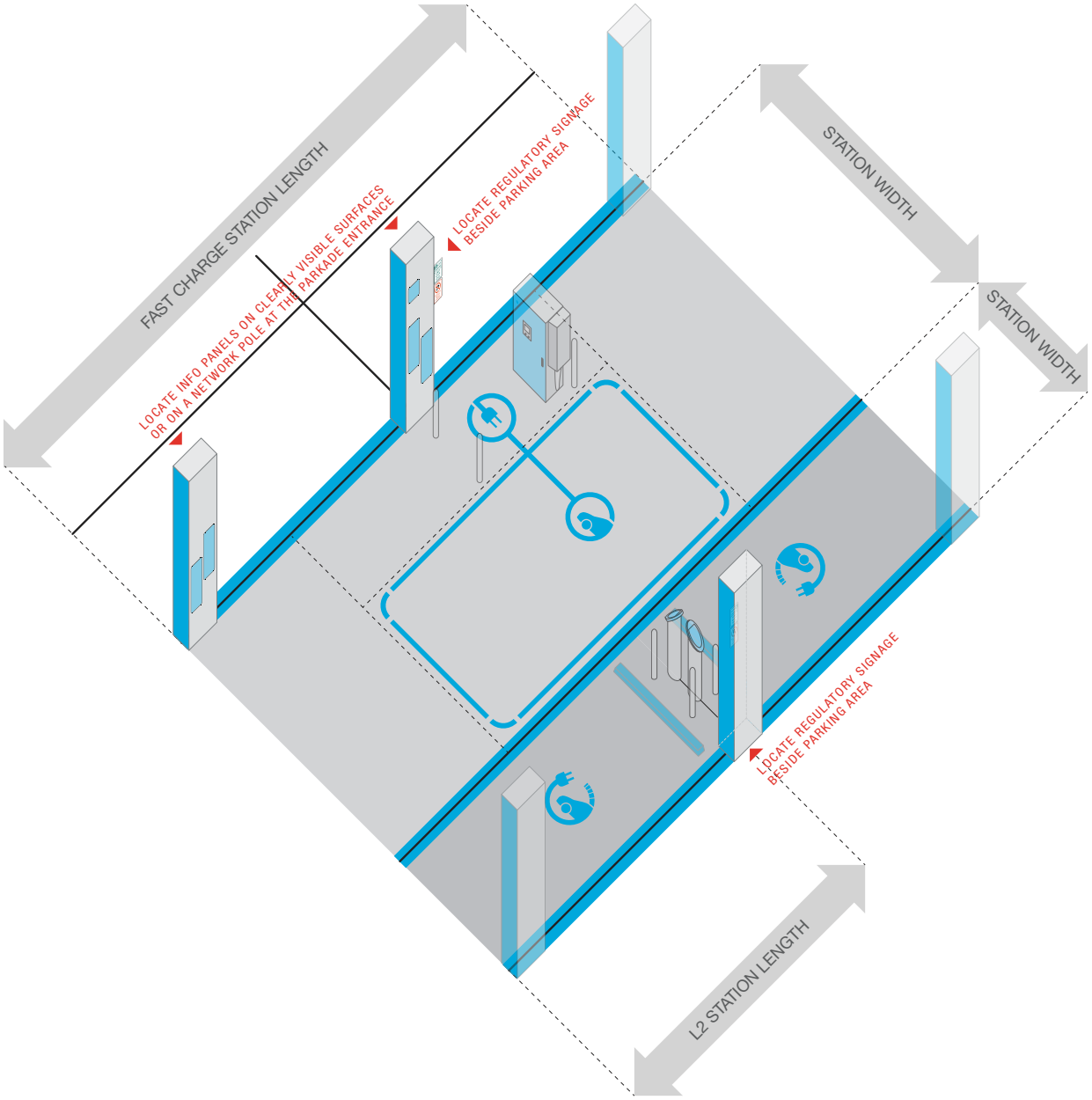


Figure B3.3 Full station pavement markings.

B4 Charger Box Vinyl Wrap

For this step, refer to Figures B4.1-B4.4.

1. Fast Charger Vinyl Wrap

Vinyl decals which are placed on one or both sides of the fast charger serve to communicate and reinforce the consistency of the BC electric vehicle initiative to passersby and station users. The vinyl decals are configured differently to accommodate each fast charger model. When ordering, specify the fast charger model to ensure the provided decals fit properly.

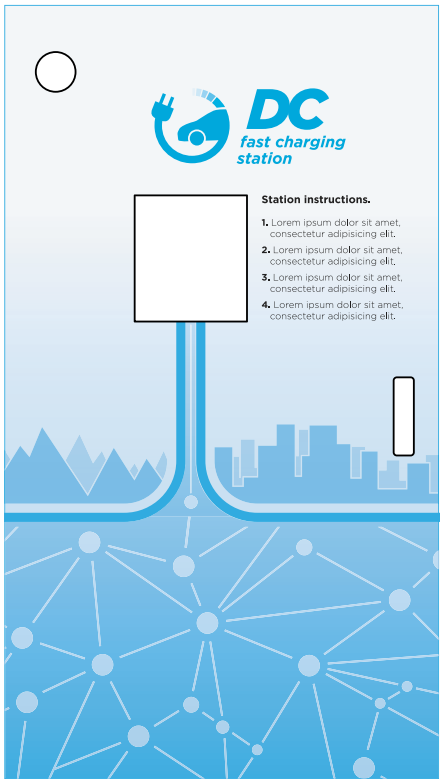


Figure B4.1 Fast Charger Front Vinyl Wrap.

Figure B4.2 Fast Charger Back Vinyl Wrap.

Charger Box Vinyl Wrap

Figure B4.3 Fast Charger Front Vinyl Wrap.

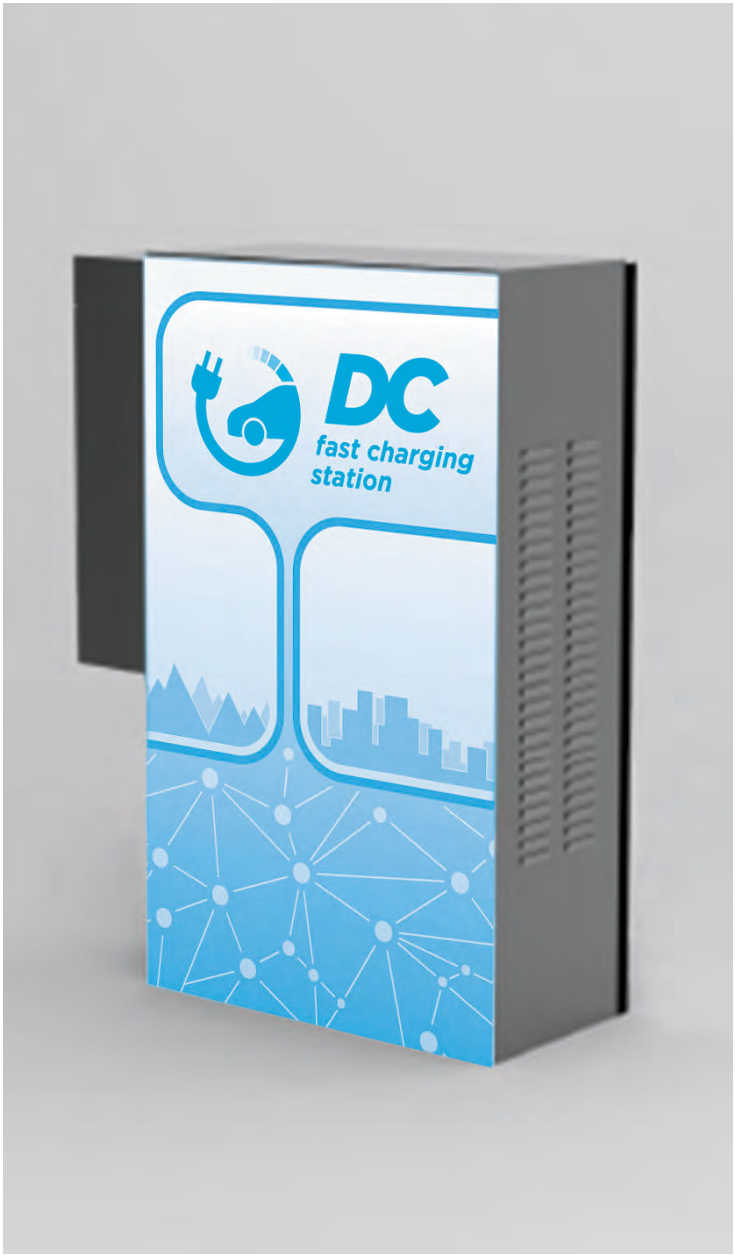


Figure B4.4 Fast Charger Back Vinyl Wrap.

B5 Wayfinding

1. Directional Arrows as Wayfinding *(Refer to Figure B5.1 and B5.2)*

Directional arrows with lines and icons are helpful to direct drivers within a parkade if the station is not immediately visible from the entrance.

For this step refer to Figures B5.2.

1. Wayfinding Arrows Best Practices

Sparingly place wayfinding arrows whenever the location of the station might not be immediately apparent.

Wayfinding arrows must be placed in the centre of the travel path. Usually the travel path is the right lane on a two way path, or the entire lane in case of a one way path. The travel path is indicated by the light green fill in Figure B5.2.

Place wayfinding arrows at each turning point (see TP1, TP2. and TP3 in Figure B5.1). DO NOT place wayfinding arrows directly in front fast charging stations or level 2 stations. Excess arrows may cause confusion.

Place an EV charging station logo at the base of the first ‘entrance’ arrow.

A sign with the EV charging station logo should be placed near the entrance of the parkade.

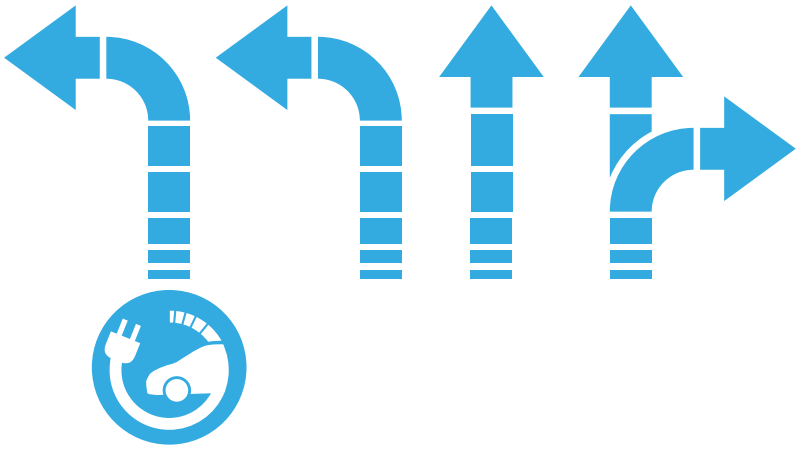


Figure B5.1 Wayfinding Pavement Markings - Entrance Left, Left , Straight, Right or Straight

B5 Wayfinding

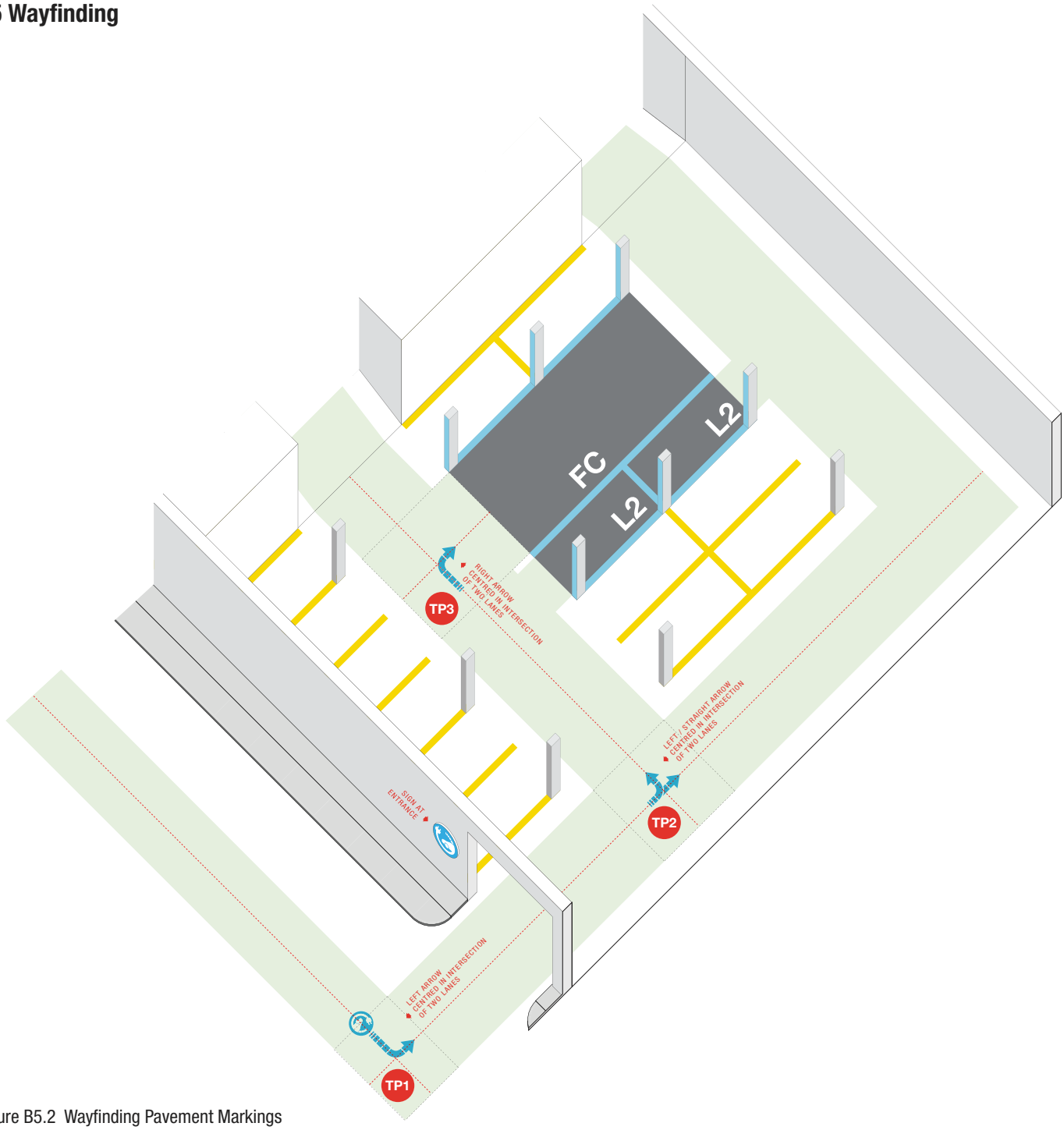


Figure B5.2 Wayfinding Pavement Markings

B6 Beacon placement

Figure B6.1 Beacon

Refer to Appendix Section - 2.8- Beacon for details.

Beacon:
At 5 meters tall, and visible from a distance while driving at speed, the 'beacon' is designed to be the major signage element consistent across every EV charging station. Designed with the appropriate steel gauge, the pole withstands vehicle impact similar to a typical bollard. LED strip lights along the top and bottom meters offer the possibility of a steady glow or interactive lighting which could be designed to respond to vehicle charging or the presence of occupants at the station. The half-pole protruding at the top provides a surface for a logo, front and back, which will be visible from a distance. Optionally, information panels can be integrated with the mother pole as a vinyl wrap.

For this step, refer to Figure B6.2.

Exterior entrance of parkade only - Fast charging stations only.

1. Position Beacon
Place the beacon outside of the parkade in an area that is visible to EV drivers but does not interfere with pedestrian traffic. In this example, the beacon is placed on a grassy area between the parkade and the sidewalk (equipment zone.) Place the beacon 1500 mm away from the parkade entrance. Centre the beacon on the zone which does not interfere with vehicular or pedestrian traffic (equipment zone.)

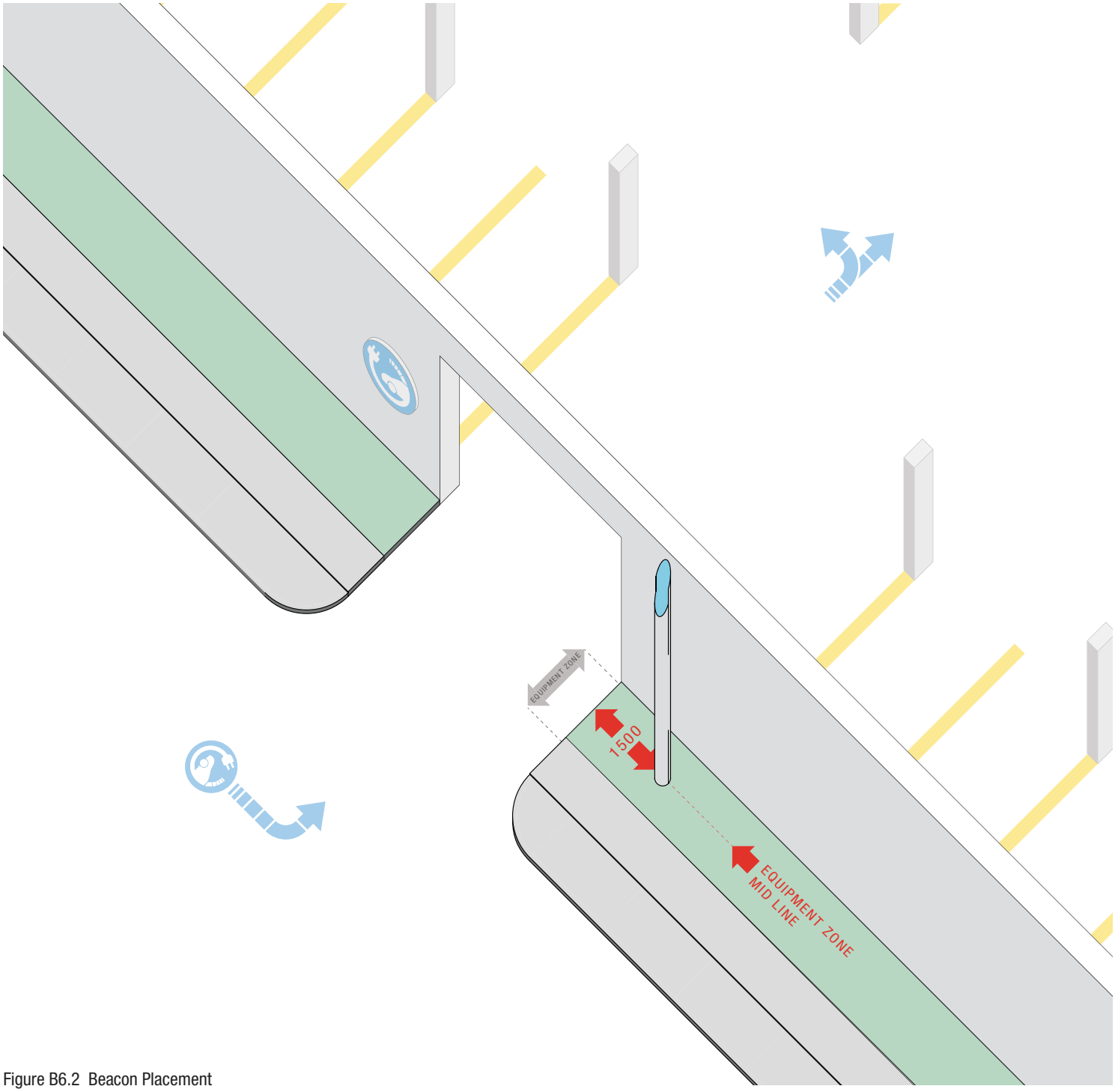


Figure B6.2 Beacon Placement

C
CURBSIDE DESIGN GUIDELINES

C1 Station Configuration

For the first two steps, refer to Figure C1.1.

1. Determine the type, number, and sequence of charging stations on your site.
In the case of multiple charging stations, place the fast charging station(s) first in the sequence of chargers and the level two charging station(s) behind.

2. Determine parking space(s) size.
Allocate 2 typical parking spaces for each fast charger and 1 typical parking space for each level two charger.

For the next three steps, refer to Figure C1.2.

3. Determine midline of parking area(s).

4. Place fast charger(s) and bollards.
Place the fast charger on the mid line, 600 mm from the curb on the sidewalk. Place the bollard 1500 mm x 150 mm off of the fast charger's front corner nearest the 'pull out' area. The front of the fast charger must face the pull-in direction of the station, perpendicular to the station length.

5. Place level two charger(s) and bollards.

Place the level two charger(s) on the mid line, 600 mm from the curb on the sidewalk. Place bollards 150 mm x 150 mm off the corners of the level two chargers. The front of the level two charger must face the pull-in direction of the station, perpendicular to the station length.

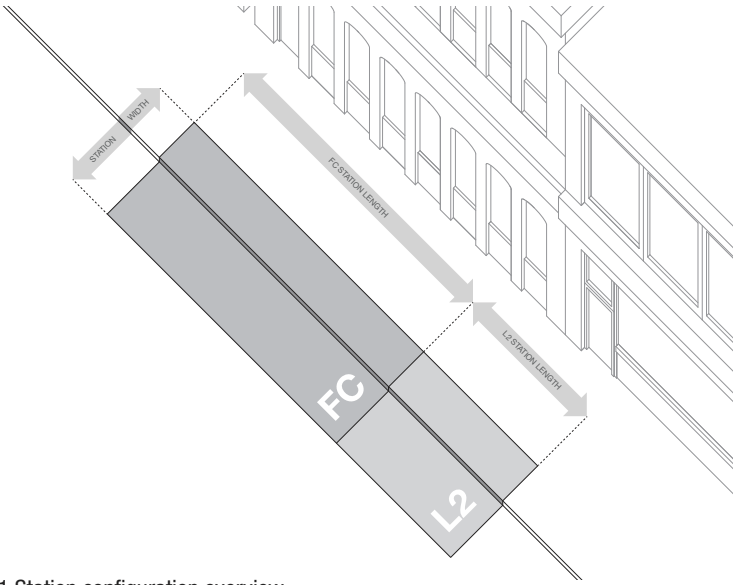


Figure C1.1 Station configuration overview.

Access Notes:
If the site does not have existing parking spaces then you must define the dimensions of the parking space. We recommend a typical parking space of 2.7m x 5.5m (non-accessible) or 3.7m x 5.5m (accessible); otherwise please refer to your local bylaws for guidelines.

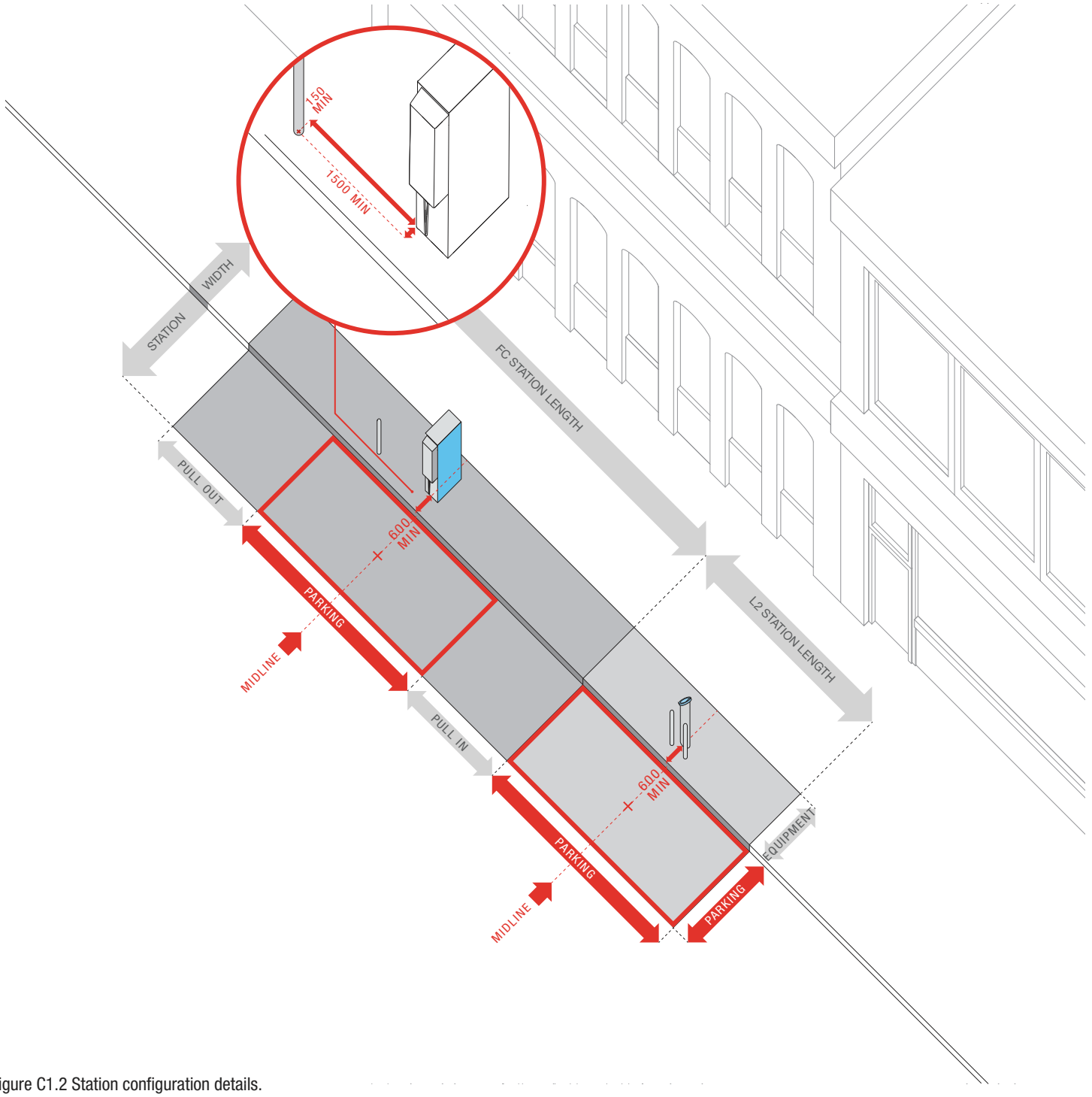


Figure C1.2 Station configuration details.

C
CURBSIDE DESIGN GUIDELINES

C2 Pavement Marking Placement

For all steps, refer to Appendix Section - 2.3 - Pavement markings for curbside for details.

For this step, refer to Figure C2.1.

1. Wide Boundary Lines and Dashed Curb Lines
Wide boundary lines mark the extents of the charging station and indicate the direction of vehicle entry/exit. Apply the parking lot markings perpendicular to the path of the vehicle in order to define curbside parallel parking type stalls. Apply dashed markings along the lip of the curb to visually differentiate between the parking space and pedestrian space.

Fast Charging Stations Only

For these next 4 steps, refer to Figure C2.1.

2. Parking Area Box
Place the corner detail at the four corners of the parking area box. Connect the corner details with a typical line.

3. Plug Icon
Place the Plug Icon 750 mm off of the end of the fast charger. Only one Plug Icon per charger should be used.

4. Car Icon
Place Car Icon in relation to the Plug Icon and centred in the parking area markings.

5. Connect Icons
Connect the Plug Icon and Car Icon with a typical line.

Level Two Charging Stations Only.

For this next step refer to Figure C2.1.

6. Place Logo
Place the logo icon at the intersection of the centre line and midline in the level 2 charger parking space.

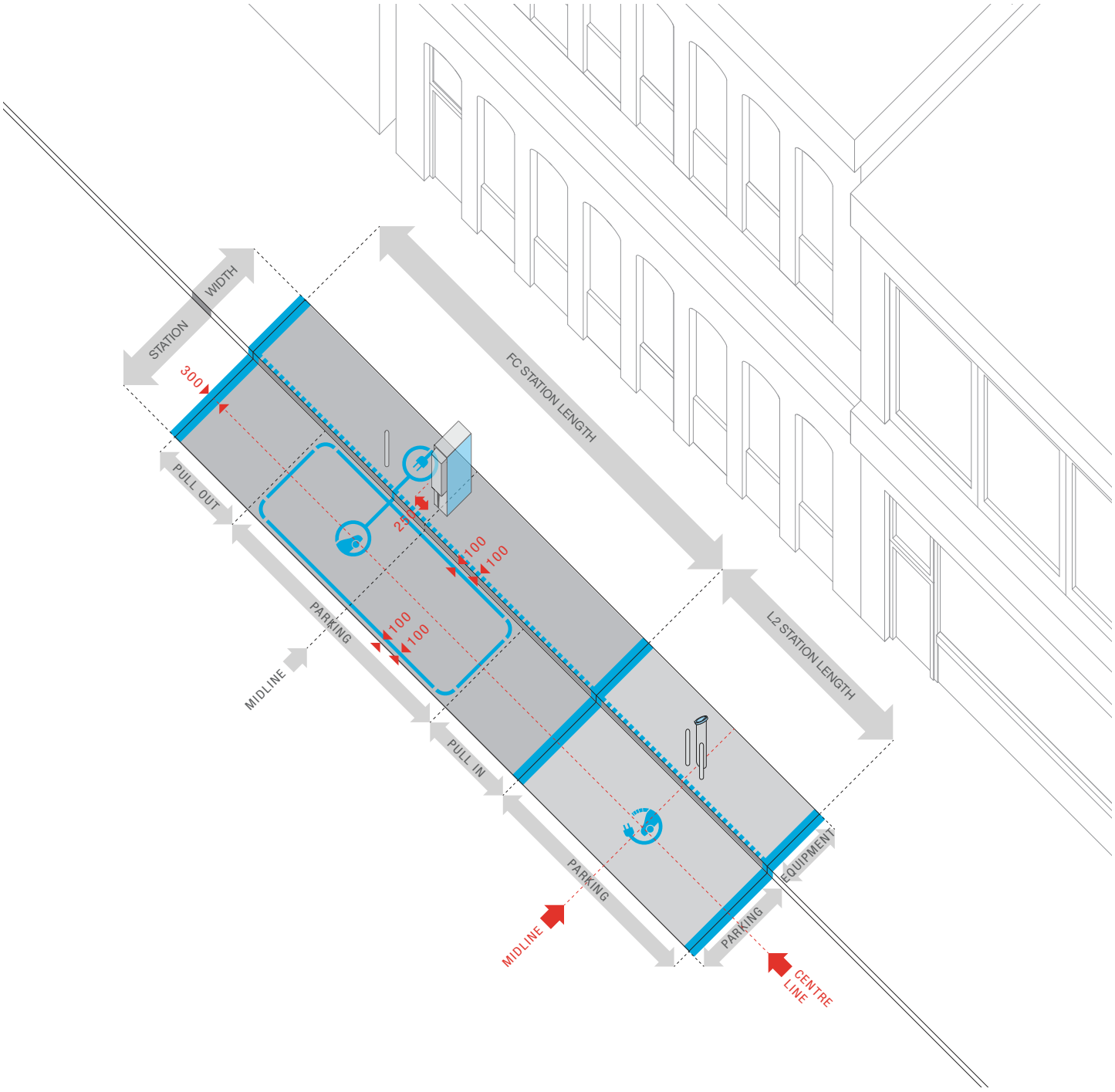


Figure C1.3 Full station pavement markings.

C3 Signage Placement

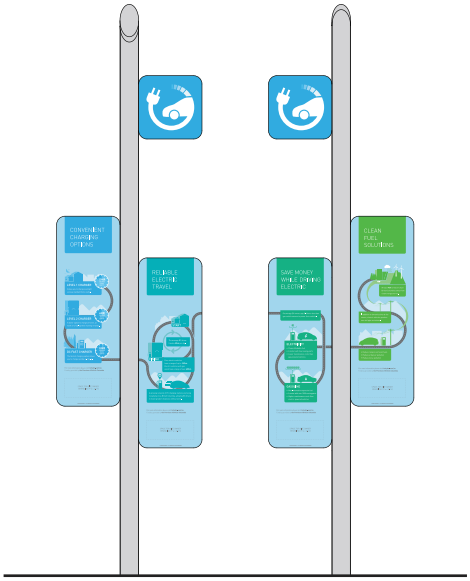


Figure C3.1 Information Sign Front and Back

Refer to Appendix Section - 2.5 - Network Poles

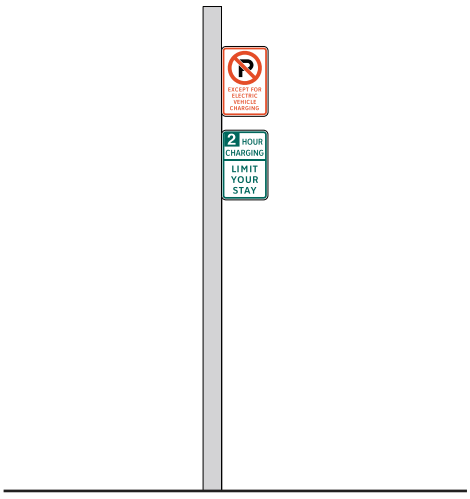


Figure C3.2 Regulatory Sign

Refer to Appendix Section - 2.7 - Regulatory Sign

Information Signage *(Refer to Figure C3.1)*
These four information panels, developed by Powertech and approved by the Province of BC, provide a consistent message across all of the EV charging stations. The panels are intended to be double-sided when affixed to a pole. Where possible, use network poles (refer to section A7) for this application. An area is provided on each panel for host branding if desired, and for the branding still under development for the DC Fast Charging stations. Each panel is 305 mm x 915 mm.

Regulatory Signage *(Refer to Figure C3.2)*
The Ministry of Transportation and Infrastructure (MOTI) has approved EV charging station signage for three purposes: highway service signs, in-town wayfinding signs, and EV parking space signs. Each of the signs approved by MOTI is available in three sizes depending on the location of the signage: local road / low speed, arterial / expressway, and freeway. At the charging stations, the signage should be installed on a standard galvanized steel sign pole.

For the following three steps, refer to Figures C3.3.

Fast Charging Stations Only.

1. Place Information Signage
Place the information pole in line with the corner of the fast charger furthest from the parking area. Align the information pole with the 'top edge' of the parking area. The signs on the information pole must be set perpendicular to the wide boundary lines.

2. Place Regulatory Signage
Place the regulatory signage pole 150 mm x 150 mm off the back corner of the fast charger closest to the parking area. The signs on the regulatory signage pole must be set to face oncoming vehicles.

Level 2 Charging Stations Only.

3. Place Regulatory Signage
Place the regulatory signage pole at the mid point between the level 2 charger and the end of the station (or parking area if there is more than one level 2 charger). Align the regulatory signage pole with the level 2 charger's bollards.

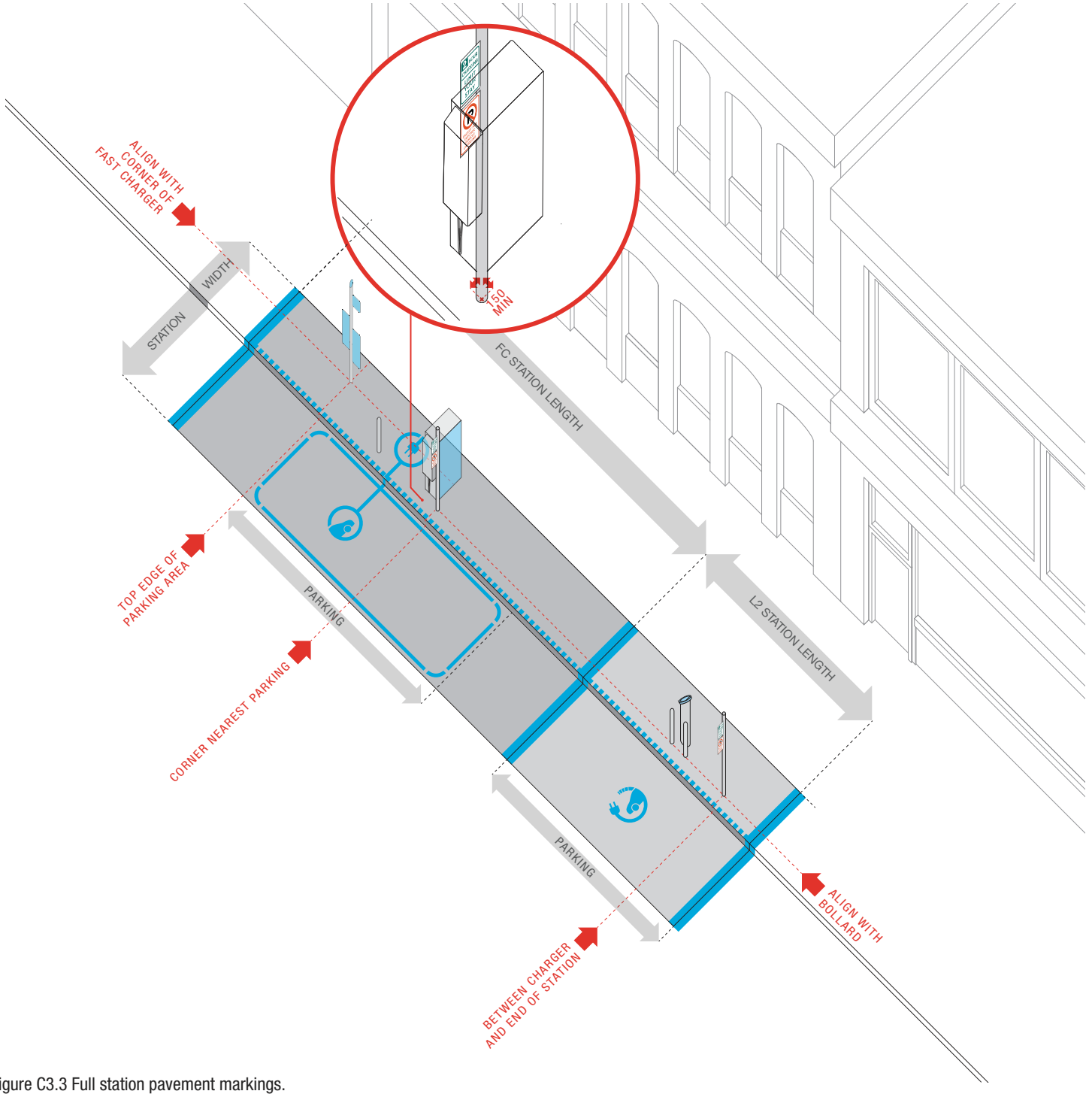


Figure C3.3 Full station pavement markings.

C4 Charger Box Vinyl Wrap

For this step, refer to Figures C4.1-C4.4.

1. Fast Charger Vinyl Wrap

Vinyl decals which are placed on one or both sides of the fast charger serve to communicate and reinforce the consistency of the BC electric vehicle initiative to passersby and station users. The vinyl decals are configured differently to accommodate each fast charger model. When ordering, specify the fast charger model to ensure the provided decals fit properly.

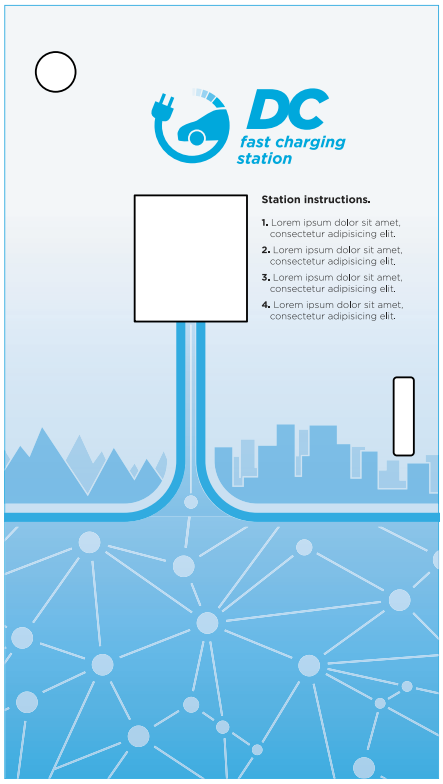


Figure C4.1 Fast Charger Front Vinyl Wrap.

Figure C4.2 Fast Charger Back Vinyl Wrap.

Charger Box Vinyl Wrap

Figure C4.3 Fast Charger Front Vinyl Wrap.

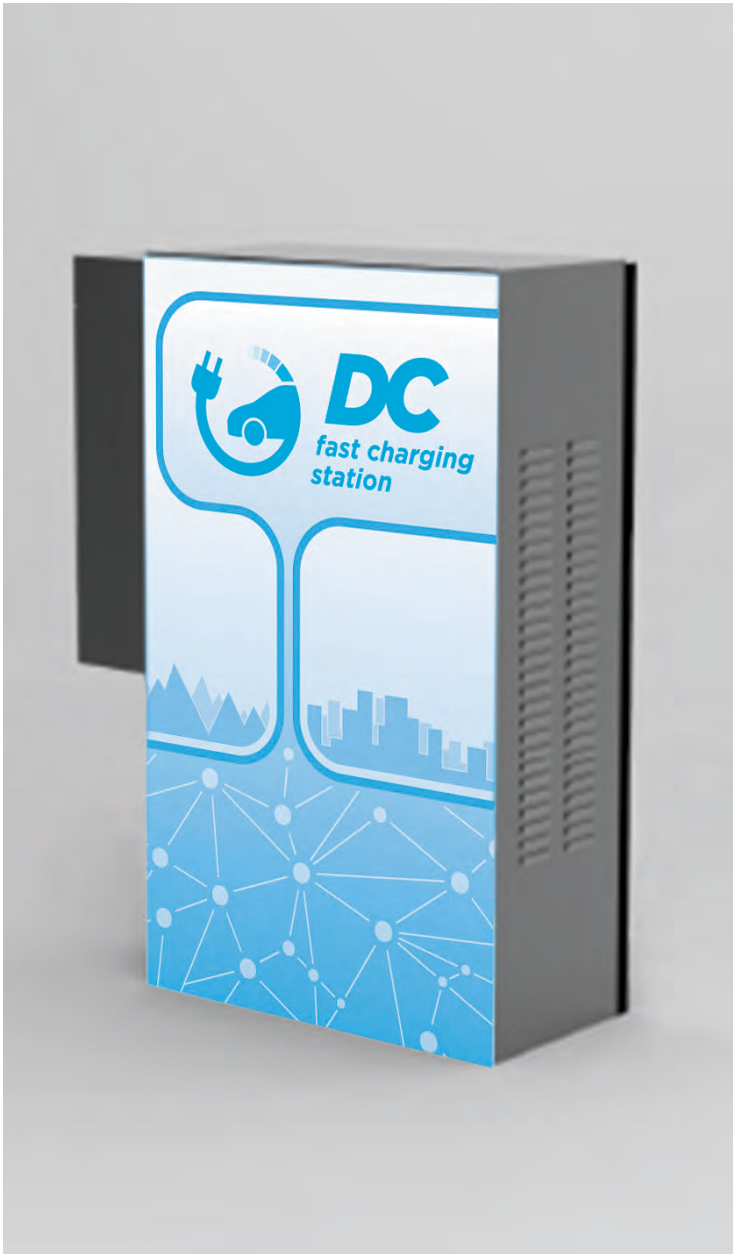


Figure C4.4 Fast Charger Back Vinyl Wrap.

C5 Beacon placement

Figure C5.1 Beacon

Refer to Appendix Section - 2.8- Beacon for details.

Beacon:
At 5 meters tall, and visible from a distance while driving at speed, the 'beacon' is designed to be the major signage element consistent across every EV charging station. Designed with the appropriate steel gauge, the pole withstands vehicle impact similar to a typical bollard. LED strip lights along the top and bottom meters offer the possibility of a steady glow or interactive lighting which could be designed to respond to vehicle charging or the presence of occupants at the station. The half-pole protruding at the top provides a surface for a logo, front and back, which will be visible from a distance. Optionally, information panels can be integrated with the mother pole as a vinyl wrap.

For this step, refer to Figure C5.2.

Fast Charging Stations Only.

1. Position Beacon
Place the beacon in line with centre of the fast charger. Place the beacon a minimum of 1500 mm away from the fast charger.

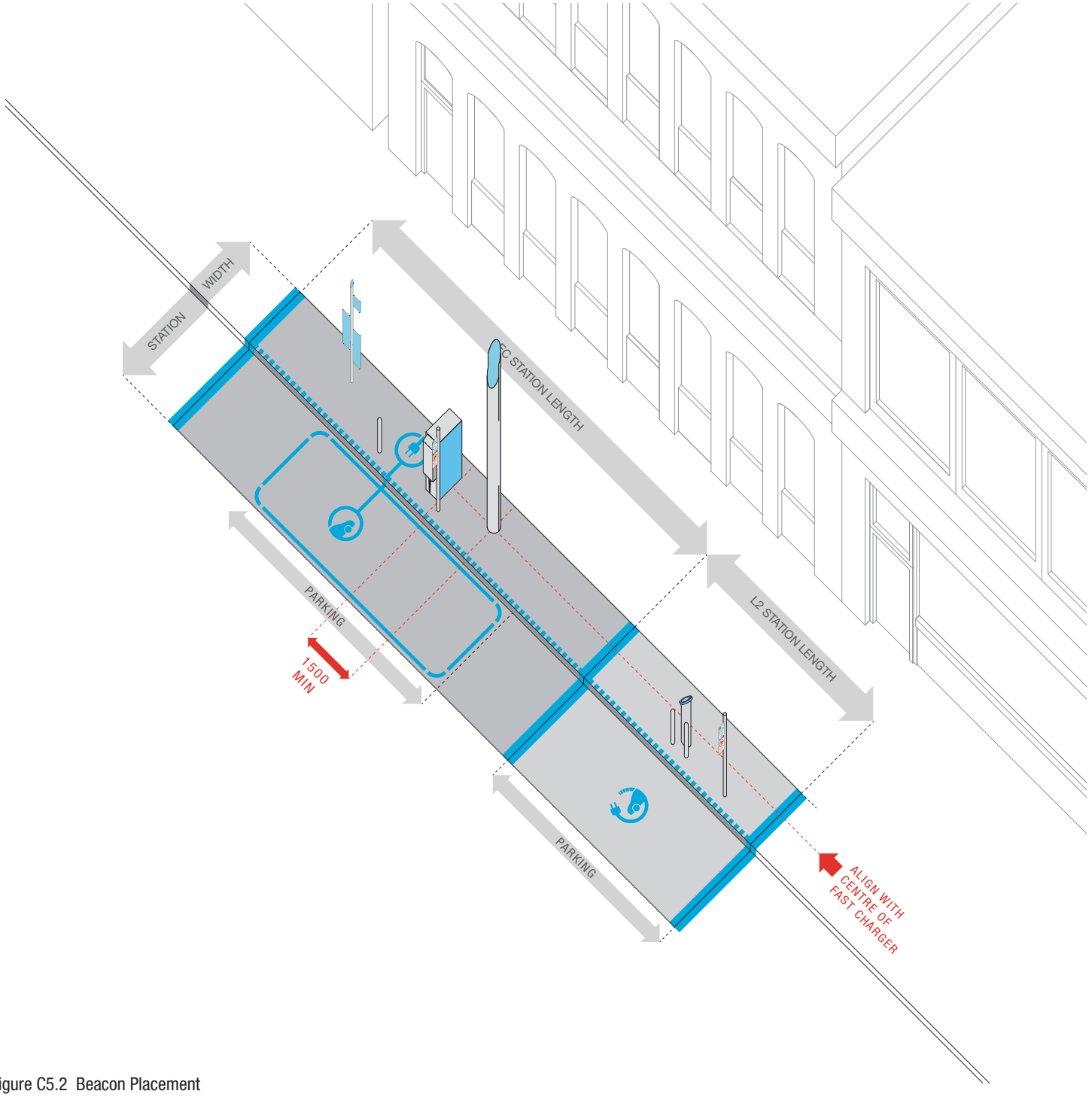


Figure C5.2 Beacon Placement

D
CONSTRAINED AND IRREGULAR SITES

D1 Two parking spaces side by side

Constraints *(Refer to Figure D1.1)*
In this situation, the area available equals two standard parking spaces side by side (as opposed to the recommended four standard parking spaces). The length of the station may be constrained by any of the following: full wall, partial wall, curb, or other occupied surfaces.

Design Considerations *(Refer to Figure D1.2)*
If the site is in a parking lot, follow the guidelines in Section A, Parking Lot. If the site is in a parkade, follow the guidelines in Section B, Parkade. Some adjustments to component placement may be required.

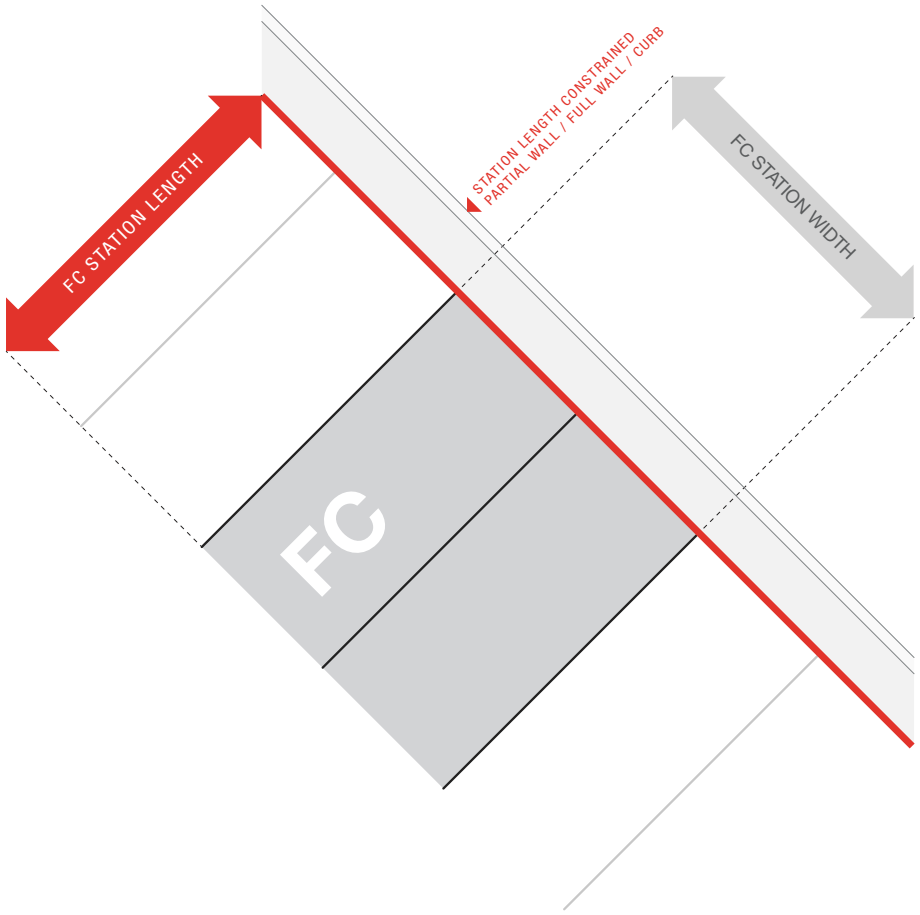


Figure D1.1 Two parking spaces side by side

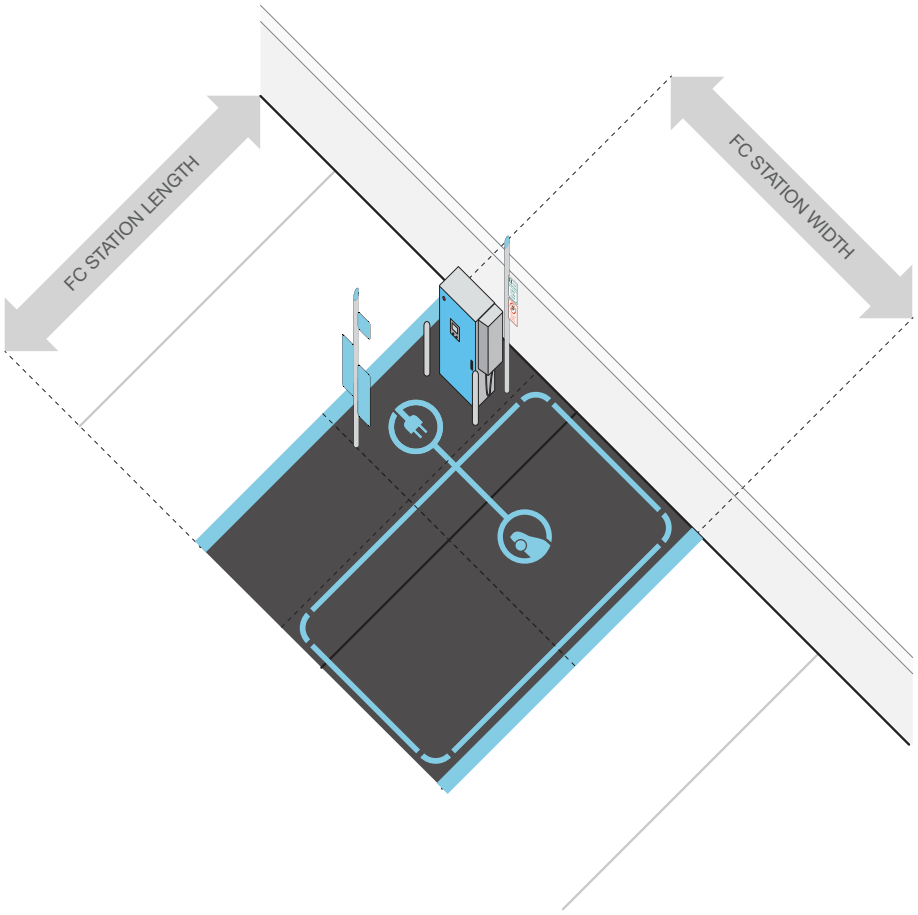


Figure D1.2 Two parking spaces side by side. Possible station design.

D
CONSTRAINED AND IRREGULAR SITES

D2 Two parking spaces end to end

Constraints *(Refer to Figure D2.1)*
In this situation, the area available equals two standard parking spaces end to end (as opposed to the recommended four standard parking spaces) with limited space for equipment along the left side.

Design Considerations *(Refer to Figure D2.2)*
If the site is in a parking lot, follow the guidelines in Section A, Parking Lot. If the site is in a parkade, follow the guidelines in Section B, Parkade. Some adjustments to component placement may be required.

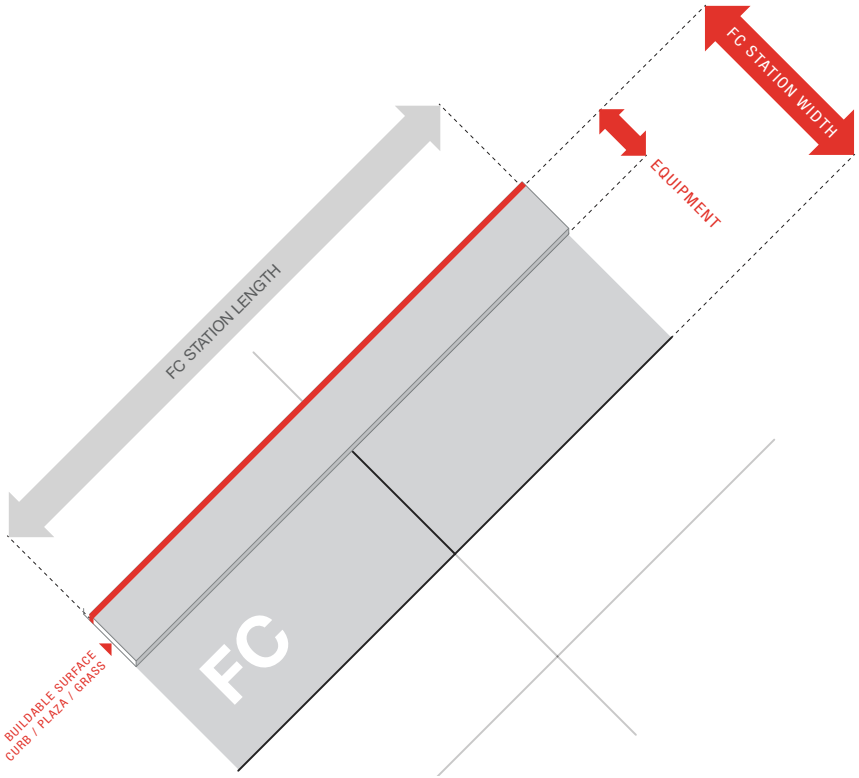


Figure D2.1 Two parking spaces end to end

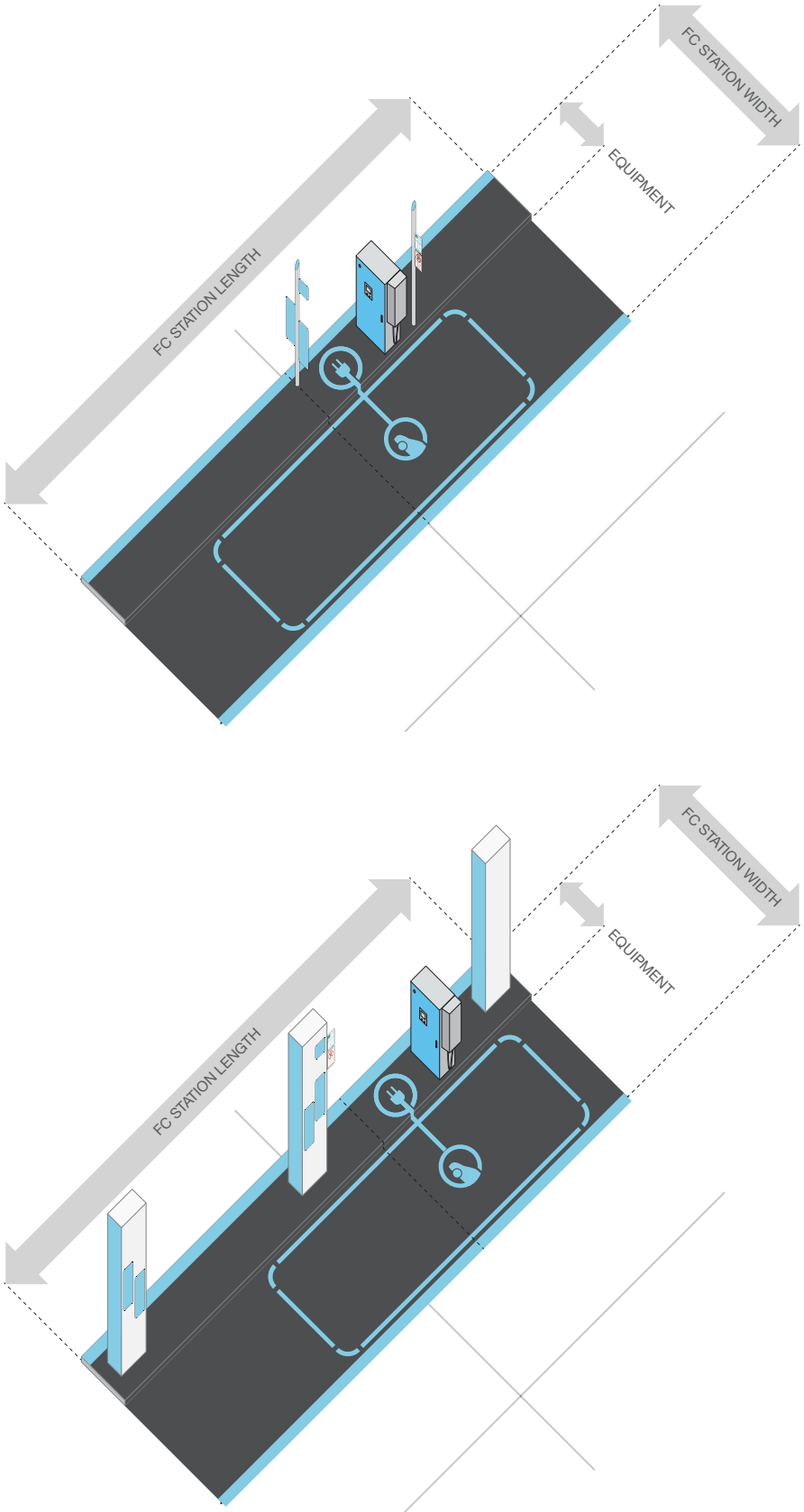


Figure D2.2 Two parking spaces end to end. Possible station design.

D
CONSTRAINED AND IRREGULAR SITES

D3 Single parking space with charger in front

Constraints *(Refer to Figure D3.1)*
In this situation, the area available equals one standard parking space (as opposed to the recommended four standard parking spaces) with limited space for equipment in front of the station.

Design Considerations *(Refer to Figure D3.2)*
This is the only station configuration where the charger is located at the front of the station and faces away from the parking area. Follow the guidelines in Section A, Parking Lot. Modifications to the pavement markings are made to accomodate the vertical extension of the station onto a curb or plaza.

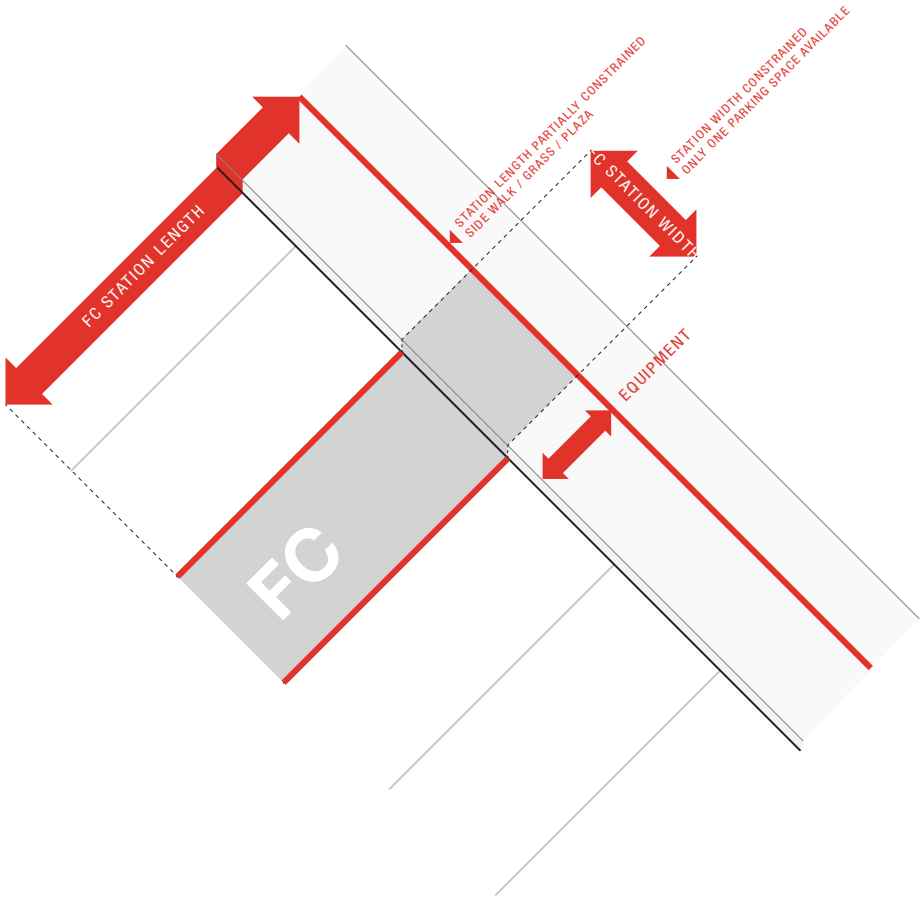


Figure D3.1 Single parking space with charger in front.

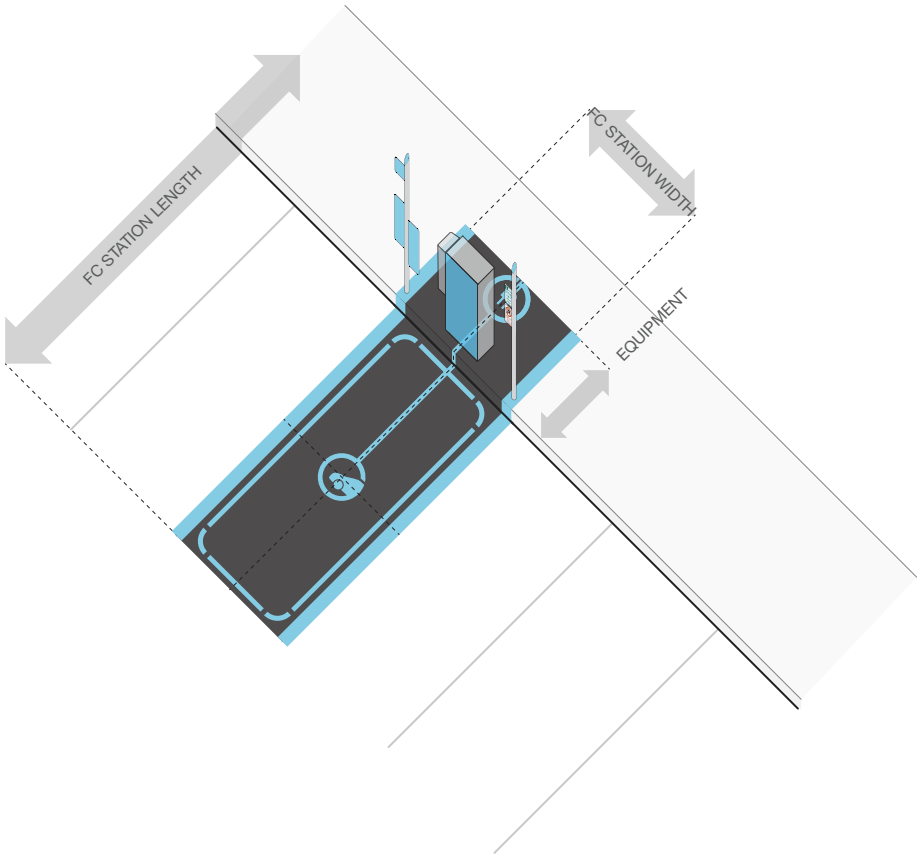


Figure D3.2 Single parking space with charger in front. Possible station design.

D
CONSTRAINED AND IRREGULAR SITES

D4 Single parking space with charger at left

Constraints *(Refer to Figure D4.1)*
In this situation, the area available equals one standard parking space (as opposed to the recommended four standard parking spaces) with limited space for equipment on the left of the station. The length of the station may be constrained by any of the following: full wall, partial wall, curb, or other occupied surfaces. The width of the station is constrained by the curb or plaza space available for the equipment.

Design Considerations *(Refer to Figure D4.2)*
If the site is in a parking lot, follow the guidelines in Section A, Parking Lot. If the site is in a parkade, follow the guidelines in Section B, Parkade. Some adjustments to component placement may be required.

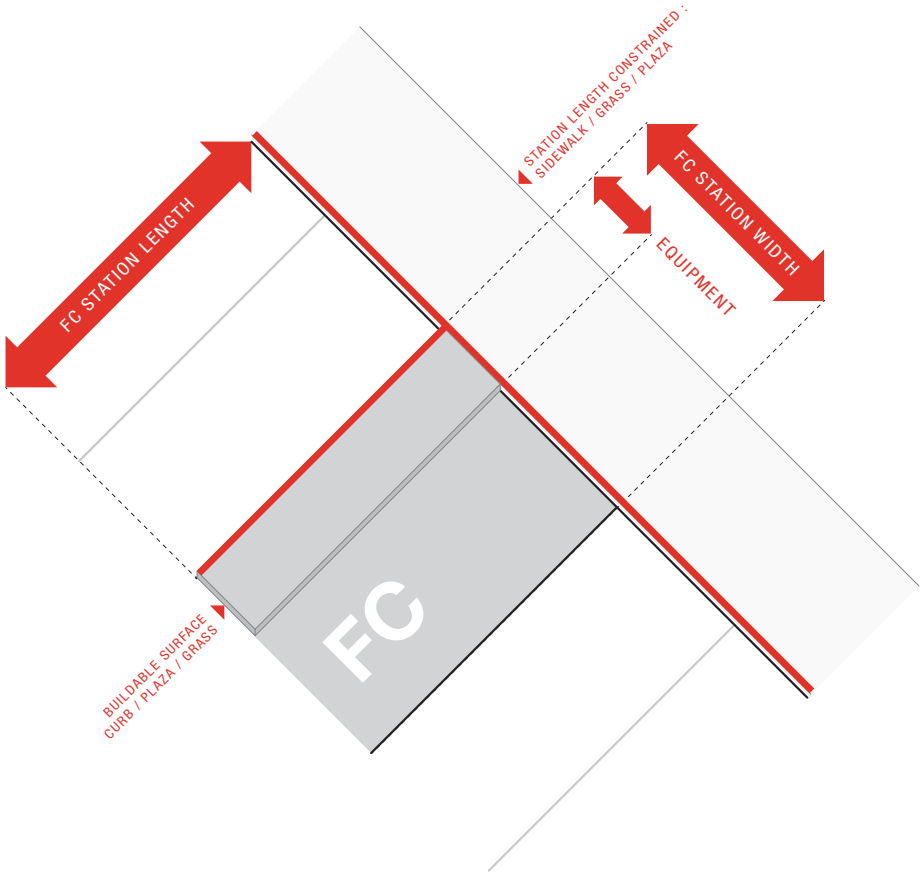


Figure D4.1 Single parking space with charger at left.

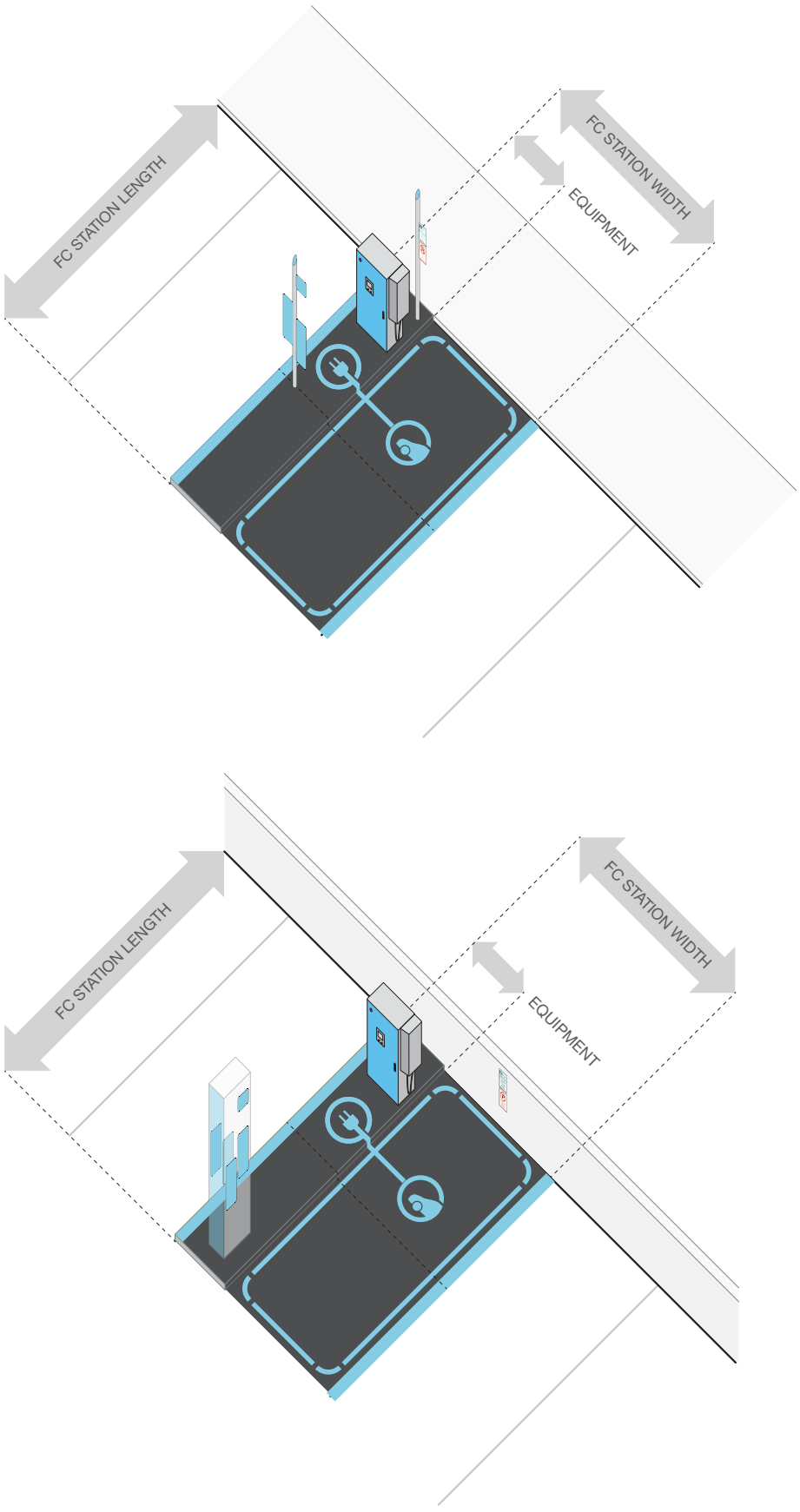


Figure D4.2 Single parking space with charger at left. Possible station designs.

D
CONSTRAINED AND IRREGULAR SITES

D5 Single parking space with charger at right

Constraints *(Refer to Figure D5.1)*
In this situation, the area available equals one standard parking space (as opposed to the recommended four standard parking spaces) with limited space for equipment on the right of the station. The length of the station may be constrained by any of the following: full wall, partial wall, curb, or other occupied surfaces. The width of the station is constrained by the curb or plaza space available for the equipment.

Design Considerations *(Refer to Figure D5.2)*
If the site is in a parking lot, follow the guidelines in Section A, Parking Lot. If the site is in a parkade, follow the guidelines in Section B, Parkade. Some adjustments to component placement may be required. To maximize compatibility with electric vehicles, it is recommended that the charging equipment be placed to the left of the parking area unless absolutely necessary.

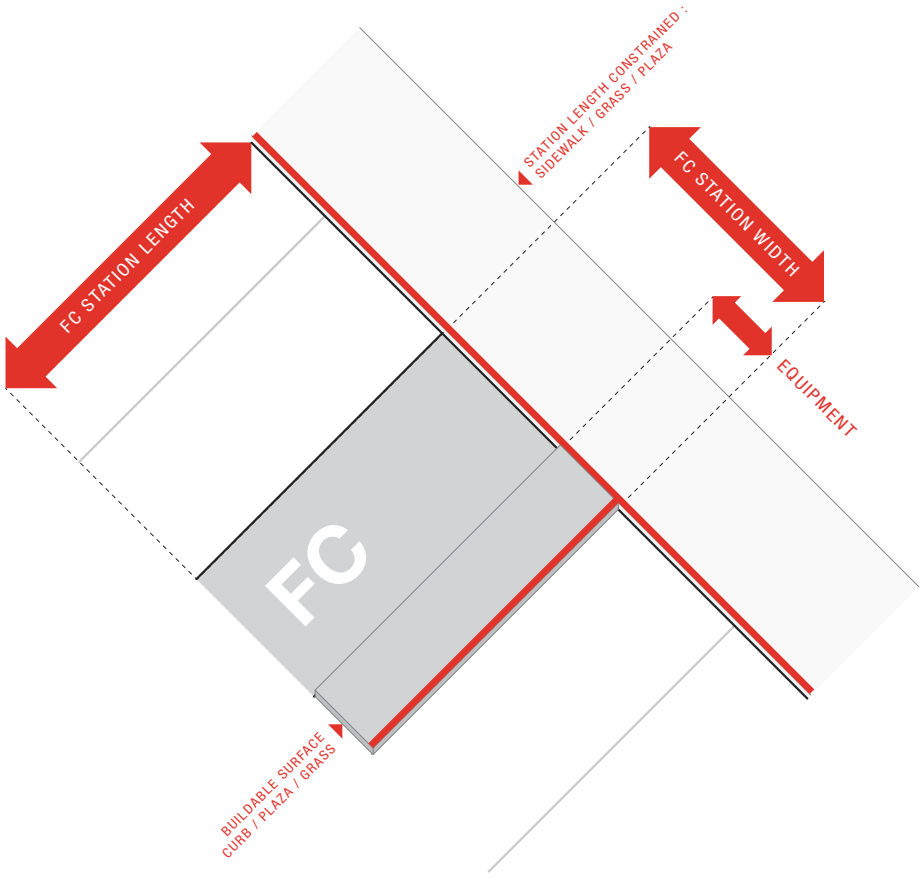


Figure D5.1 Single parking space with charger at right.

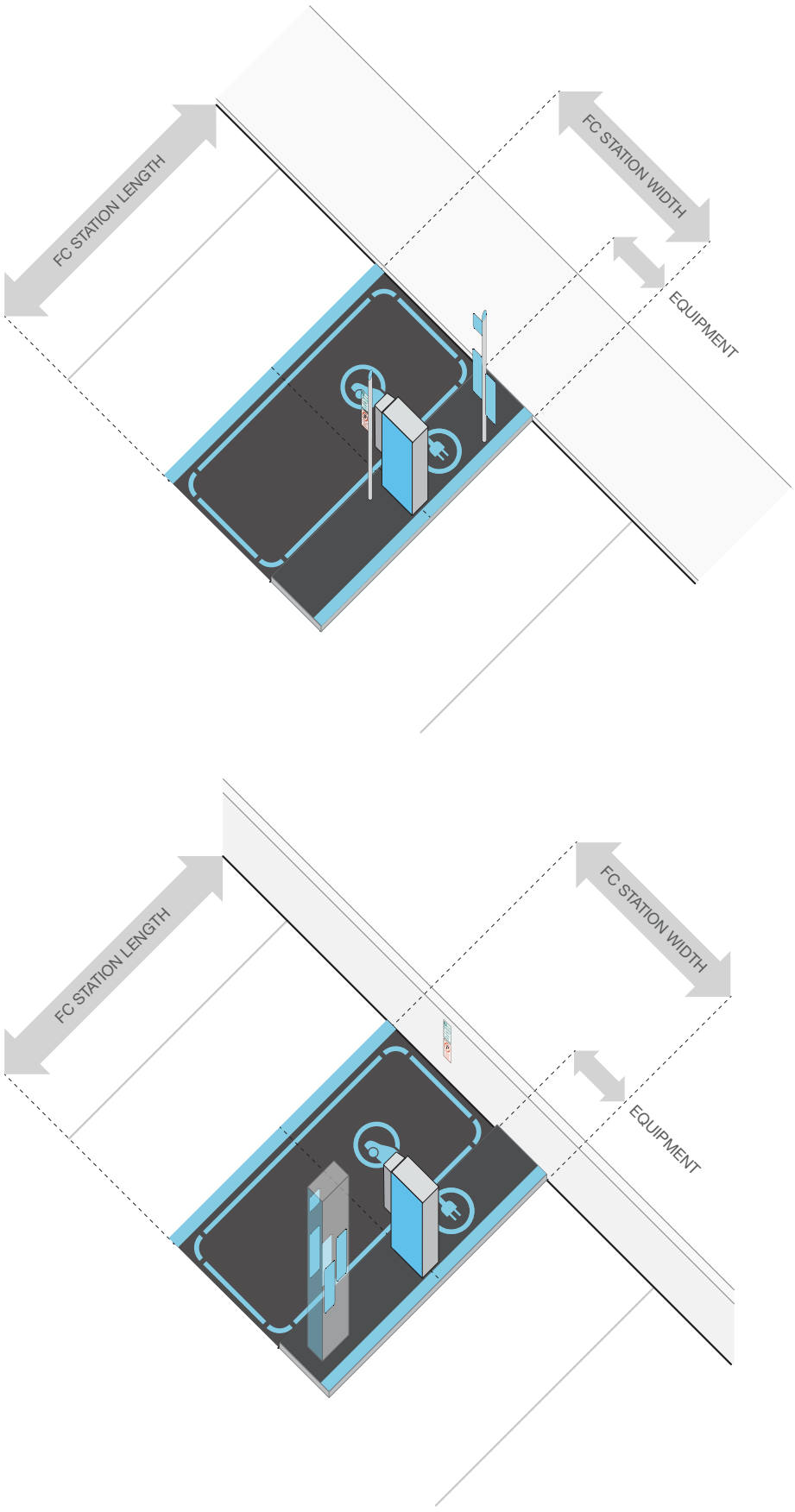


Figure D5.2 Single parking space with charger at right. Possible station designs.

D
CONSTRAINED AND IRREGULAR SITES

D6 Irregular Sites

A fixed station configuration will facilitate the recognizability and user adoption of EV charging stations, and should be adhered to as much as possible even on irregular sites.

Place station component as a group *(Refer to Figure D6.1 and D6.2)*
To design a charging station located on an irregularly shaped site, start by placing the station components as a group. The station group may be shifted and rotated within the site limits, but all components should remain fixed relative to each other. You may choose between standard and universally accessible configurations as illustrated below.

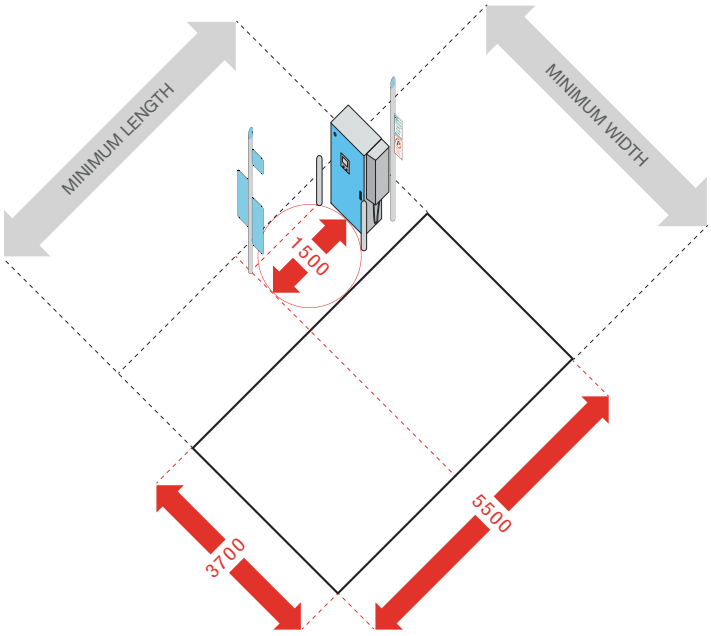


Figure D6.1 Universally accessible station group

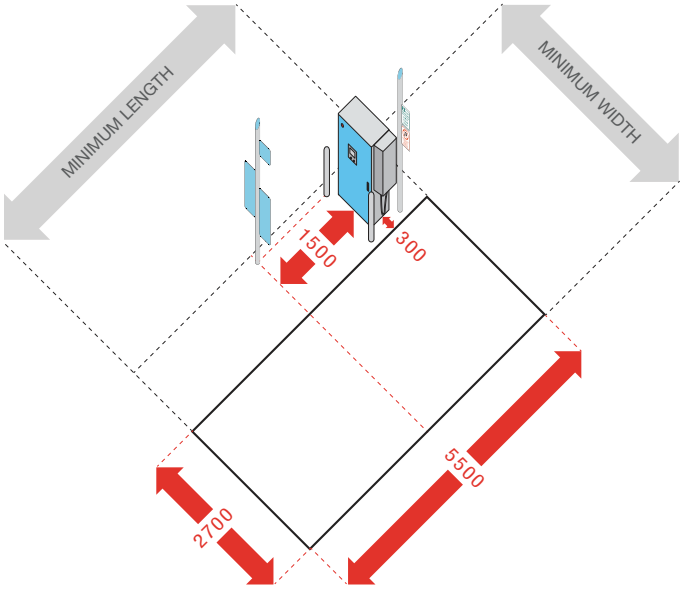


Figure D6.2 Standard station group

4

LEVEL 2 CHARGING STATION
DESIGN GUIDELINES

EF

L2 SITE TYPE OVERVIEW

Level 2 charging stations may exist singularly or in groups without being next to a fast charging station. In these cases the design of the station is simplified. However, the overall typology is conserved through the station configuration and pavement markings.

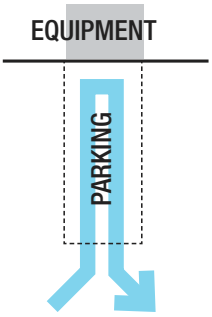
In addition to fast charging station types A-D described in Chapter 3, there are two main types of level 2 charging station types:

E Stall - applies to parking lot and parkade sites

F Pull-Through - applies mainly to curbside sites

E Stall

Stall type level 2 charging stations apply to parking lot and parkade sites. These stations require the least amount of space and can be installed as a series of charging stations in a row.



F Pull-Through

Pull-through type level 2 charging stations are applied to curbside sites and can be installed as a series of charging stations end to end.

E
L2 PARKING LOT DESIGN GUIDELINES

E1 Station Configuration

1. Determine the number of level two charging stations on your site. *(Refer to Figure E1.1)*
Allocate 1 typical parking space for each level two charger with additional space at the end for charging equipment. In the case of multiple charging stations, place the stations beside each other.

2. Place level two charger(s), bollards, wheel stop, and regulatory signage. *(Refer to Figure E1.2)*
Place level 2 chargers on the centre line, at the end of each stall. Install the charger on a curb or on grade with the parking area. If on grade, place the bollards 150 mm x 150 mm off the corners of the level two chargers. Place the wheel stop 1000 mm from the curb or charger. Place regulatory signage pole adjacent to the charger. Set the signs on the regulatory signage pole to face vehicles.

E2 Pavement Markings

For the following steps refer to Figure E2.1.

1. Wide Boundary Lines
Wide boundary lines mark the extents of the charging station and run along the length of the station.

2. Place Logo
Place the logo in the middle of the parking area.

3. Dashed Curb Line
Dashed curb lines - 100 mm dash, 100 mm space - are 100 mm thick and mark a change in grade.

4. Paint wheel stop

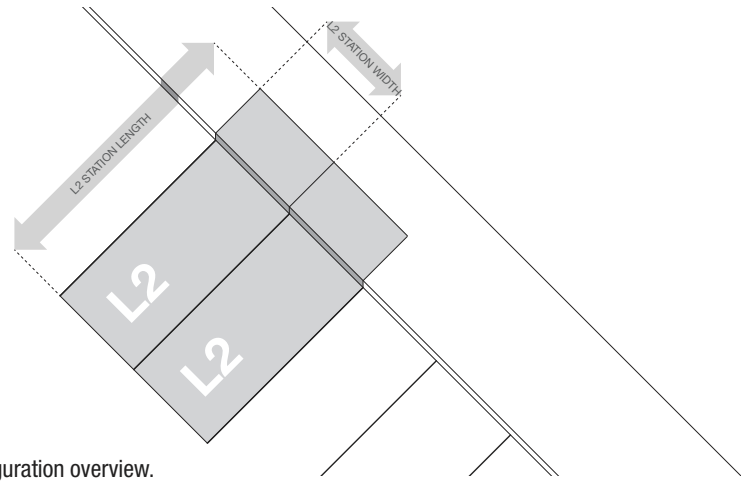


Figure E1.1 Station configuration overview.

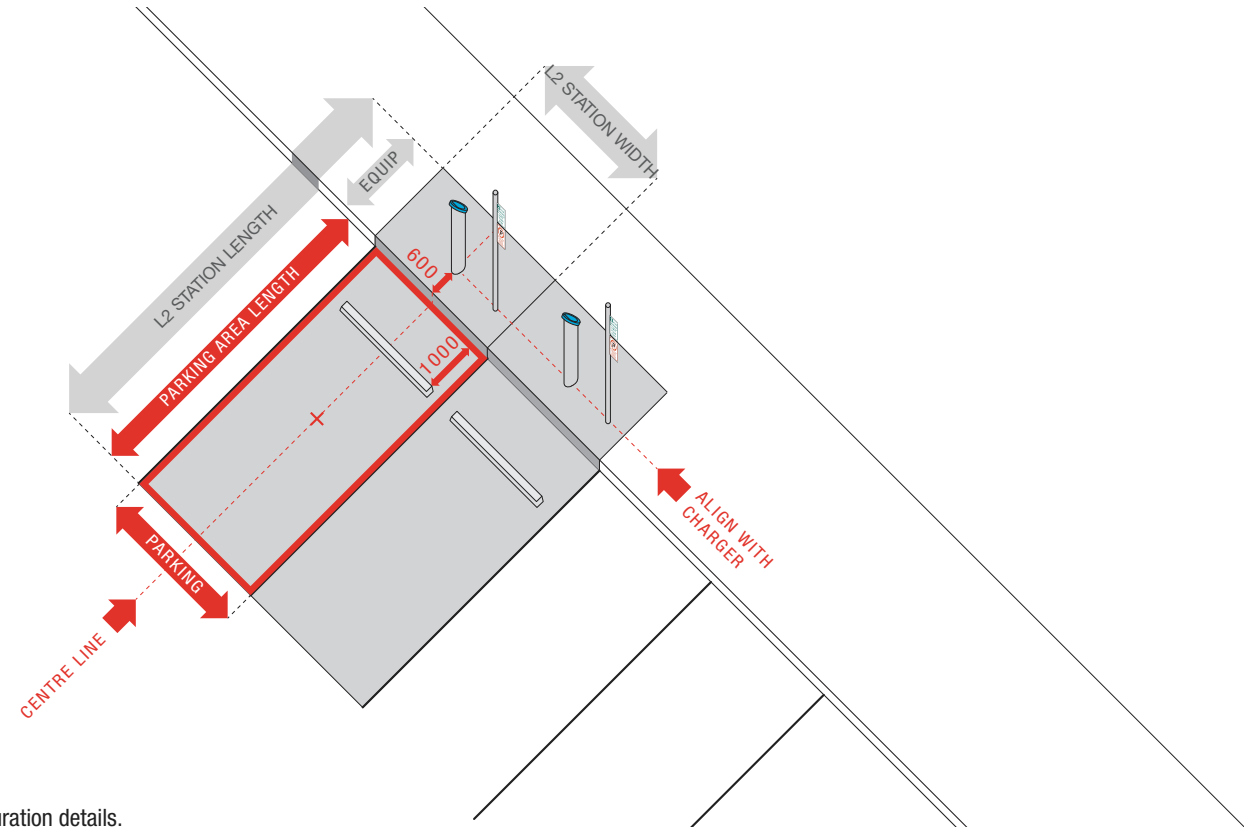


Figure E1.2 Station configuration details.

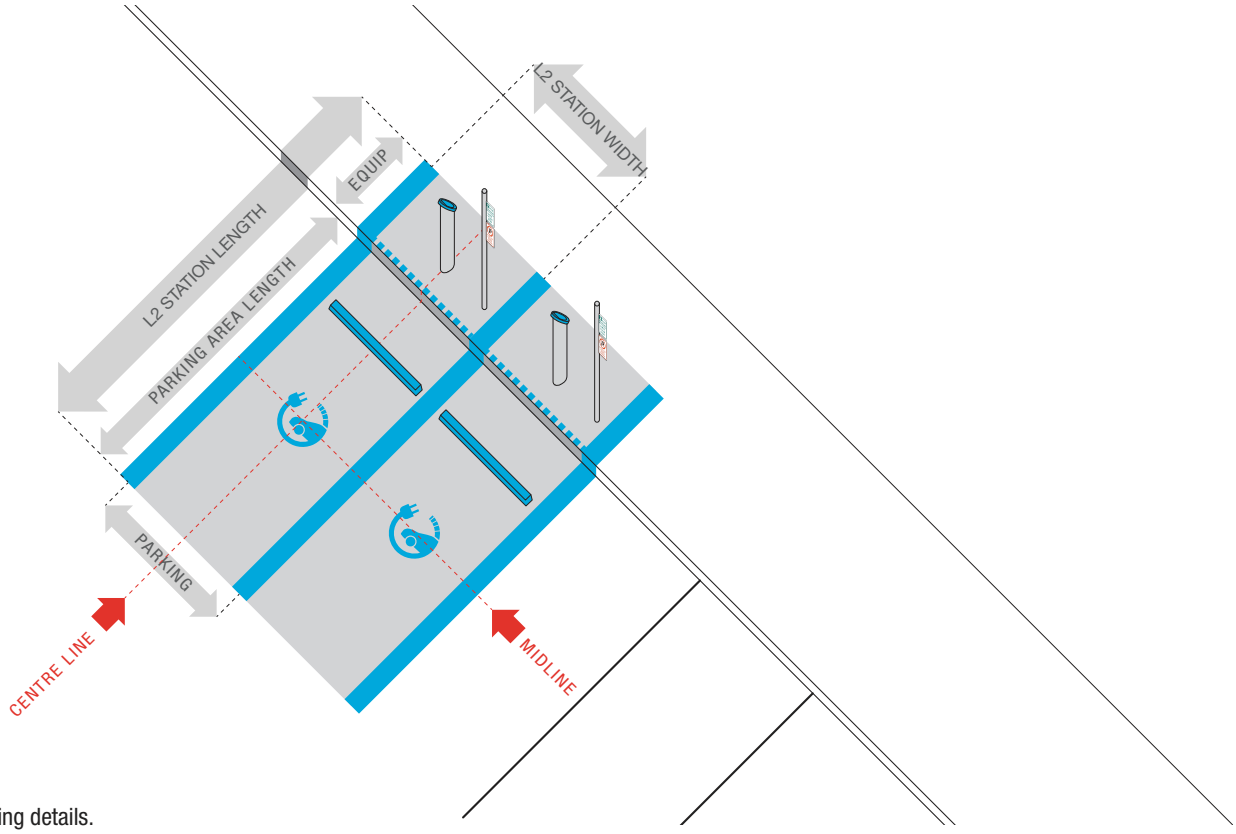


Figure E2.1 Pavement marking details.

F

L2 CURBSIDE DESIGN GUIDELINES

F1 Station Configuration

1. Determine the number of level two charging stations on your site. *(Refer to Figure F1.1)*
Allocate 1 typical parking space for each level two charger with additional space on the curb for charging equipment. In the case of multiple charging stations, place the stations end to end.

2. Place level two charger(s) and regulatory signage. *(Refer to Figure F1.2)*
Place level two chargers on the curb. Align the level two chargers with the parking area midline and face towards front end of station. Place regulatory signage pole between the charger and back end of the station. Set the signs on the regulatory signage pole to face vehicles.

F2 Pavement Markings

For the following steps refer to Figure F2.1.

1. Wide Boundary Lines
Wide boundary lines mark the extents of the charging station and run along the width of the station.

2. Place Logo
Place the Logo in the middle of the parking area.

3. Dashed Curb Line
Dashed curb lines - 100 mm dash, 100 mm space - are 100 mm thick and mark a change in grade.

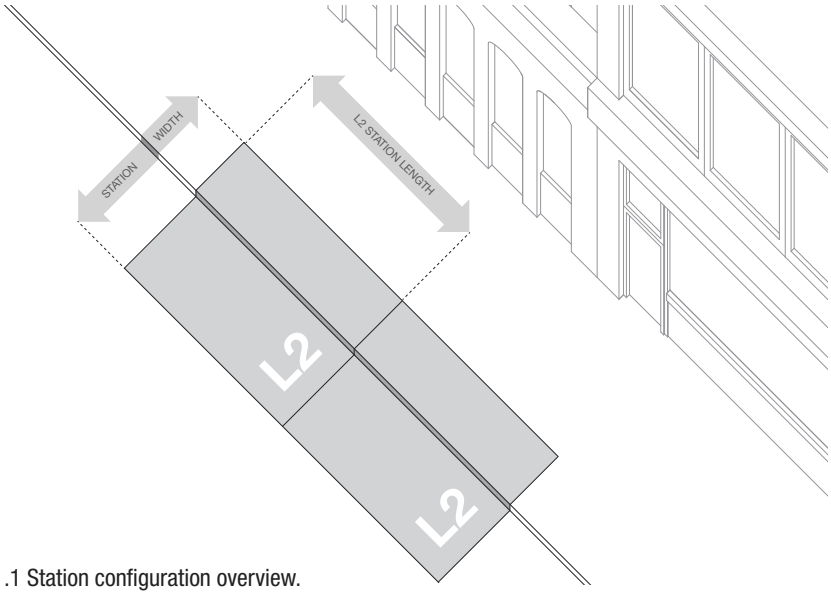


Figure F1.1 Station configuration overview.

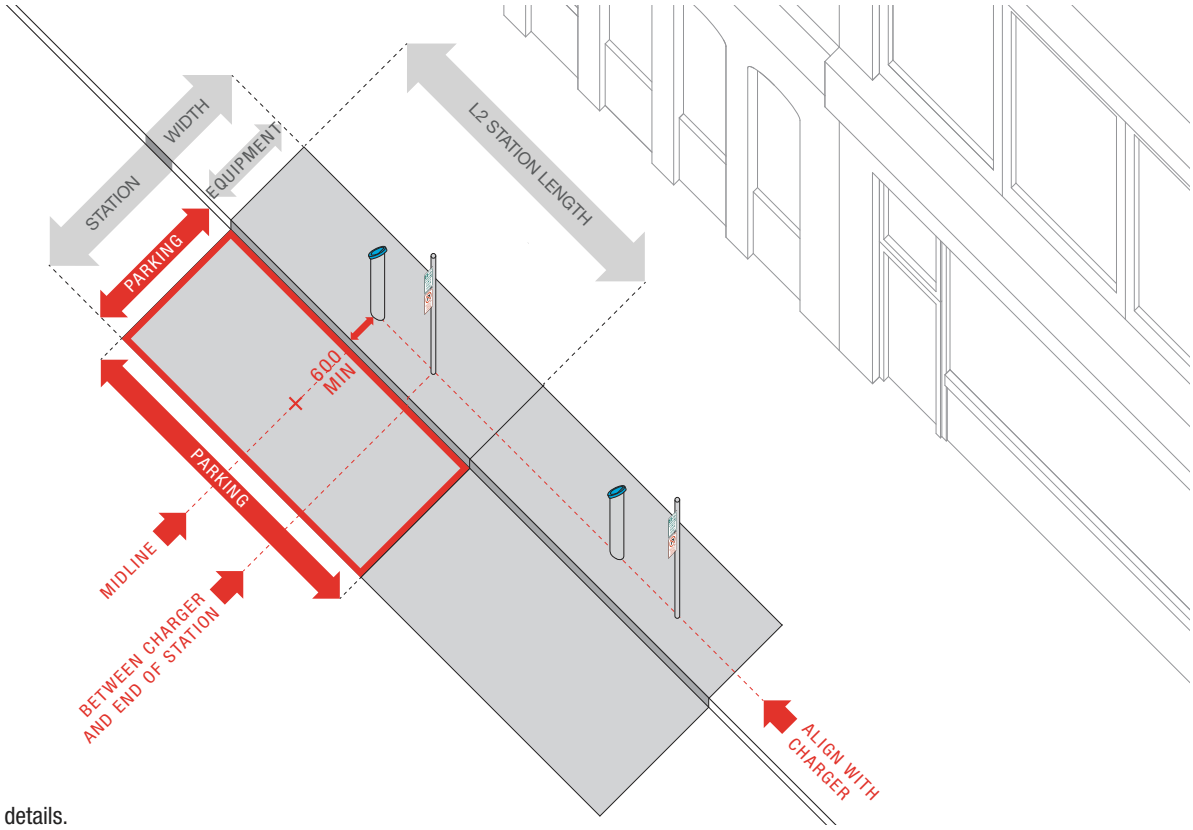


Figure F1.2 Station configuration details.

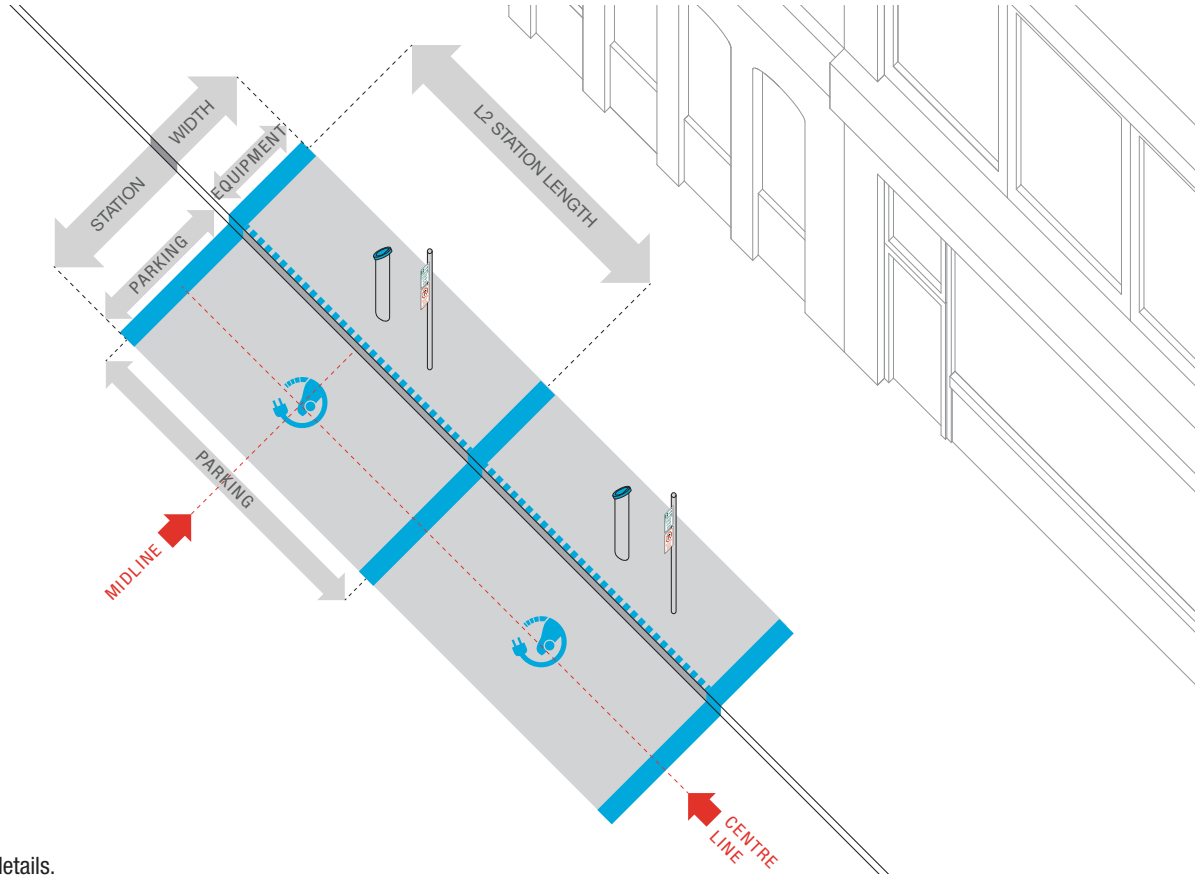


Figure F2.1 Pavement marking details.

5

FAST CHARGING STATION
ELECTRICAL DESIGN GUIDELINES

ELECTRICAL DESIGN GUIDELINES OVERVIEW

1 INTRODUCTION

1.1 Purpose

This document has been prepared to assist the installation of DC Fast Chargers in the distributed network throughout the Province of British Columbia. The intended audience includes all parties involved in the installation, operation and maintenance of this type of equipment, such as engineers, electrical contractors, etc. This document provides examples of various electrical configurations and scenarios that may be encountered in the field when installing DC Fast Chargers for Electric Vehicles (EVs).

1.2 Background

Electric Vehicles (EVs) are coming to the British Columbia marketplace, and represent an opportunity to decrease emissions from the transportation sector, by using BC's clean electricity supply Transportation in British Columbia accounts for almost 34% of CO2 and a significant portion of harmful criteria emissions. This is particularly true of the Fraser Valley air shed. The use of Electric Vehicles (EVs) can reduce transportation emissions through the use of BC's clean (hydro) electricity supply. EVs have the potential to make BC streets and neighbourhood air quality healthier by reducing harmful particulate and gaseous emissions associated with internal combustion engine vehicles (ICE).

Charging infrastructure projects are a relatively new occurrence. Lessons learned from other jurisdictions suggest site selection and usability considerations are often overlooked. This results in underutilized charging stations and poor user experience.

DC Fast Chargers are currently the quickest way to recharge an EV (typically 25-30min), The DCFC appliance is a large industrial converter which accepts incoming AC power and converts it to DC voltages to feed directly into the vehicle battery systems. There are currently two competing standards for the type of connector to connect the DCFC appliance to the vehicle, these are:

- ChaDeMo (Japanese standard, with over 2000 installations, to date)
- SAE Combo (USA standard, just recently introduced, no installations to date)

Regardless of the connector type, the DCFC appliances need to be connected to a supply of AC power. The input power required varies depending on the make and model of DCFC unit. Some of the common AC input voltages and amperages are as follows:

- 208V, 156A, 3Ø
- 480V, 80A, 3Ø

2 GENERAL ELECTRICAL CONSIDERATIONS

At each and every host site where a DCFC shall be located, electrical power must be pulled from some nearby source. The following configuration scenarios outline and delineate some of the most common situations which may be encountered in the field.

2.1 Sub-Metering

Due to electrical safety requirements, Sub-Metering, where power may be pulled from an existing Building/Facility which already has a dedicated BC Hydro Service Meter is not a viable option for providing electrical service. For details pertaining to BC Hydro Sub-Metering practices, please refer to the BC Hydro document: "Requirements for Secondary Voltage Revenue Metering (750V and less)", May 2011, available on the BC Hydro website.

In addition the Canadian Electrical Code Handbook has information pertaining to this:

- Rule 6-102 "Number of Supply Services Permitted"
- Rule 6-104 "Number of Consumer Services Permitted in or on a Building"

It is recommended that a NEW BC Hydro service is requested to provide electrical power to the DCFC appliance.

Table of Specific examples:

DCFC Type	Minimum Sized Service	Future-proof Sized Service
Eaton DC Quick Charger Voltage = 208/240V Amperage = 156A	208V, 200A	208V, 400A
ABB Terra 51 DC Charge Station Voltage = 480V Amperage = 80A	480V, 100A	480V, 200A

2.1 Sub-Metering Cont.

Service sizing shall be based on the Canadian Electrical code requirements for the equipment to be energized. The code dictates that the electrical capacity shall be larger than the bare minimum requirements for the loads. From a practical and logistical point of view the minimum "best sized" service should be selected for a site. Additional future power requirements for a particular site may determine if a larger service would be called for. If the DCFC site is located on transportation corridor and it is predicted that a future upgrade of the station location may incorporate an additional second DCFC appliance, it may be best to pull a larger service initially to allow for future expansion at a given site. Additional electrical capacity should be specified for any future electrical services, such as additional DCFC appliances and Level 2 Electric Vehicle Supply Equipment.

In addition to the DCFC appliance, electrical provisions should be made for additional circuits for lighting, illumination, communication and telecom equipment. It is recommended that two (2) 15A circuits at 110V be provided for this purpose.

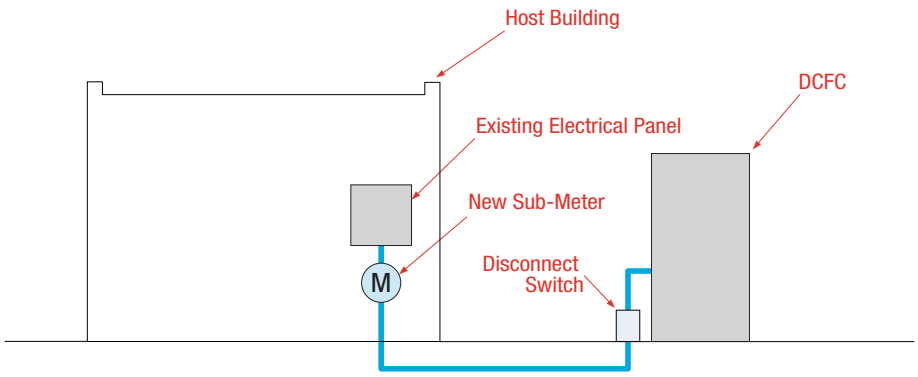
2.2 BC Hydro Distribution Standards

BC Hydro has detailed standards pertaining to the layout, configuration and design of the incoming service feed. BC Hydro Standard ES54 S2-01.03 pertains to single and three-phase commercial / industrial services up to 1600A which specifically addresses new service of the sizes required for a DCFC appliance installation. This standard can be obtained from the BC Hydro website.

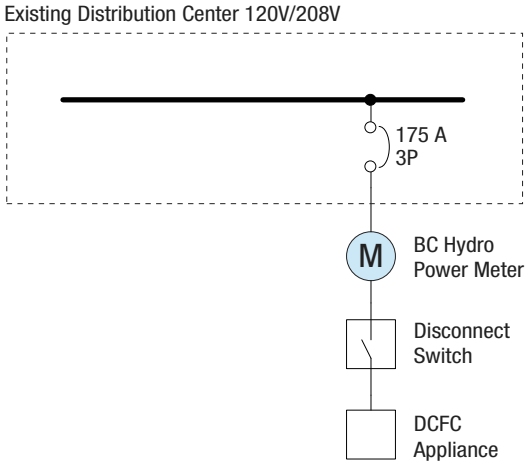
3 ELECTRICAL SCENARIOS

Note: most of the single line electrical diagrams provided in this Design Guidelines document have been created using the Eaton DCFC appliance as the example.

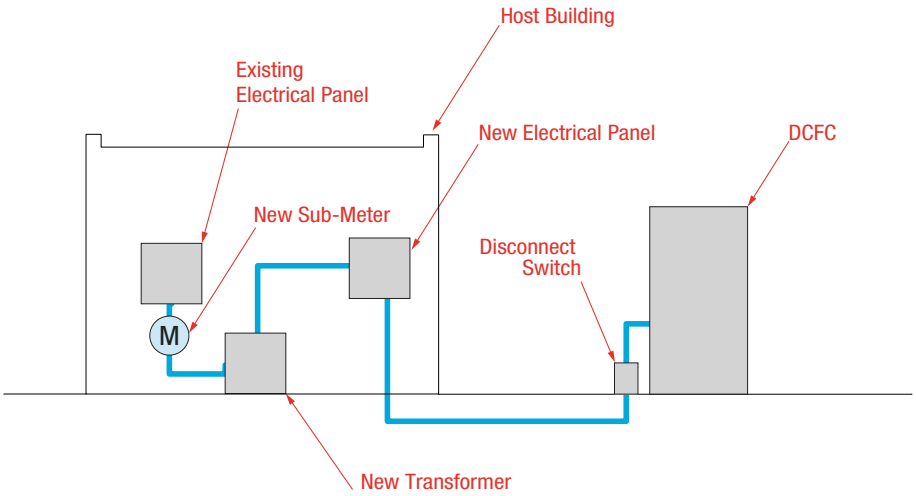
3.1 Power Supplied from Building/Facility at Host Site



This scenario assumes that the Host Building/Facility has an existing electrical panel that has the appropriate voltage to feed the DCFC appliance, and that there is spare capacity (both physically, and electrically) to add the DCFC to the existing panel. The new sub-meter would be for informational purposes only, as the existing facility will already have a main meter for the incoming service.

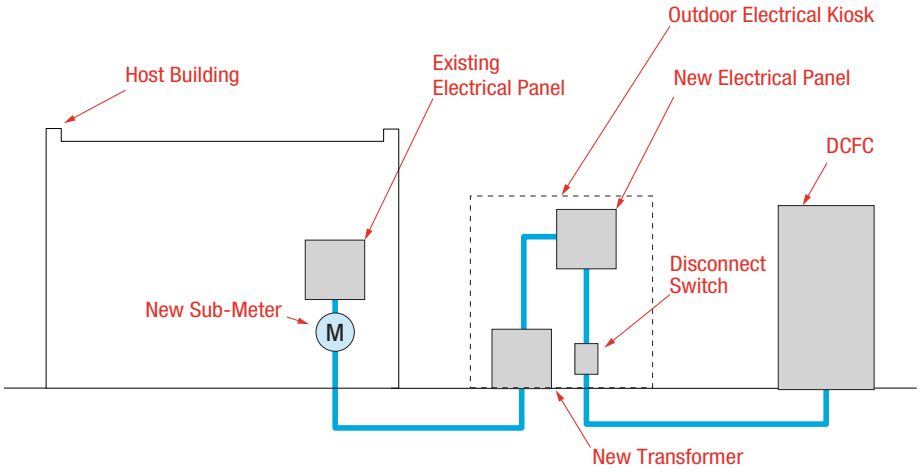


3.2 Power Supplied from Building/Facility at Host Site (with indoor Transformation)



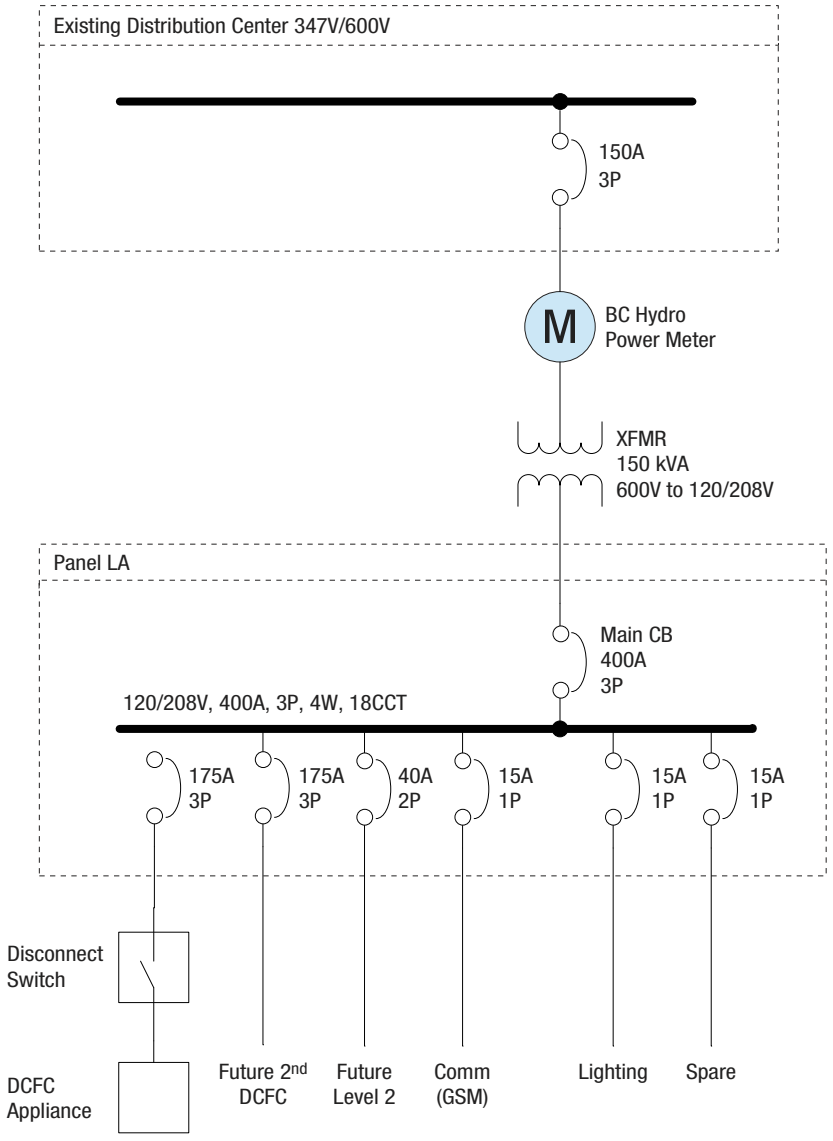
The above diagram assumes that there is sufficient space to install the required transformer inside the building. Creative methods of mounting and installing transformers can be devised, such as ceiling mounted and wall mounted. All mounting configurations must comply with the Canadian Electrical Code and seismic requirements.

3.3 Power Supplied from Building/Facility at Host Site (with outdoor Transformation)



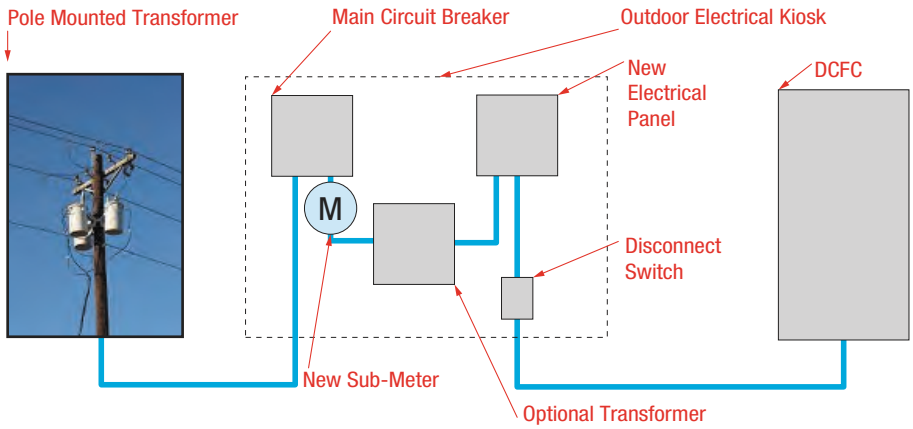
If the transformer is mounted indoors or outdoors, inside the electrical distribution kiosk, the electrical single line diagram remains unchanged.

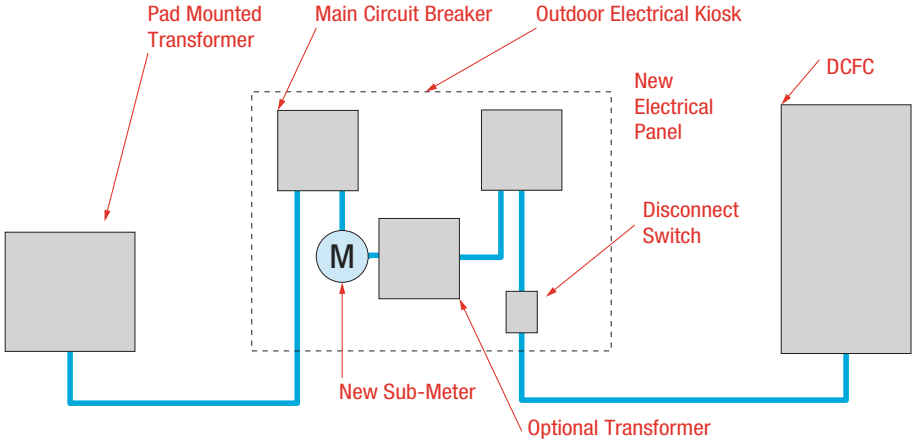
Single line diagram corresponding to 3.2 and 3.3



This single line diagram shows an electrical service with additional capacity for the future installation of a second DCFC appliance, as well as a Level 2 EVSE. Depending on the location of the site, a larger electrical service may be required.

3.4 Power Supplied from BC Hydro Transformer





In this scenario, the electrical meter would be a “New Service”, as power is being pulled directly from the BC Hydro distribution system, either a pole mounted or a pad mounted BC Hydro distribution transformer. There are several different transformer voltage used in the BC Hydro distribution system, and several options for the single line diagram are presented below. The decision to choose the best option for a given site would be determined by the site layout, configuration and distances.

Two different electrical options are presented in the single line diagrams:

OPTION A – 600V service

Depending on the length of the service run, it may be more economical to pull a new 600V service. This will result in a smaller and less costly cable from the power source to the electrical distribution kiosk. The distance between the power source and the kiosk location will determine which option is more economical. The disadvantage of this option is that an additional transformer is required.

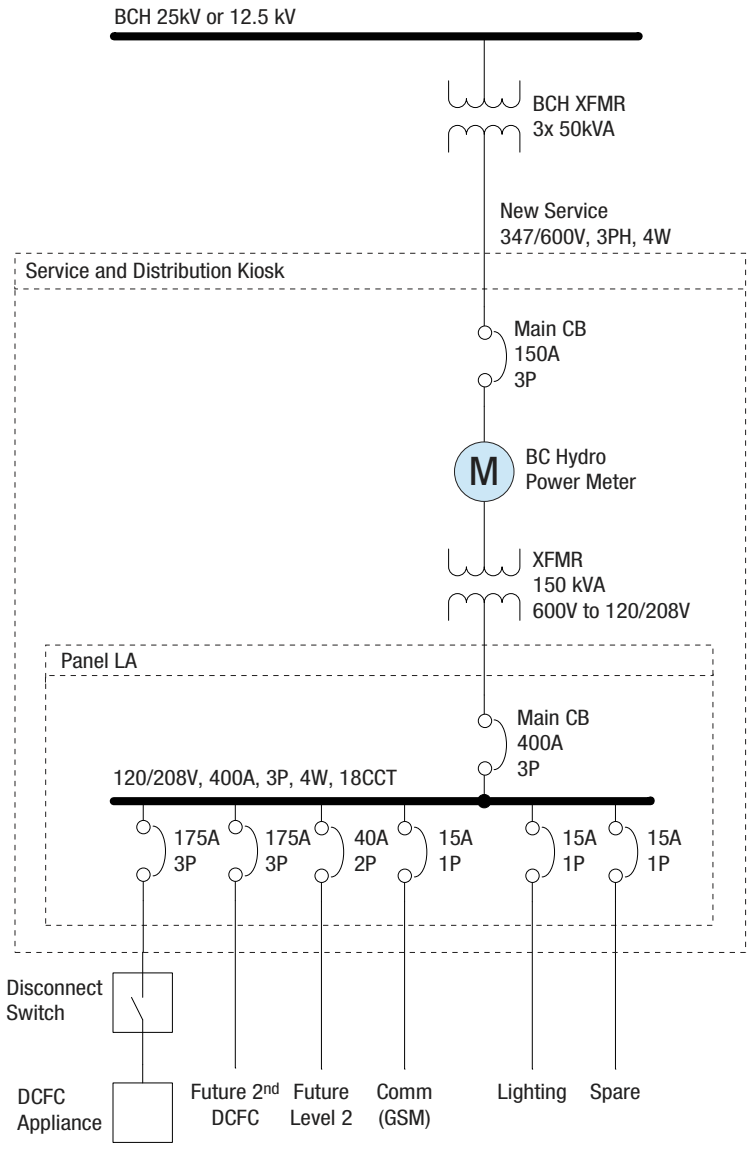
OPTION B – 208V service

The advantage of this option is that an additional transformer is not required, however, larger and more expensive cable runs are required for 208V as opposed to 600V service.

3 ELECTRICAL SCENARIOS

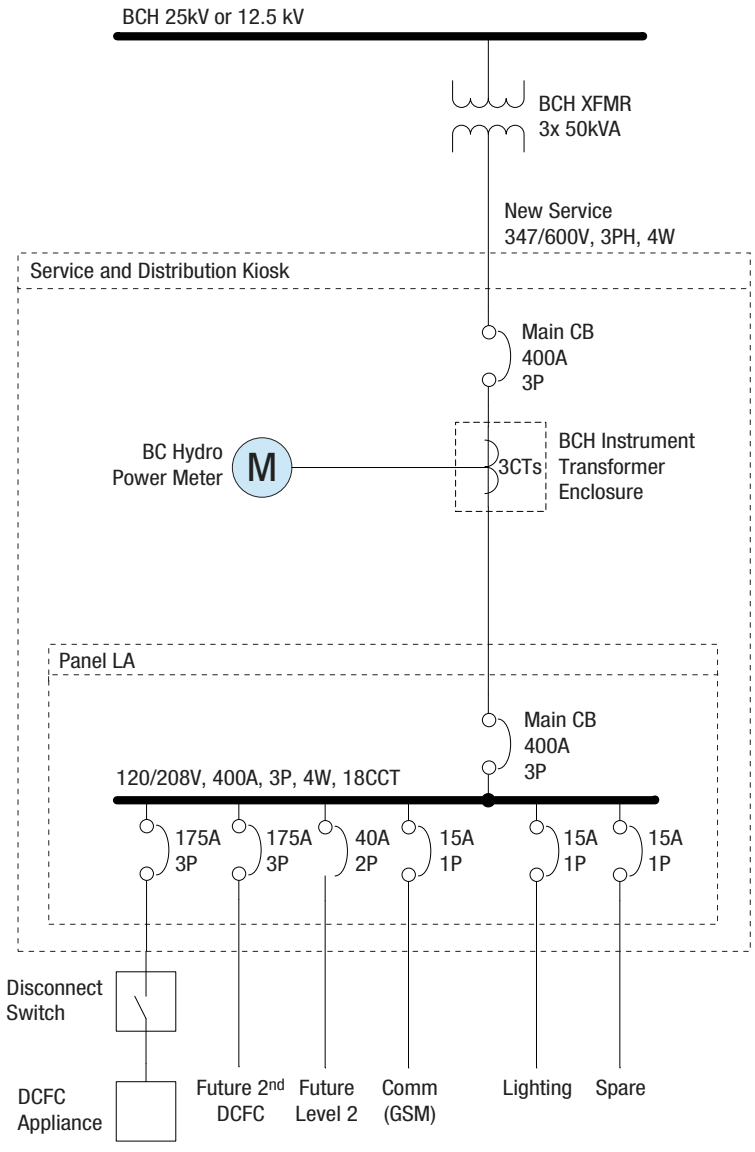
Single line diagram corresponding to 3.4

Option A – 600V Service



Single line diagram corresponding to 3.4

Option B – 208V Service



3.5 Equipment Dimensions

The size and dimensions of the various pieces of electrical equipment will vary between different manufacturers. The sizes listed below are intended to provide a rough estimate of the dimensions of the various pieces of equipment.

1) Transformer

Dimensions: 762 mm (height) x 762mm (length) x 762 mm (width)

Specifications: 150kVA, 600V primary side to 120/208V secondary side intended for a future-proofed location with capacity for two (2) DCFC appliances.

For some installations it may be required to have a different transformer, such as a 600V to 480V transformer, and this would change the sizing dimensions. In addition different brands of transformers have different sizes. This transformer is intended to be housed inside the kiosk, however alternate configurations with an outdoor pad mounted transformer are possible.

Figure 1: Example of a wall mounted transformer

2) Electrical Panel

Dimensions: 1600 mm (height) x 600 mm (length) x 200 mm (width)

The electrical panel contains the breakers for each piece of equipment. This electrical panel is intended to be housed inside the kiosk.

Figure 2: Example of an electrical panel mounted on the back-plane of an outdoor kiosk.

3) Disconnect Switch

Dimensions: 590 mm (height) x 220 mm (length) x 220 mm (width)

The disconnect switch, required by code, is to be within visual sight of the DCFC appliance. The code's intention is that an electrical worker can visually see that the disconnect switch is locked into the OFF position before he/she begins any work on the DCFC appliance. The disconnect switch is intended to be housed inside the kiosk, however the doors of the kiosk need to be oriented so that the disconnect switch can be visible from the DCFC appliance. An alternative option would be to have the disconnect switch outside of the kiosk in a visible location, but not obtrusive to the EV drivers and general public.

Figure 3: Example of a visual disconnect mounted in a visually obtrusive location, the general public and EV drivers will not need to use this switch, therefore it should be positioned in a less conspicuous location.

4) Service Distribution Kiosk

Dimensions: 1800 mm (height) x 2600 mm (length) x 1000 mm (width)

Items 1, 2, 3 are intended to be placed inside the Kiosk. See Figure 2, 3, & 4 for photographic examples of this hardware.

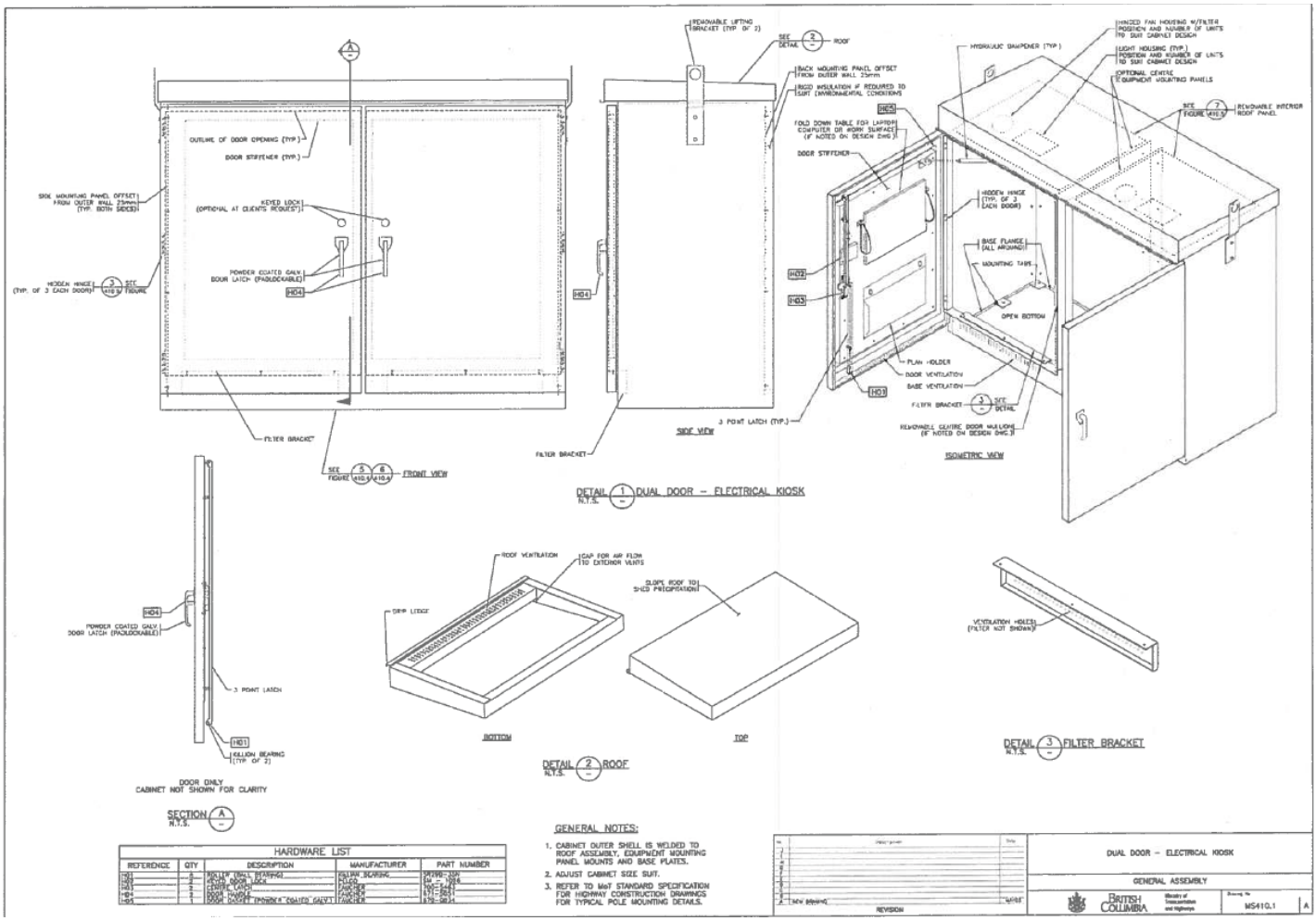


Figure 4: Ministry of Transportation highway electrical distribution kiosk.

5) DCFC appliance

Figure 5: Dimensions: Eaton 1695 mm (height) x 460 mm (length) x 880 mm (width)

Figure 6: Dimensions: ABB Terra 51 = 1898mm (height) x 600mm (length) x 960mm (width)

4 ELECTRICAL CODES AND STANDARDS

4.1 Canadian Electrical Codes and Standards Links

The references below are taken from the Canadian EV Infrastructure Deployment Guideline (ECOtality, 2013).

Canadian Electrical Codes and Standards Links	
CSA Group (CSA)	http://www.csa.ca/cm/ca/en/home
Institute of Electrical and Electronics Engineers (IEEE)	http://www.ieee.ca/index.htm
National Building Code of Canada (NBC)	http://www.nationalcodes.nrc.gc.ca/eng/nbc/index.shtml
National Energy Code of Canada for Buildings (NECB)	http://www.nationalcodes.nrc.gc.ca/eng/necb/index.shtml
National Fire Code of Canada (NFC)	http://www.nationalcodes.nrc.gc.ca/eng/nfc/index.shtml
Society of Automotive Engineers (SAE) International	http://www.sae.org/
Standards Council of Canada (SCC)	http://www.scc.ca/
Underwriters Laboratory of Canada (ULC)	http://www.ul.com/canada/eng/pages/

Appendix

1 COMPONENT SUPPLIERS

Supplier chart

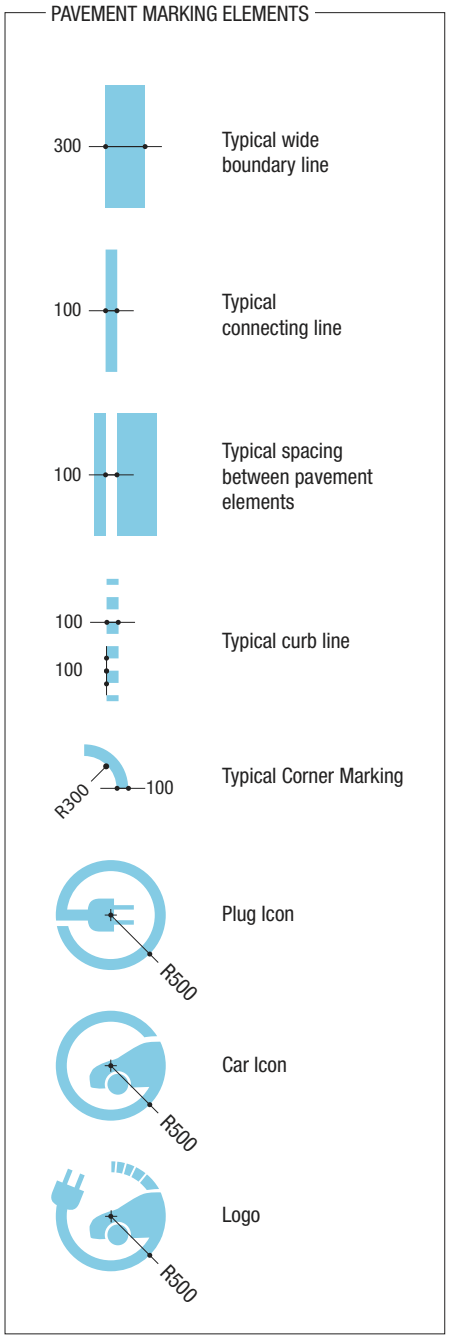
Components:	Notes:
Fast charger L2 charger	There are many makes and models of both level two and fast chargers. Chargers, being a fairly new technology, are constantly changing and improving. Consult with the leading charger suppliers for more information. Refer to section 1.1 - Introduction and charging equipment for some examples.
Pavement paint	TBA
Stencils	TBA
Thermoplastic decals	DecoMark thermoplastics are recommended. Go to - **http://www.decomark.com/solutions/** to find installers.
Charger wraps	TBA
Beacon Network poles	Contact Knight Signs for more information on the production of Beacons or Network Poles - **http://www.knightsigns.com/**
Regulatory Poles	Consult with the province of British Columbia to find current provincially approved sign suppliers.

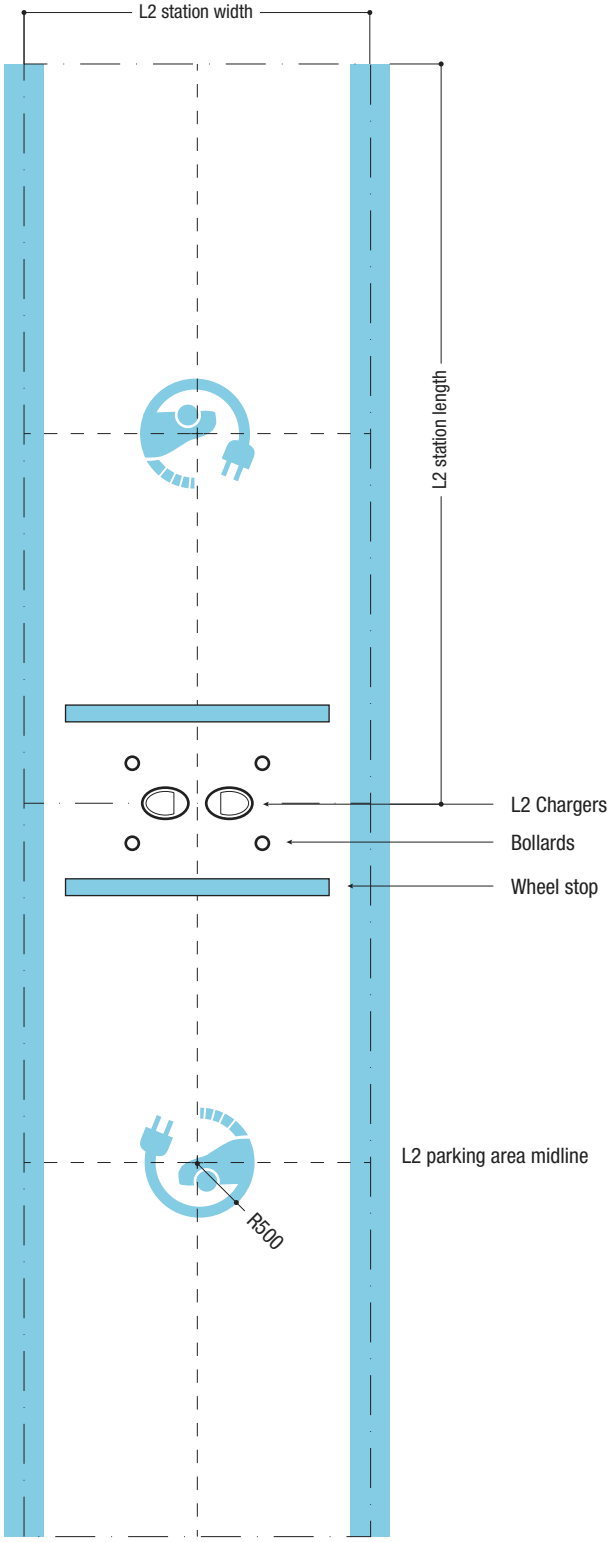
Table 1.1 Component and notes

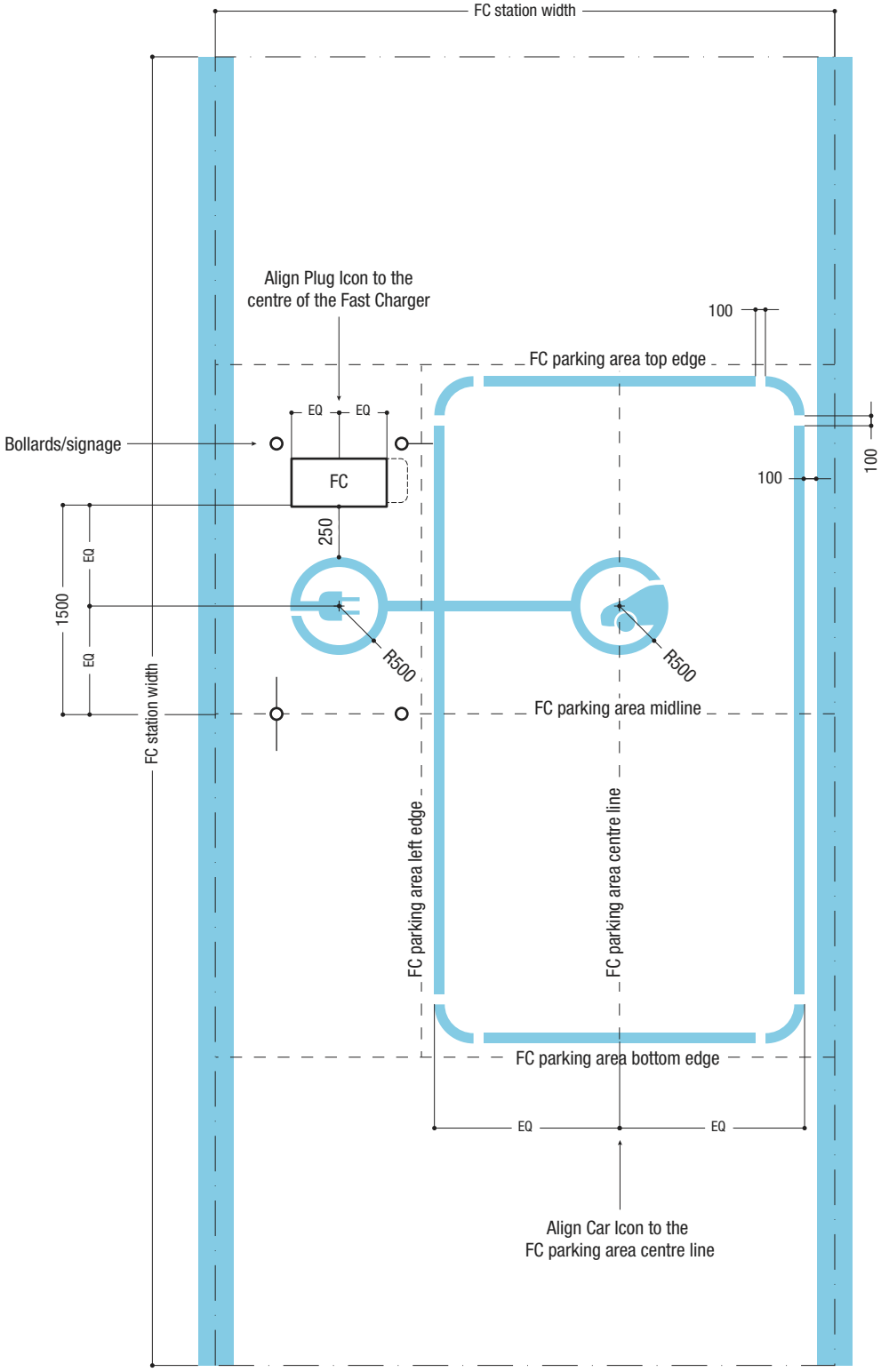
2 TECHNICAL DRAWINGS

List of technical drawings

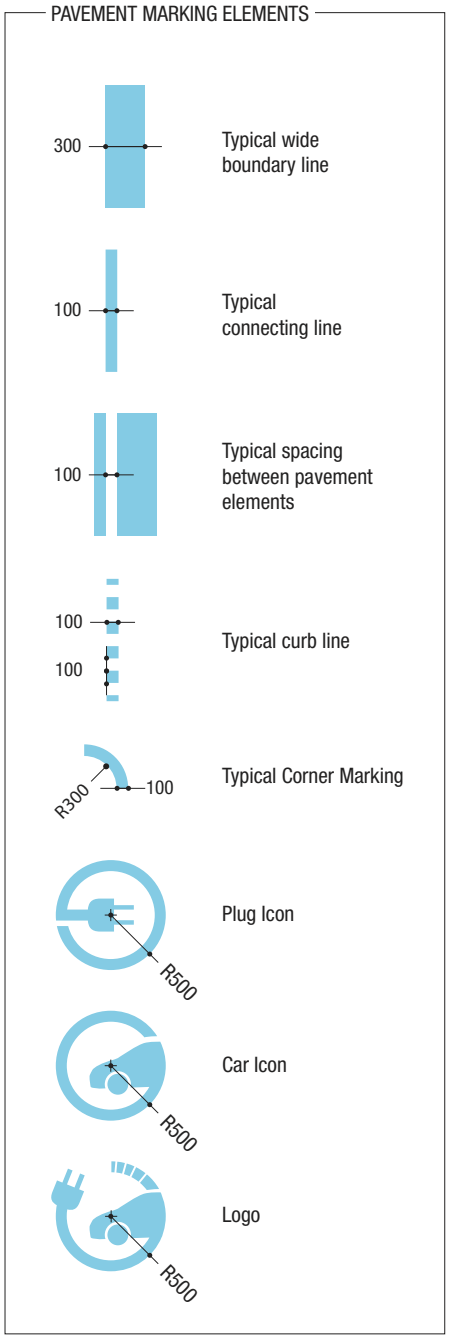
2.1 Pavement markings for parking lot

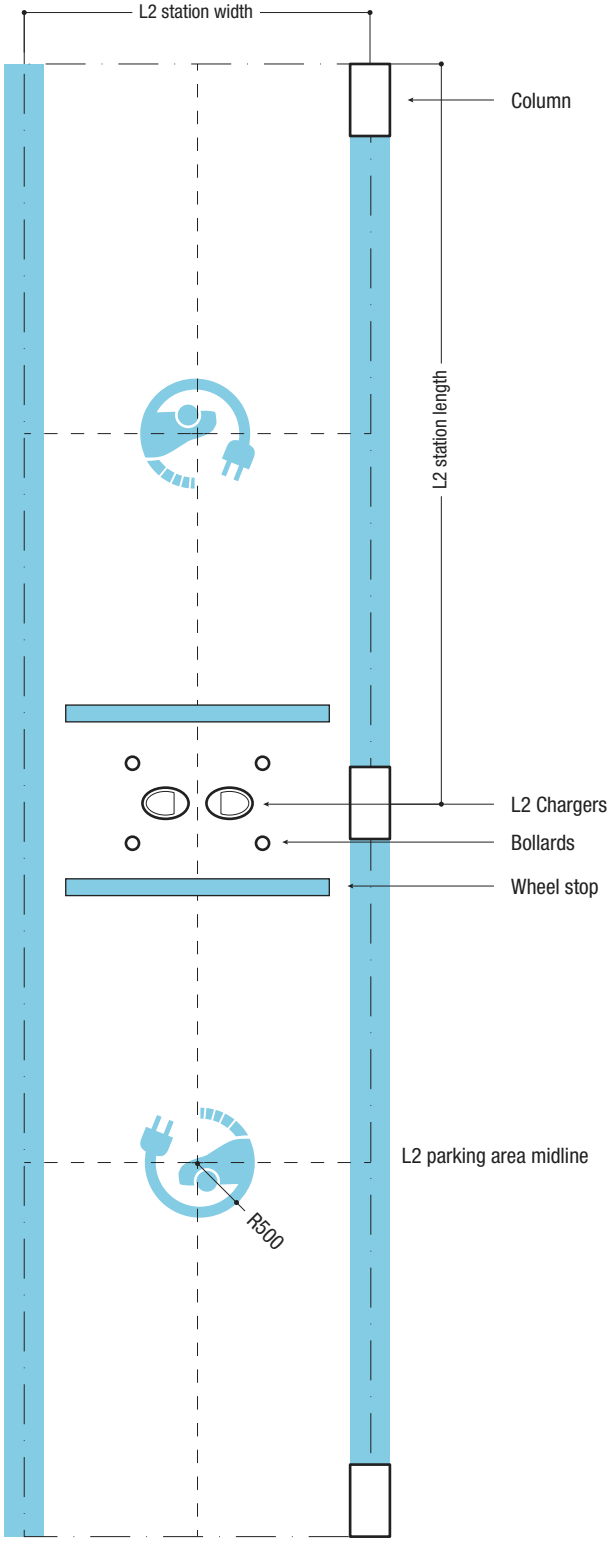


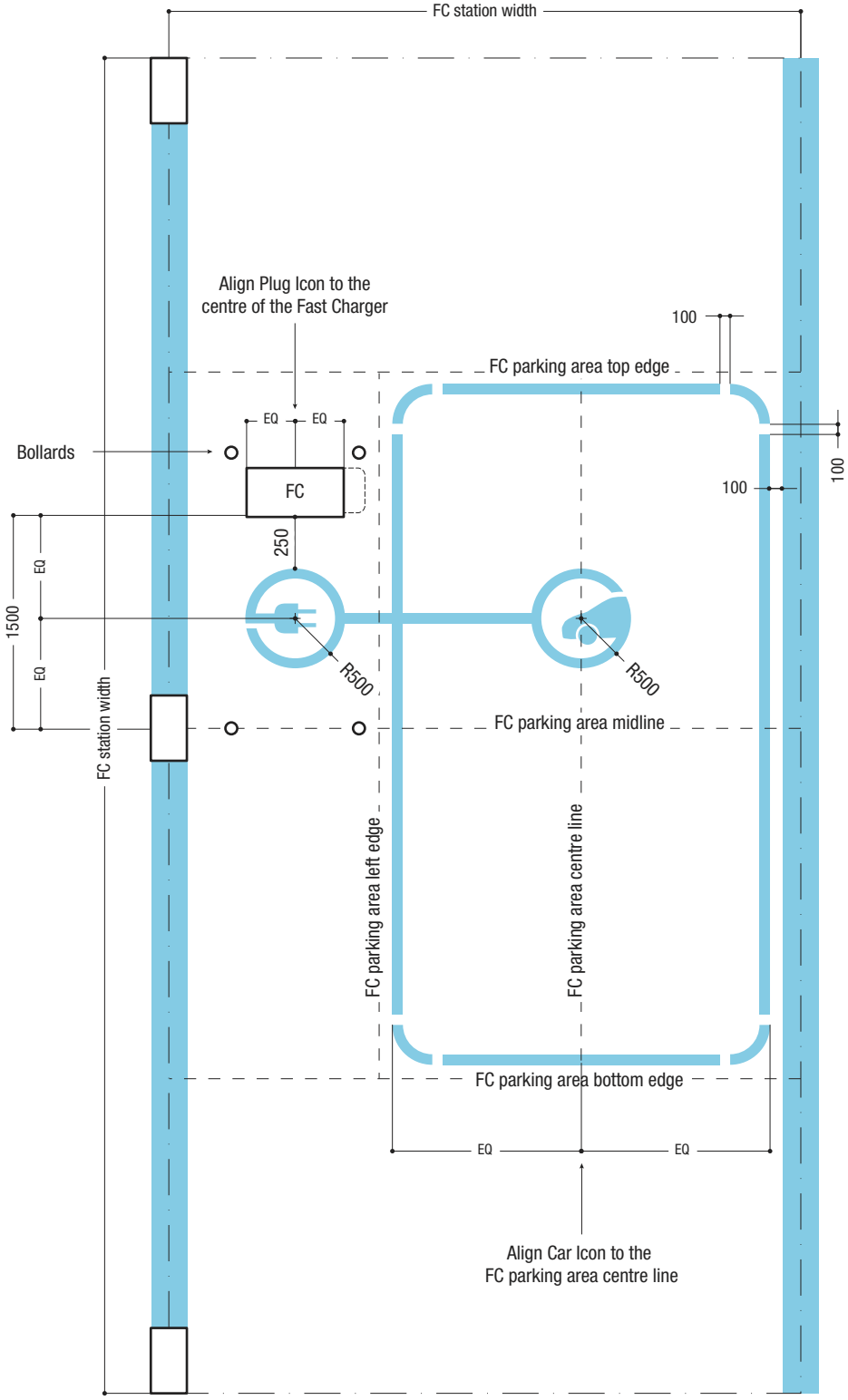



FC station width
Align Plug Icon to the
centre of the Fast Charger
100
FC parking area top edge
EQ
EQ
Bollards/signage
FC
100
100
250
EQ
1500
EQ
R500
R500
FC station width
FC parking area midline
FC parking area left edge
FC parking area centre line
FC parking area bottom edge
EQ
EQ
Align Car Icon to the
FC parking area centre line

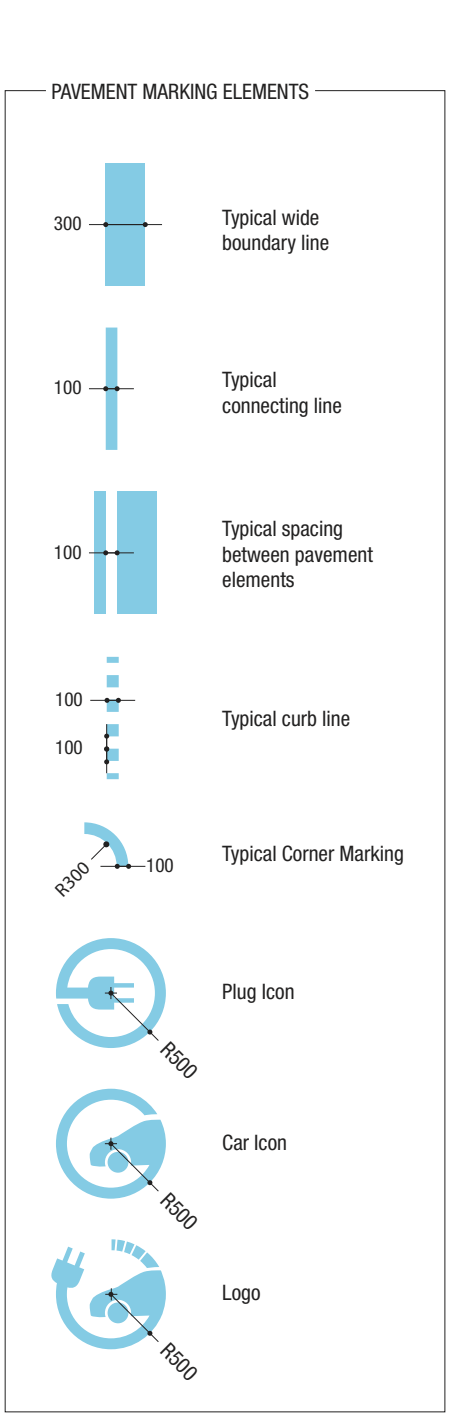
2.2 Pavement markings for parkade

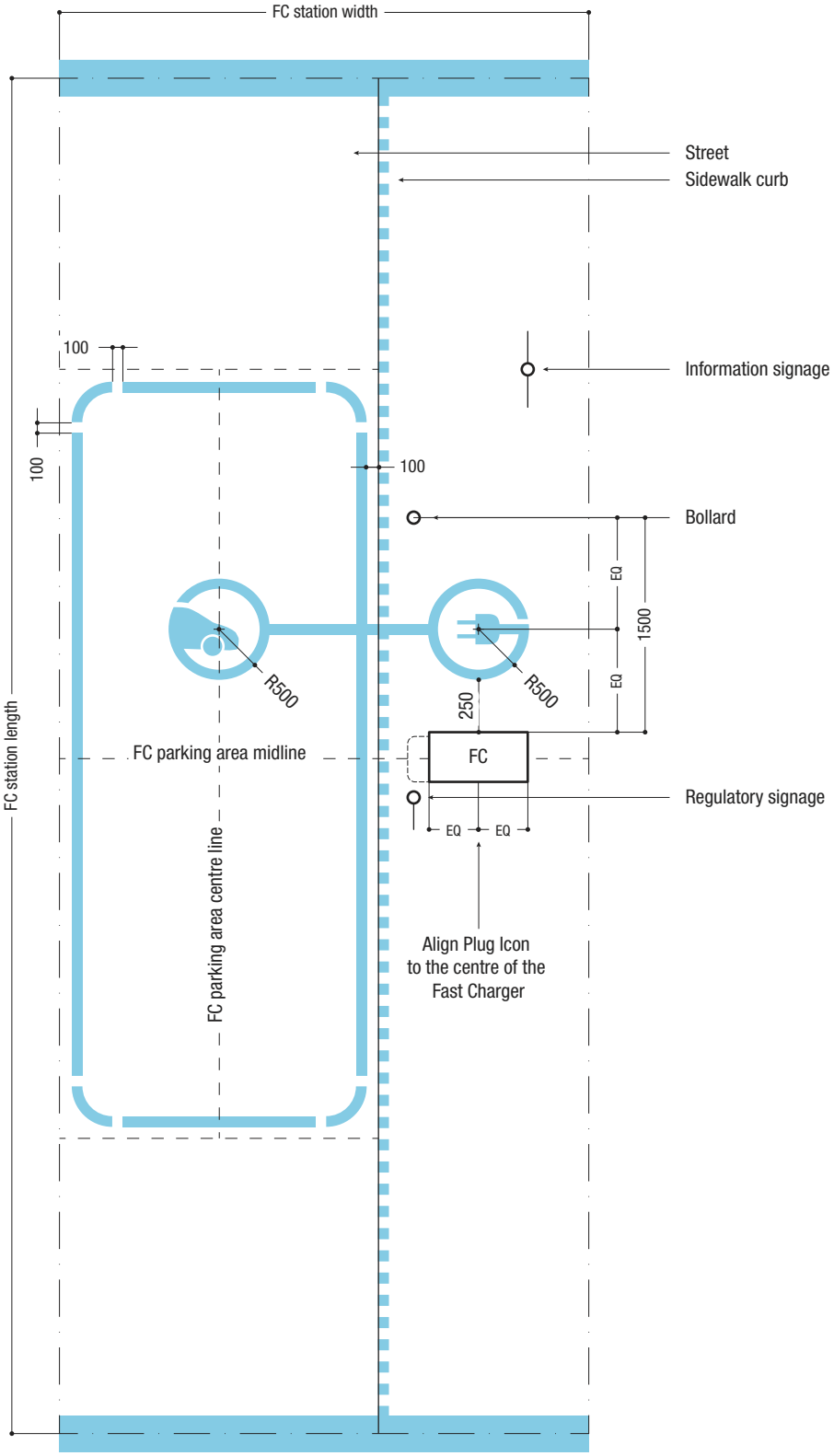


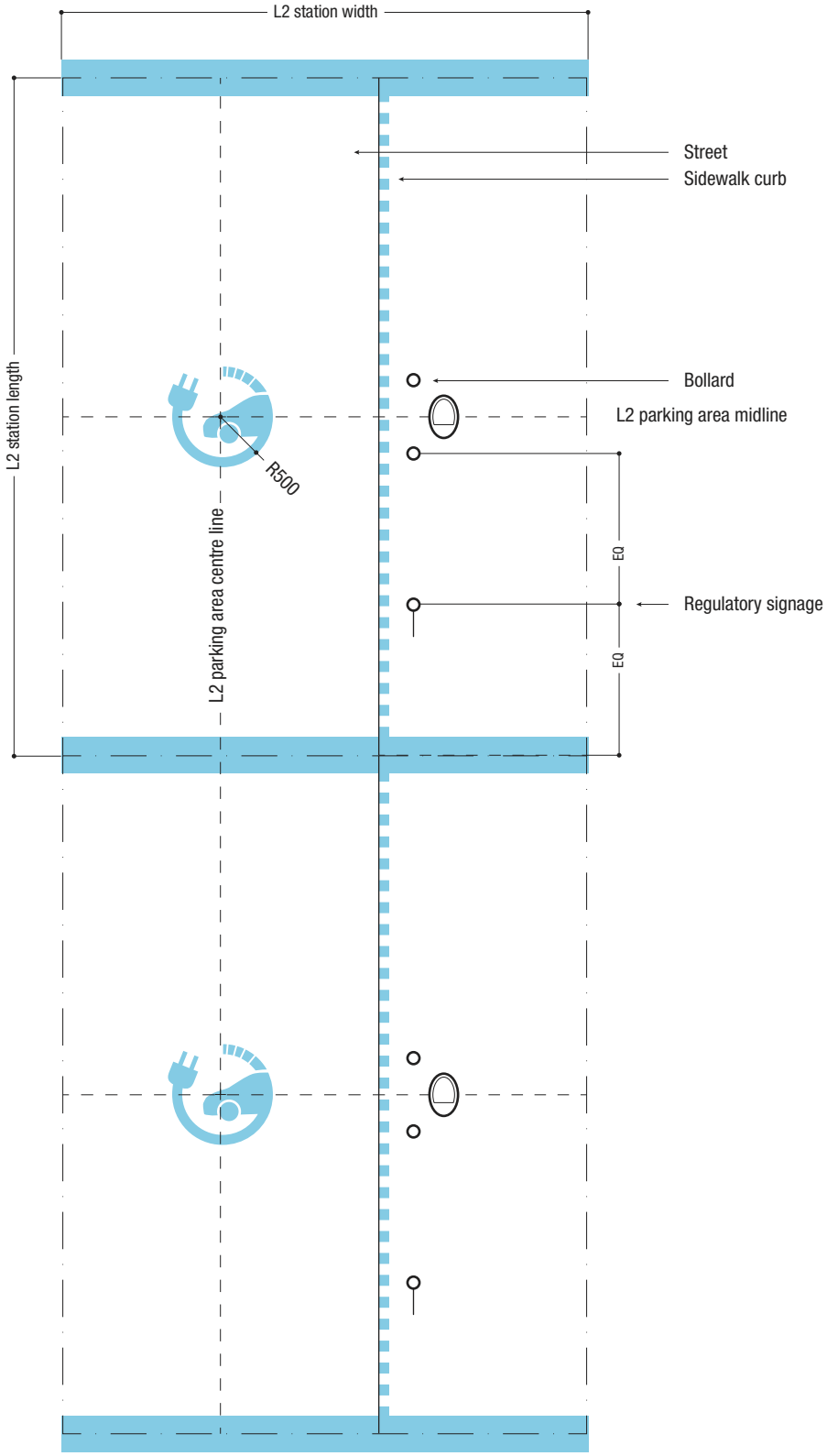



FC station width
Align Plug Icon to the
centre of the Fast Charger
100
FC parking area top edge
EQ
EQ
Bollards
FC
100
100
250
EQ
1500
EQ
R500
R500
FC station width
FC parking area midline
FC parking area left edge
FC parking area centre line
FC parking area bottom edge
EQ
EQ
Align Car Icon to the
FC parking area centre line

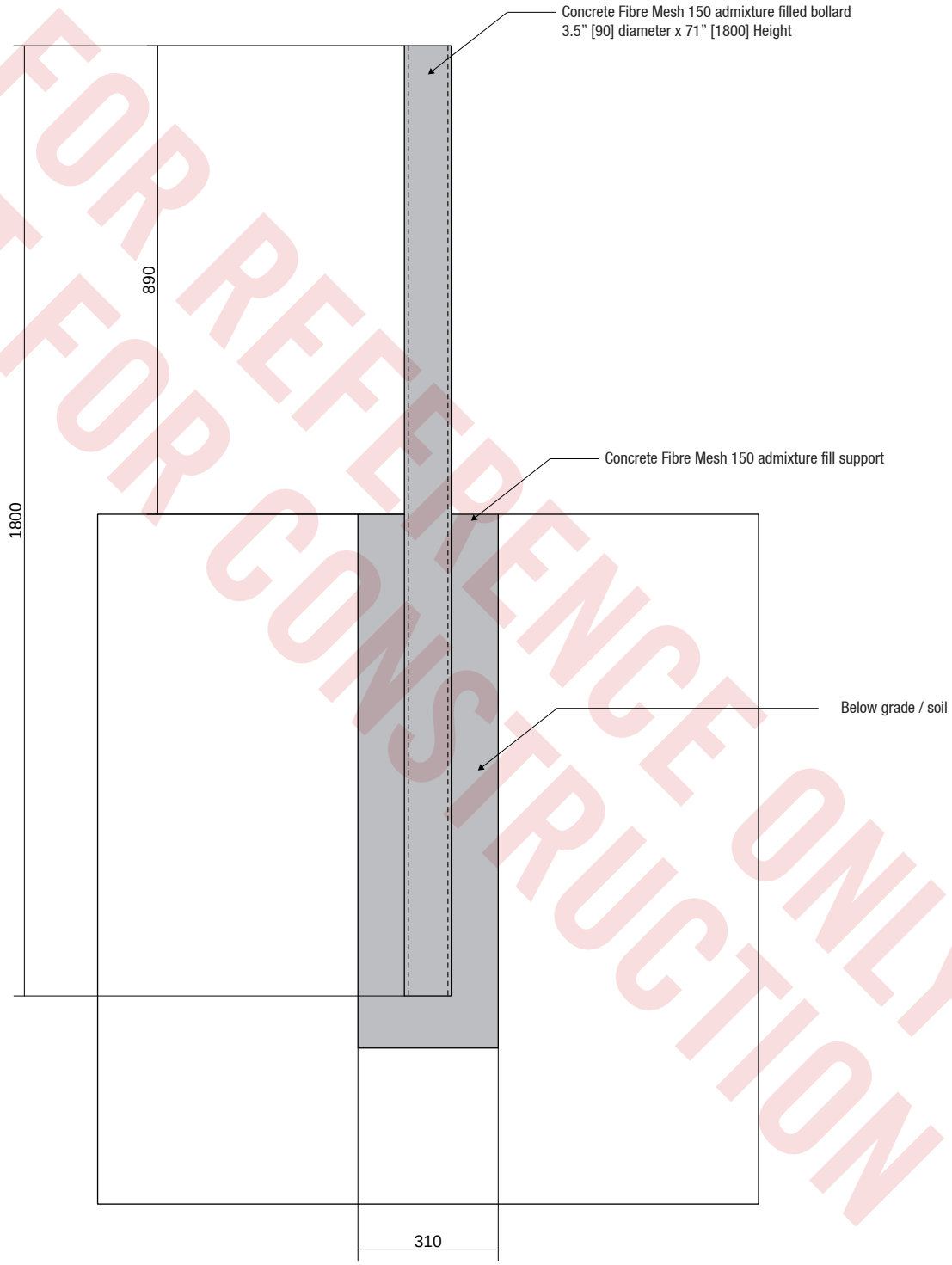
2.3 Pagement markings for curbside





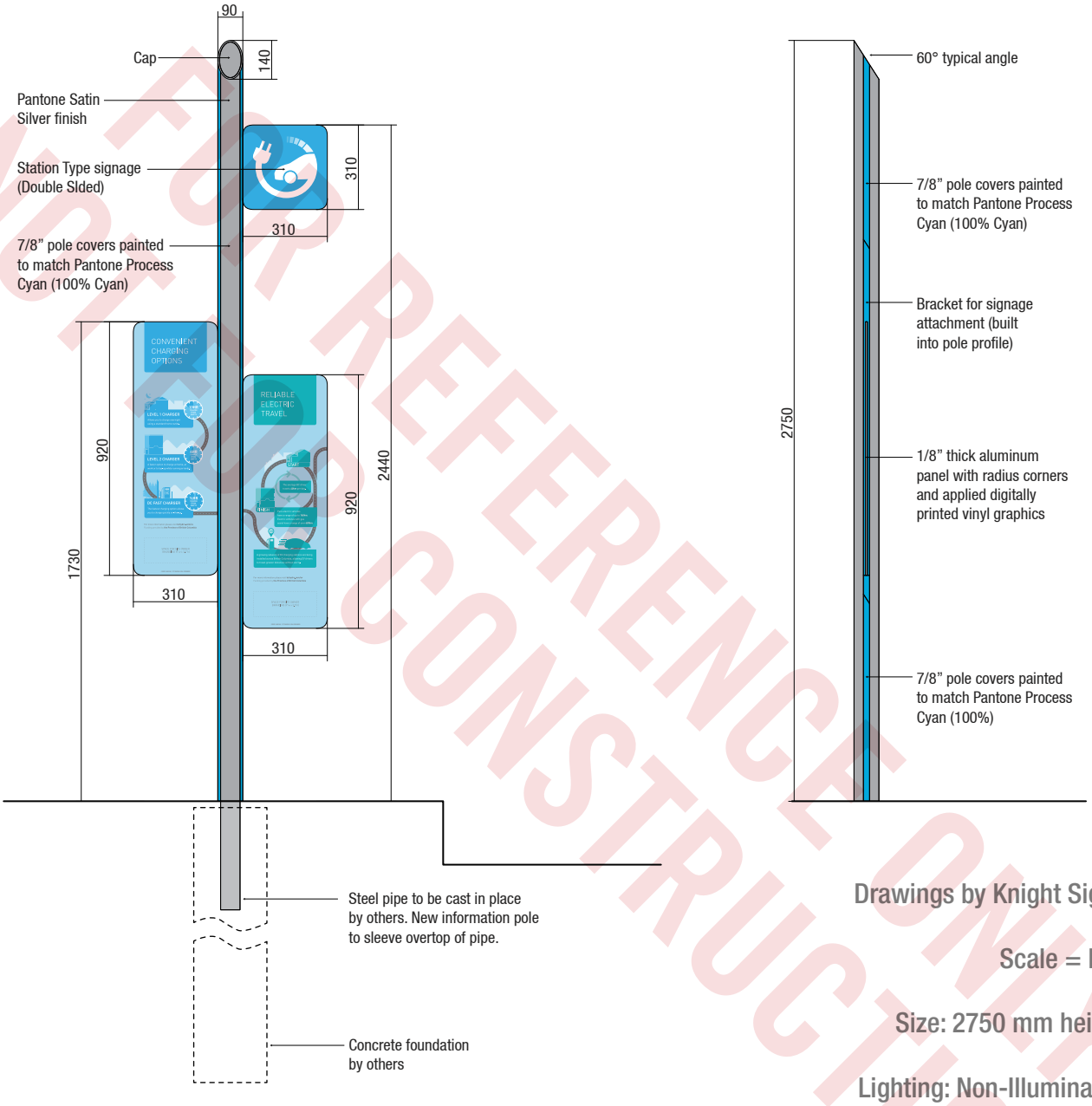

L2 station width
L2 station length
Street
Sidewalk curb
Bollard
L2 parking area midline
R500
L2 parking area centre line
E0
E0
Regulatory signage

2.4 Bollards



Scale = N/A

2.5 Network pole



Drawings by Knight Signs

Scale = N/A

Size: 2750 mm height

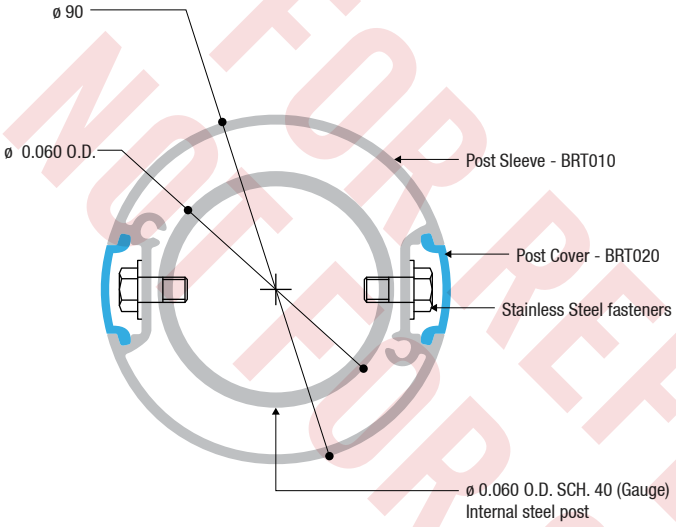
Lighting: Non-Illuminated

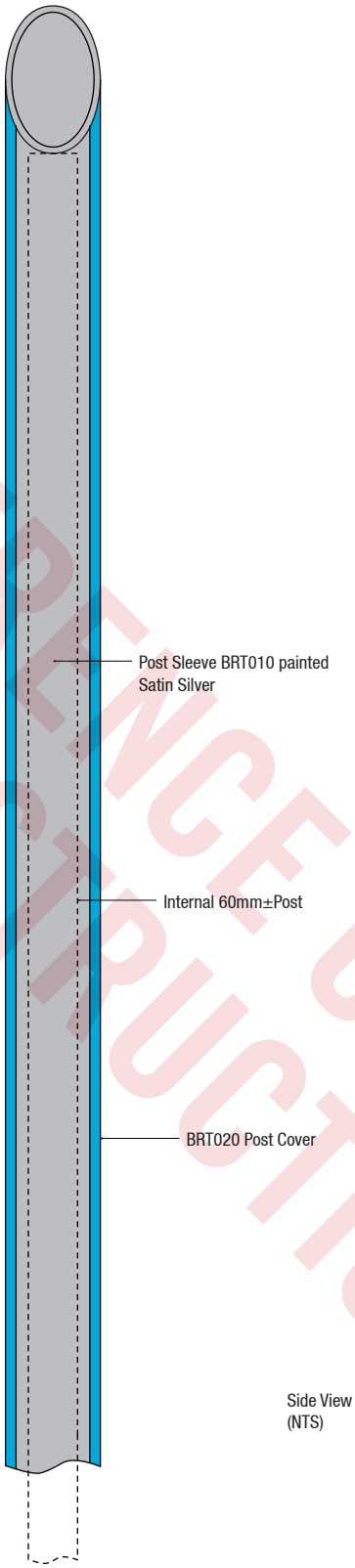
Material: Extruded aluminum with post covers
Built in Brackets for signage attachment
1/8" aluminum panel with radius corners
Digitally Printed Vinyl Graphics

Sided: Double Sided

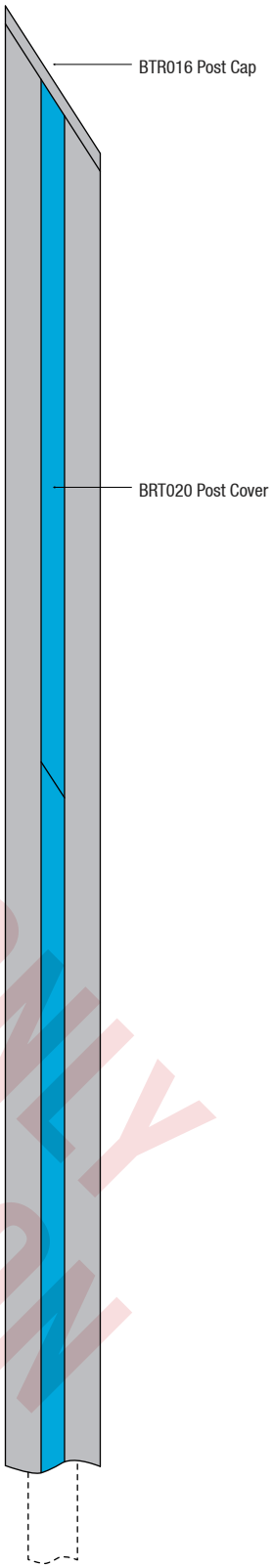
Colours: Nu Sparkle Silver Powder # 449-91170
Pantone Process Cyan (100% Cyan)

2.5 Network pole





Front View
(NTS)



Side View
(NTS)

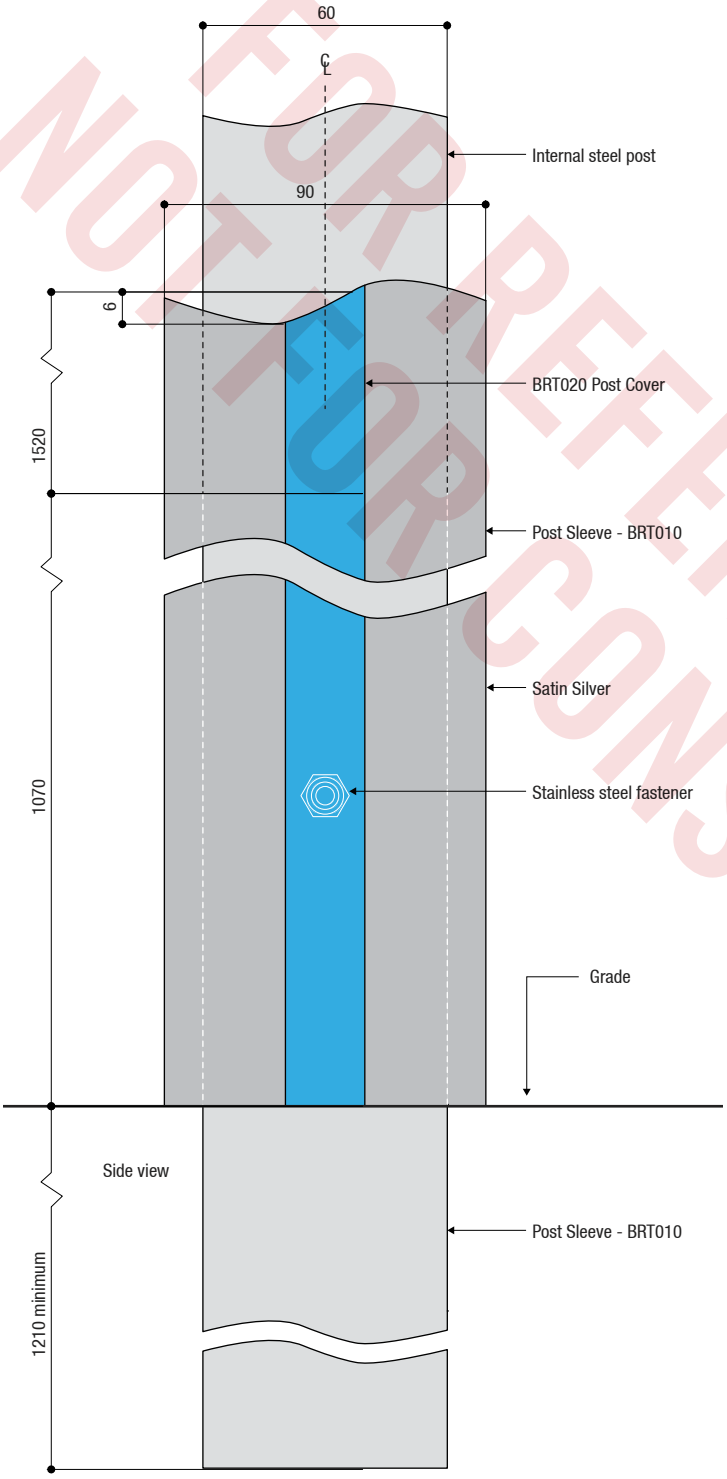
Drawings by Knight Signs

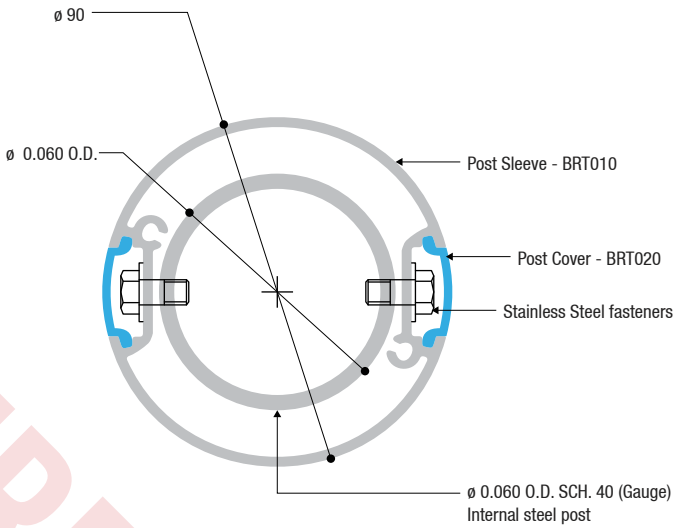
Scale = N/A

Sign Blades
Panel to be fabricated from 1/8" aluminum, water jet or router cut with radius corners as shown

Extruded Post Sleeve
Post Sleeve to be fabricated from Part # BRT010
Top section of post to be primed and painted to match satin silver of post

Graphics
Digitally printed or die cut vinyl graphics





Drawings by Knight Signs

Scale = N/A

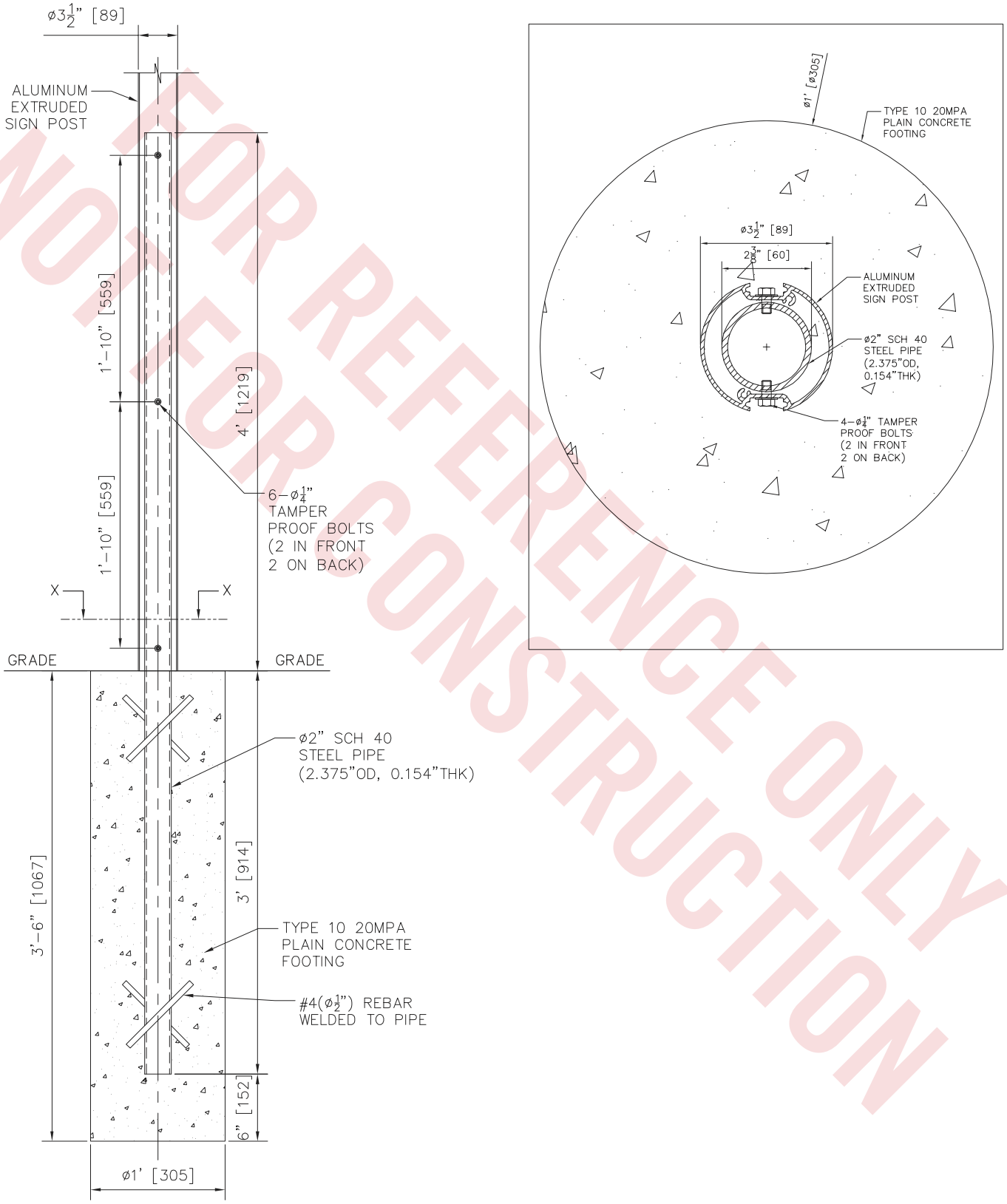
Internal Post
Internal Post to be fabricated from Ø 0.065 O.D. SCH 40 (gauge) galvanized steel tube for direct burial application

Post Sleeve - BRT010
Post sleeve to slide over existing steel post & be secured with appropriate stainless steel fasteners
Fasteners to be hidden with post sleeve channel & concealed by post cover.

Post Cover - BRT020
Post covers to be painted to match Pantone Process cyan (100%) cyan

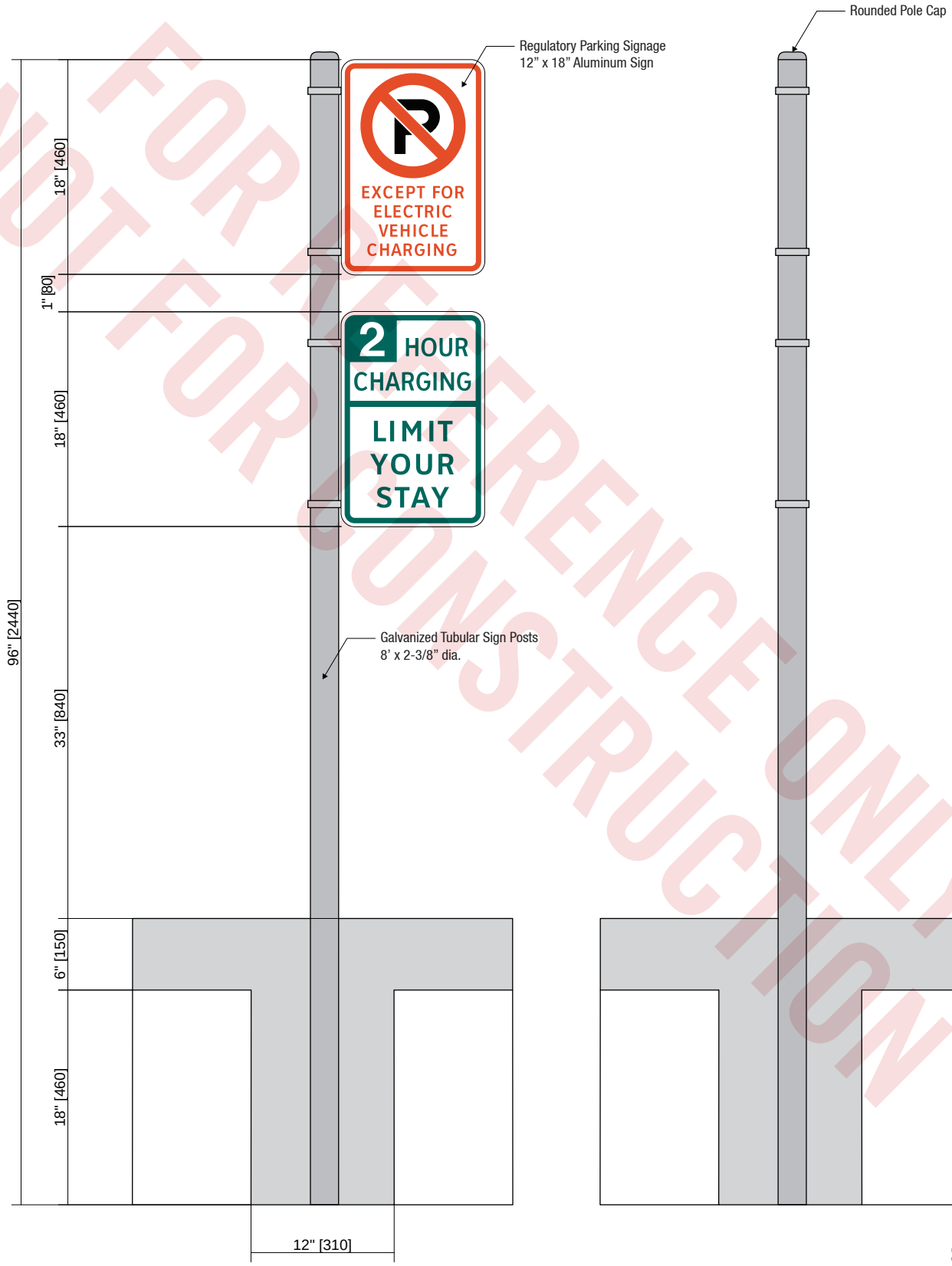
Note:
All painted components to be primed & painted with polyurethane paint, finish to be a semi-gloss.
A suitable bond-break to be provided between all dissimilar materials to prevent galvanic reaction.
When assembled unit to be straight, level & plum.

2.6 Network pole footing



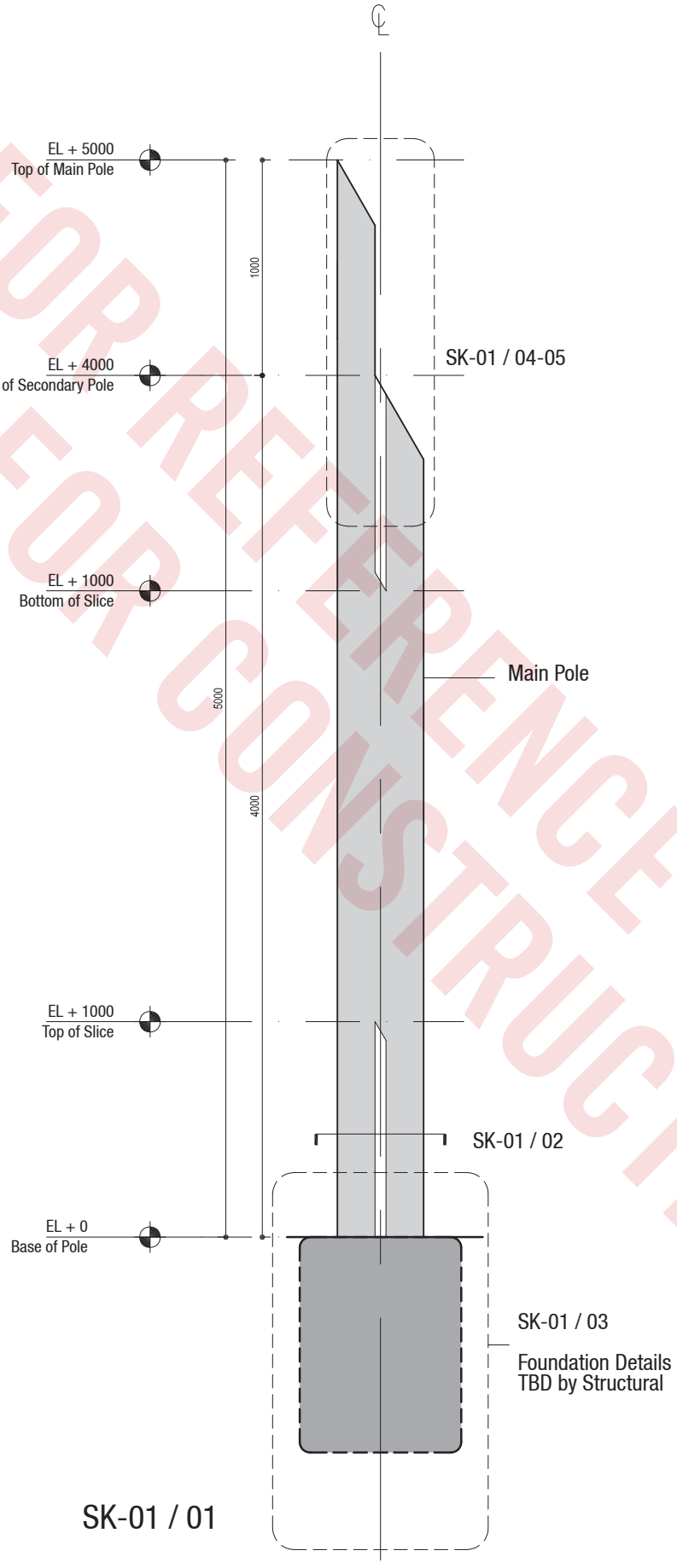
Drawings by Knight Signs
Scale = N/A

2.7 Standard pole with regulatory signage



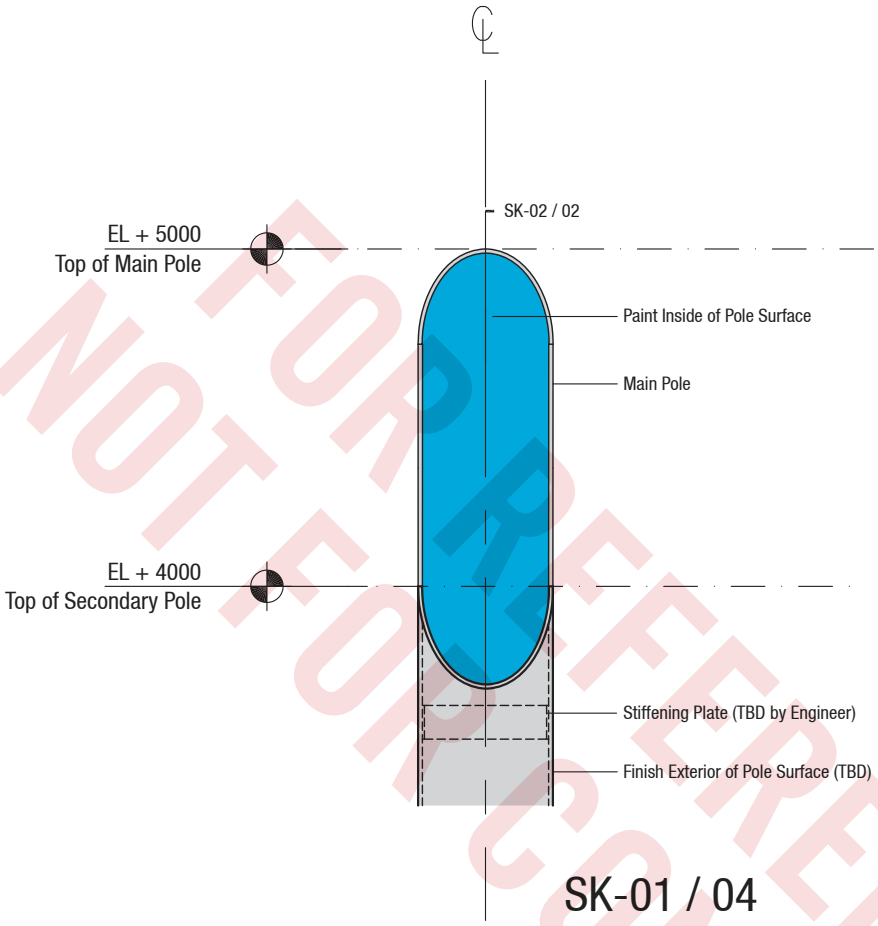
Scale = N/A

2.8 Beacon

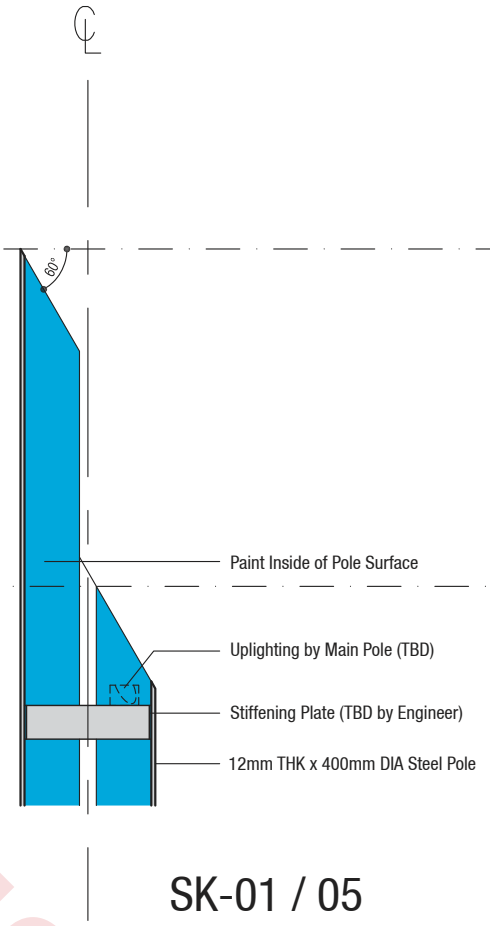


SK-01 / 01

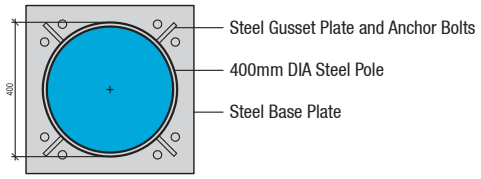
Scale = N/A



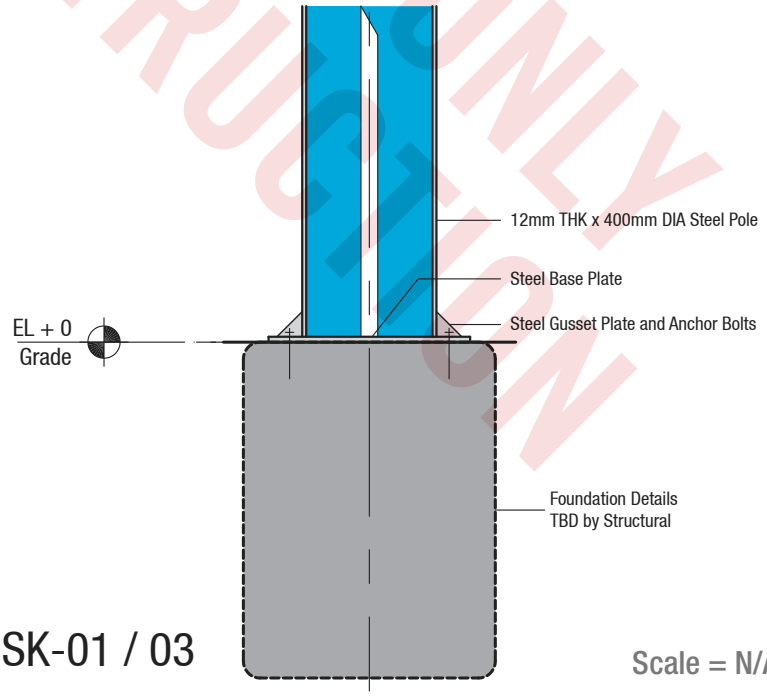
SK-01 / 04



SK-01 / 05



SK-01 / 02



SK-01 / 03

Scale = N/A

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