

EV Fast Charging Design & Operational Guidelines

FOR PUBLIC DCFC STATIONS IN BRITISH COLUMBIA

Prepared by:



In consultation with:



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Chapter 1: Overview

1. Welcome

Thanks for your interest in Direct Current (DC) fast charging stations. We're proud to power transportation electrification with clean and renewable electricity and support British Columbia's CleanBC goal of 100% zero emission vehicles sold by 2040.

We've been piloting and deploying EV fast charging stations since 2013 and we're sharing our knowledge and experience with other organizations in B.C. Although these guidelines are not intended as industry standards, they can help you avoid some of the challenges we faced. You may even want to build upon these guidelines and take the EV fast charging experience even further.

By working together to build an extensive, reliable, consistent and accessible public EV fast charging network, we can help remove barriers to EV adoption and accelerate the growth of zero emission transportation in B.C. We welcome your interest, support and feedback.

2. Background

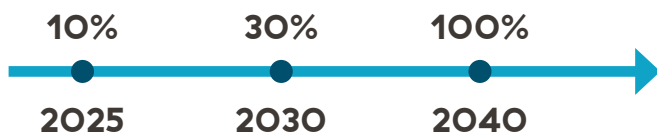
Electric vehicles are becoming an increasingly popular choice among consumers. In B.C. alone, the number of registered electric vehicles—which includes battery electric vehicles and plug-in electric vehicles—has grown from 5,500 at the end of 2016 to more than 50,000 by the end of 2020.

However, there is a long way to go before we meet the Province of B.C.'s Zero-Emission Vehicles (ZEV) Act. Potential EV owners are also concerned about their ability to charge conveniently. That means we need to work together to remove barriers to EV adoption and growth.

ZEV ACT

In 2019 the Government of British Columbia passed the ZEV Act, which requires all new cars and light trucks sold from 2040 onwards to be zero emission vehicles. ZEVs include battery electric vehicles (BEV), plug-in hybrid electric vehicles (PHEV) and hydrogen fuel cell electric vehicles (FCEV).

ZEV sales as a percentage of new vehicle sales



PERCEPTIONS OF PUBLIC CHARGING

Concerns over charging—the perception that public charging stations are not conveniently located, for example—is one of the barriers to EV adoption¹.

Developing a robust, reliable and dense network of charging stations can address this concern and alleviate any anxiety drivers have that they can easily, quickly and conveniently charge whenever they need to.

¹Understanding Potential for PEV Adoption in B.C.: A Consumer Lens, IPSOS (Oct 2019)

ABOUT THE GUIDELINES

Our fast charging station guidelines are based on what we have learned about selecting driver-friendly site locations, and designing and operating EV fast charging stations. As of February 2021, we've installed 93 DC fast chargers at 71 sites. We have evolved our approach by regularly consulting with our EV drivers.

These guidelines will be useful to any organization considering installing one or a network of fast chargers, such as:

- Municipalities or other local government entities
- Businesses wanting to operate their own stations or act as a site host
- Health authorities
- Post-secondary institutions
- Indigenous communities
- Airports
- Other government entities in B.C.

Installing fast chargers is a way to visibly display your commitment to innovation, sustainability and B.C.'s clean energy goals.

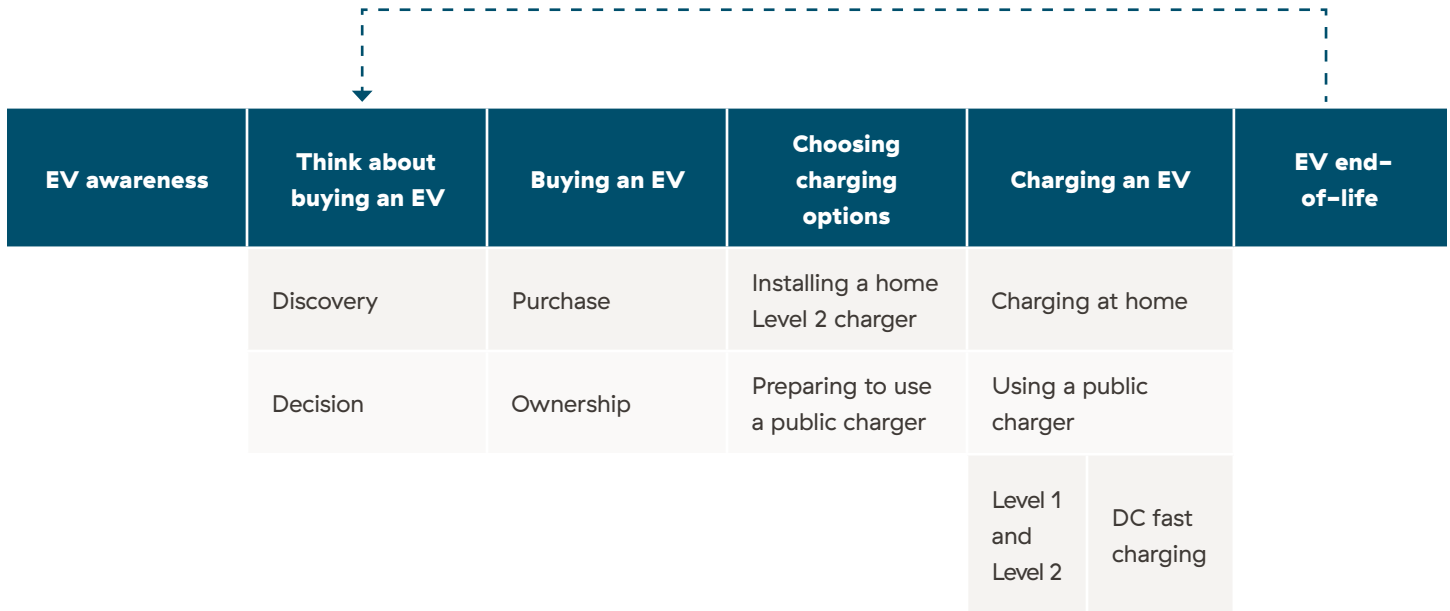
Chapter 2: A quick primer

“Always design a thing by considering it in its next larger context—a chair in a room, a room in a house, a house in an environment, an environment in a city plan.” — Eero Saarinen

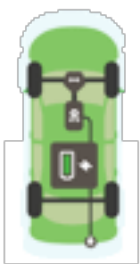
1. The customer journey

Although these guidelines are focused on public fast charging only, it is good to remember that the effort involved in locating and charging at a public fast charging station is only a small part of a driver’s entire EV journey.

We need to consider how charging fits into the broader ecosystem of a driver’s life and charging habits.



If you decide to commit to this process, make sure to apply the customer lens to your evaluation and design work. The better you know your customers—the EV drivers you want to attract—the better your site selection, charging station design and utilization rate.



2. Electric vehicles

While there are currently four different electric vehicle technologies, this document will focus only on plug-in electric vehicles which include battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV).

“Plug-in electric vehicle” is the technical term that describes vehicles with a battery that can be charged by plugging into an electrical source. Unlike conventional hybrids which generate electricity through regenerative braking, plug-in electric vehicles need to connect to a charging source in order to charge. Across the electric vehicle community, “EV” is the accepted generic term for plug-in electric vehicles.

See [Appendix 1](#) for more information about different electric vehicle technologies.





3. Charging

There are different power levels for charging; the higher the power level, the less time it takes to charge. Charge times can vary from 15 minutes to 20 hours depending on the type of EV you are driving and which power level you are using to charge.

All EVs have what is called a ‘J plug’ (J1772), which is used for Level 1 and Level 2 charging. Alternating current (AC) is delivered to the on-board charger in the EV and it is converted to direct current (DC), which charges the battery. For fast charging, the AC to DC conversion is done within a DC fast charger because an on-board charger capable of that conversion would be much too large for an EV. For DC fast charging, there are currently two types of plugs available:

- **CCS** Used by most manufacturers including BMW, General Motors and Volkswagen.
- **CHAdeMO** Used by Mitsubishi and Nissan. While Tesla has a proprietary plug, it can use CHAdeMO or a J plug with an adapter.

Here is an overview of different charging levels and plug types in use across North America:

Level 1 Wall outlet charging	Level 2 AC charging	DC fast charging
<ul style="list-style-type: none">○ Power output: 1.4kW○ Involves plugging EV into a standard 120V wall socket  <p>Wall outlet</p>	<ul style="list-style-type: none">○ Power output: 6.6 to 7.2kW○ Requires single-phase power input at 208V or 240V  <p>J1772 or ‘J plug’</p>	<ul style="list-style-type: none">○ Power output: 25 to 350kW +○ Anything above 50kW requires 3-phase high-power input  <p>CCS</p>  <p>CHAdeMO</p>

See [Appendix 2](#) for details.

4. What solution is right for you?

Before proceeding down the path of selecting site locations and designing charging stations, it is useful to spend some time thinking about your overall strategy, whether you are planning to install a single charging station or a network of them.

WHAT ARE YOUR BROADER ELECTRIFICATION GOALS?

- Are you trying to remove barriers to EV adoption and grow demand for charging?
- Do you want to support your organization’s green goals?
- Is this part of a broader initiative to integrate EVs with other forms of electrified transportation such as e-bikes, taxis, car-sharing, ride-hailing, buses, light rail, etc.?

HAVE YOU DONE AN ORGANIZATIONAL AND FINANCIAL ASSESSMENT?

- Do you have the financial resources and capacity to meet at least a 10-year commitment?
- What cost recovery or subsidization model have you considered? Sustainment, operations and maintenance of fast charging stations requires sufficient annual budget.
- Do you have the human resources, expertise and capacity to manage your fast charging stations or administer and manage vendor contracts?
- What will you want to do in-house versus out-source to another vendor? Think of functions like customer support, maintenance and repairs, network management, etc.

It is also useful to think about how you want EV drivers to use and interact with your charging station. Knowing your goals and knowing who you are trying to attract to your station will result in a better utilization rate.

Here is a comparison of different charging levels, their characteristics and what they're best suited for:

	Level 1 Wall outlet	Level 2 AC Charging	DC fast charging
	Best suited for at-home charging	Best balance when it comes to charging speed, cost and time—whether at home, work or at a public site	Best for drivers who need to quickly come and go
Use case	Best for overnight charging at home due to the slow charge rate	Best for destination charging where EV drivers can leave their vehicles for a few hours (e.g. at work) or where the station host wants drivers to stay onsite (e.g. shopping mall)	Best for en route charging where the goal is to charge quickly so EV drivers can get back on the road as soon as possible
Location	Due to the slow charge rate, Level 1 charging might be more suitable for locations such as long-term airport parking, workplaces or park and ride	Ideal locations include workplaces, shopping malls, recreation centres, movie theatres, arenas and tourist destinations	Generally located along highways and main thoroughfares
Charge times²	Ten hours of Level 1 charging will add about 70 km of range	2.5 hours of Level 2 charging will add about 100 km of range	Generally, 30–40 minutes at a DC fast charger will add about 100 km of range The rate of charge will drop to a trickle at some point; for many EVs this is when the battery is 85% full
Customer experience & driver obligations	EV drivers without a dedicated wall outlet in their parking spot will often use an extension cord to bring power from a nearby wall outlet (with permission from the outlet's owner, of course)	The maximum acceptable charging time at a Public Level 2 charger is four hours This means it is acceptable for drivers to leave their vehicles while they go shopping, see a movie or go for a workout EV drivers are encouraged to set a timer, or enable notifications from the charger network provider, so they don't overstay	The maximum acceptable charging time at a Public DC fast charger is 30–40 minutes at busy locations and if others are waiting Drivers should stay nearby in case there is an issue with the charger or if they need to move their vehicles to allow the next driver to charge Clear signage is helpful to remind drivers of good etiquette

If DC fast charging is right for you, please continue reading for recommended practices in selecting a site location, and designing and installing a driver-friendly site.

² Charge times can vary depending on a number of variables including EV type, battery state of charge, temperature, power output, etc.

Chapter 3: Design and operations guidelines

Before we take you through the process of selecting a site location and designing a fast charging station, we would like to remind you about a few things when it comes to budgeting for your site. While Federal (NRCan) and Provincial (CleanBC Go Electric) programs will fund a large portion of capital costs if you choose to leverage them, station owners need to budget for station operations for upwards of 10 years.

When you start putting together your budget for your site, be aware of potential fixed and variable costs with respect to installation and ongoing maintenance. The following is not meant to be a comprehensive list; only a reminder that it is important to consider balancing the elements of costs and revenue (should you wish to charge EV drivers to use your station) so that you can sustain your station over the longer term.

Carefully consider your design and equipment selection. The lowest capital cost option could potentially lead to higher operating costs or the need for future upgrades to address less than optimal design or equipment purchase decisions.

Potential costs		Potential contribution & revenue sources
Fixed <ul style="list-style-type: none"> ○ Hardware (fast charger, kiosk) ○ Fixtures (lighting, signage) ○ Installation costs ○ Electrical distribution system upgrades or extensions ○ Paving & stall painting ○ Design elements (branding, weather protection, seating, etc.) ○ Adequate insurance coverage 	Variable <ul style="list-style-type: none"> ○ Energy costs (kWh and demand) ○ Customer support costs ○ Ongoing maintenance and repairs ○ Network management costs ○ Operations & issue management ○ Inventory & spare parts ○ Write-offs and replacement of equipment damaged or beyond repair 	<ul style="list-style-type: none"> ○ Federal (NRCan) & Provincial (Clean BC Go Electric) DCFC incentive programs ○ Price per charge (time-based)* ○ Parking fees ○ Branding & marketing ○ Utilization <p>* Subject to Measurement Canada approval, kWh-based pricing may be an option in the future</p>

1. Designing things right—what EV drivers want

Let's start with the most important element in site location and station design: EV driver experience. Make sure you include EV owners, both current and potential ones, in your consultation work to make sure that you create a good experience. Consider their needs and how they might want to interact with your station.

Our own consultation and engagement with EV drivers around fast charging revealed a number of important expectations and insights, which are summarized here. These insights are reflected in our guidelines for station location and design in the next section.

- **Growing B.C.'s EV charging network** Drivers want more stations and more chargers.
- **Operating a reliable charging network** Drivers expect chargers to be working all the time.
- **Considering driver experience & safety** Drivers appreciate a station that is safe and provides a good experience.

a. Growing B.C.'s EV charging network

“We need more fast chargers to cover the whole province and meet the needs of a growing number of EV drivers.”

Drivers not only want stations in a greater number of locations but also want more than one station at a given location. Since some sites can be much busier than others, adding additional charging stations reduces wait times for drivers. Another important consideration is that drivers are looking to ensure that stations are installed along popular travel corridors to reduce anxiety about being able to charge while travelling. Ideally, stations should be spaced out in 80–100 km intervals along highway corridors.

Site locations should be examined in a broader context. For example, if a site's location is a junction for multiple corridors, you might want to consider not only the number of fast chargers at that site, but also supplementing the station with other chargers such as a Level 2 charger or a lower power 25kW unit. What you decide should align with the goals and objectives of

your station and your organization. What is the charging experience you want to create? Do you want EV drivers to stay longer at your site or do you want to encourage a quick charge?

b. Operating a reliable network

“Fast charger was down again. I had to settle for a Level 2 which meant having to cancel plans to see a movie with my son.”

EV drivers expect chargers to be working when they arrive at a station to charge. A non-operational charging station can erode EV driver confidence not only in the site host but also in the public charging network. Make sure you provide robust maintenance and service support and prioritize consistency in experience across the charging network.

Here are some of the activities to think about (see [Operating a Station](#) in the next section for a complete list):

- Keep equipment well-maintained; do regular inspections and cleaning
- If possible, install more than one charger at a station location or ensure that there are alternative charging options close by if a dual charger station is not an option
- Be available (or have your vendor available) to help 24/7 and provide a way for EV drivers to call for help or to report a problem
- Ensure repairs are done on a timely basis

c. Considering driver experience & safety

“I like when I can grab a coffee or run some errands while I charge.”

A preferred driver experience can be created by selecting a site with the following elements³.

i. Proximity to amenities

For many EV drivers, “waiting time is wasted time” and they would like something to do while they charge or wait to charge. Choose a site location that is within walking distance to shops, banks, washrooms and other amenities. Also ensure there is cellular coverage in the area.

ii. Safety

It is important to think about driver safety as they get out of their cars to charge or if they decide to wait in their cars while they charge. Considerations include adequate lighting, security and open sight-lines.

iii. User experience

This covers a broad area of how drivers will interact with your station including what they will need to activate a charge such as a mobile app or RFID card, how they will pay to charge, and how you will enable out-of-town drivers to charge, etc.

iv. Etiquette

A scan of PlugShare⁴ comments will quickly reveal driver frustrations over charging behaviour. A lack of awareness of proper EV charging etiquette can lead to conflict between some EV drivers. For example, more than 30 per cent of EV owners have had another EV driver unplug, or attempt to unplug their vehicle while it was charging at a public station. In addition, 24 per cent have experienced extreme frustration when other EV drivers use a public fast charger to fully charge their vehicle⁵. One way to address etiquette concerns is to include etiquette reminders either as part of station signage or on stickers placed directly on the chargers. See [Appendix 3](#) for suggested etiquette rules.

v. Accessibility

A great station is a barrier-free and accessible station. Drivers have different degrees of accessibility needs so make sure you are not inadvertently creating any barriers that will make it difficult or impossible to use your stations. We have chosen to embed accessibility considerations throughout our suggested design guidelines but have called them out in a section under [Designing a fast charging station](#).

³ BC Hydro focuses on selecting station sites with amenities already in place as it does not have the mandate to build amenities.

⁴ PlugShare is a comprehensive database of electric vehicle charging stations in North America, Europe, and Asia. It has a number of features including enabling EV drivers to find nearby charging stations, upload photos, sign-in and out of stations, and leave notes for other drivers.

⁵ BC Hydro online survey of EV drivers in B.C. (August 2019).

2. Overview of the installation process

Planning the installation of an EV charging station requires coordination between a number of local groups including the site owner, governing authorities, the utility provider and contractors.

The following is a summary of the steps involved in the implementation of a new charging station along with what each section will cover:

- **Choosing a site location** A list of features to look for when selecting the right location to install a charger.
- **Designing a station** Recommended design elements to help create a driver-friendly place to charge.
- **Putting it all together** A few sample layouts that incorporate our recommended design elements.
- **Selecting vendors and contractors** Questions you might want to ask when hiring the right people to operate your station.
- **Operating a station** Service level recommendations for each of the activities needed when operating a reliable, user-friendly station.

a. Choosing a site location

When you are deciding where to install chargers it helps to assess potential locations against a number of criteria. Create a shortlist of potential site locations and evaluate them against this set of criteria we've created for you.

See [Appendix 4](#) for a checklist you can take with you as you evaluate your sites.

i. Driver experience

A good driver experience can be created by selecting sites that are close to amenities, are safe and allow drivers to easily access them.

Proximity to amenities

- **Refreshments** Can drivers grab something to eat or drink nearby?
- **Shopping** Can drivers quickly run some errands like shopping or banking?
- **Washrooms** Are public washrooms close by? Consider the needs of drivers and any passengers they might have with them.
- **Cellular coverage/Wi-Fi/Hotspot** Is there network coverage? Access to cell coverage or Wi-Fi might be needed when activating a charge or calling for assistance.

Personal safety

- **Lighting** Is the general area well-lit?
- **Open sightline** Is the site clearly visible to vehicles and pedestrians passing by and not hidden behind buildings, vegetation, etc.?
- **Foot traffic** Is the area frequented by pedestrians or other passersby?

Tip One method to assess personal safety is to visit the site after dark. Determine if this would be a location where EV drivers would feel comfortable getting out of their vehicles to charge or sitting in their vehicles while charging.

Access

- **24/7/365 access** Are EV drivers going to be able to access the chargers at all times?
- **Enroute convenience** Is the charging station close to main travel routes, highways or thoroughfares in your community?
- **Ingress/egress** Will EV drivers be able to easily drive in and out of the site?

ii. Space requirements

- **Space to charge** Do you have a minimum of 1.5 stalls per charger to accommodate charging equipment and accessibility requirements?
- **Room to expand** If demand regularly exceeds capacity, is there room to add additional chargers?
- **Space for other equipment** Is there room for additional lighting, signage, etc.?

iii. Power supply

As part of this process, you will need to contact your local utility to help you with the following:

- **Power** Consult your equipment suppliers to determine how much power you will need to operate your charger(s), lighting, etc. Fast chargers with a power output of 50kW or more typically require a 3-phase power input.
- **Access to power** Determine if the proposed location for your chargers has good access to the existing electrical distribution system. If not, you may need to budget for the cost of an electrical service extension.
- **Capacity** Ask about the capacity of the local utility transformer to feed power to your site. If there isn't enough capacity, you may need to budget for the cost of a transformer upgrade.
- **Reliability** Ask about grid reliability.
- **Energy costs** Gather information about how much it will cost to power your site. Build in a range for light, medium and heavy usage. Ask if your utility offers time-varying or EV charging-specific rates.
- **Voltage** Be aware that available voltage from Canadian utilities may be different than from American utilities. Purchasing a charger designed for US distribution voltages (e.g. 480V) may require a new or additional transformer downstream of the utility transformer.
- **Electrical design standards** Your local utility representative will direct you to the applicable design standards for ensuring your electrical equipment can be properly connected to the power distribution grid. For electrical design standards that apply after the meter (on the customer side), consult the Canadian Electrical Code.
- **Other applicable codes and standards** Be sure to work with qualified professionals, such as certified electricians and engineers who are well-versed in designing charging stations.
- **Permitting and safety inspection** Before you start construction, consult your utility, your local municipality and Technical Safety BC to understand what the permitting and inspection requirements are for your fast charger project. An electrical permit is always required. Additional permits may include a Street Use Permit, a Traffic Management Plan, and in some cases, a Business Permit. Before a site can open to the public, it must pass a final safety inspection.

iv. Community planning

Ideally, your new EV charging station will dovetail with existing and long-term plans for the surrounding community.

- **Development** Will the proposed station fit in with future development plans for the area? Will the charging station help trigger a transformation in the area? Will you need to re-zone a specific area as part of a land-use planning exercise? It is expensive to relocate a DC fast charging station so think about what the area might look like at least 10 years into the future.
- **Economic growth** How well will your new station align with the longer term economic development plans for the community? Will it drive traffic into the commercial core as part of a Downtown Beautification Plan? Or will it be located close to a highway rest stop with a locally owned coffee stand with access to public washrooms?

v. Back-up charging

Are there Level 2 charging stations nearby to allow EV drivers to charge and get back enroute, if the charger breaks down? If not, consider installing your own Level 2 charger as a back-up.

Focus on Level 2 chargers—how they can play a role in the charging experience

Here are some guidelines around how best to incorporate Level 2 charging into the fast charging experience.

- Include a Level 2 charger in your fast charging station when there are no other charging options within 2 km.
- Even when a fast charging station design includes more than one fast charger, a Level 2 charger should still be included.
- After a certain point in the charging process, fast chargers slow down considerably. It is faster to switch to a Level 2 charger at this point if EV drivers need to reach a 100% charge; if they are planning to go on a long trip, for example. This will also have the benefit of freeing up the fast charger for another driver.
- Level 2 charging is an option for electric vehicles that are not supported by fast charging, such as PHEVs.

b. Designing a fast charging station

No matter which layout you choose, we recommend that you think about incorporating the design elements we've outlined in this section. We also recommend installing more than one charging unit as sites with only one fast charger will have much higher operating costs.

Note: See [Appendix 5](#) for sample technical specifications for the equipment included below (main switch kiosk, lighting, wayfinding beacon, informational signage, concrete pads and bollards).

i. Safety & security features

Personal safety

- **Station placement** Install charging stations in high pedestrian and/or high vehicular traffic areas with open lines of sight to provide natural surveillance.
- **Lighting** If there isn't enough proximal lighting, you will need to install lighting directly above the charging station to ensure the station is well-lit at night. Install pedestrian scale LED lighting with cut off fixtures. Some recommendations for minimum lighting requirements include:
 - **Face of charger** 108 Lux measured out to a distance of 1.5 metres. Beyond 1.5 metres, extend the arc to a total distance of 18 metres at 32 Lux.
 - **Back and sides of charger** 32 Lux measured out to a distance of 18 metres.
- **Surveillance** Including surveillance should help drivers feel safer and could help protect the equipment from vandalism.
- **Signage** Include emergency contact numbers for drivers and consider signage stating that the charging station does not contain any high value metals if the station is going to be located in a criminally active area.
- **Landscaping** Keep the ground vegetation in proximity to the charging station to maximum of two feet. Prune the trees in proximity to the station up to a minimum of eight feet. Make sure vegetation management is included in your charging station maintenance plans.

Equipment safety

- **Bollards** Install bollards to provide equipment protection. Make sure they are bright and reflective so they are highly visible to drivers. Also ensure the distance between bollards is close enough to protect the charger from vehicle damage but also wide enough to provide an accessible path to the charger. A distance of 1.2 metres (4 feet) to 1.7 metres (5.5 feet) between bollards should achieve both goals.
- **Wraps** Consider wrapping your charging station with anti-graffiti film.
- **Concrete pad** When using a precast concrete pad for a fast charger, the pad is elevated flush with grade so as to not make it difficult for a driver in a wheelchair to reach the screen or charging cables.

ii. Signage and communication

- **PlugShare and ChargeHub** We recommend you register your station on the following third party EV station listing websites and apps: PlugShare and ChargeHub. Include descriptive elements such as photos of your site and equipment, address, exact map location, support phone number and instructions on use.
- **Wayfinding** It is helpful to have roadside signage that points drivers in the right direction or alerts them that a charging station is nearby. This reduces EV drivers from needing take their eyes off the road to search for nearby stations and raises awareness of the existence of a fast charging network to prospective EV purchasers. Ideally, each fast charging station has at least four wayfinding signs.

When it comes to roadside signage, note there is a difference between provincial highway and municipal road signage:

Highway wayfinding

Ministry of Transportation & Infrastructure (MOTI) allows highway signs for charging stations 50 kW and above. Signage is subject to location-specific approval.



Municipal Wayfinding

Municipalities, on the other hand, have jurisdiction over signage within their boundaries. Contact your local municipal office for more information.

See [Appendix 6](#) for more information.



- **Beacons** It is also helpful to have a prominent identifier that drivers can see when they arrive at a location, so they can easily locate the charging station from across a parking lot or reduced sight-lines (such as trees blocking the view). A back-lit beacon helps highlight the station at night. The beacon should be aligned to the identity of the charging station operator.
- **Stalls** Paint stalls with clear signage, such as an EV charging symbol, to indicate that the stalls are for EV charging only.
- **Maximum charging time** It is recommended to post signage reminding drivers to keep their charging time within the maximum allotted time. While 30–40 minutes is generally considered the maximum acceptable charging time for a single 50kW charging station, you can consider adjusting this time based on the power level and number of chargers at your station. As the number of chargers at a station increases and queuing drops or disappears, you could even consider eliminating the time limit altogether.



Here are some suggestions for maximum charging times at stations with two and four chargers:

Power level	Max charge time at two-charger stations	Max charge time at four-charger stations
25kW	60 minutes	90 minutes
50kW	40 minutes	60 minutes
100kW	30 minutes	40 minutes
200kW	20 minutes	30 minutes

- **Charging instructions** Drivers may need instructions on the steps they need to take, and in what order, to charge their EVs.
- **Roaming** Stations that support activation via networks other than the base network for the station reduces barriers for activation from drivers from other jurisdictions. Signage should highlight all the networks that the charger supports. Currently the BC Hydro EV, FLO and ChargePoint networks all have roaming interoperability.



BC Hydro EV app



FLO



ChargePoint

- **Pricing information** Provide clear information about how much it costs to charge (unless it is free) and if parking is extra (though drivers may not like having to pay for parking in addition to paying for charging).
- **Etiquette** Drivers sometimes need to be reminded of good charging behaviour. See [Appendix 3](#) for a list of common etiquette rules.
- **Driver support** Be sure to provide a way for drivers to get help and to report charging station issues. It might be helpful to include the address of the station as well.

Tip Consider including some of the above elements in a sticker that can be placed in a prominent location on the charger or on an information panel. See [Branding & identity](#) below to see the station sticker BC Hydro created.

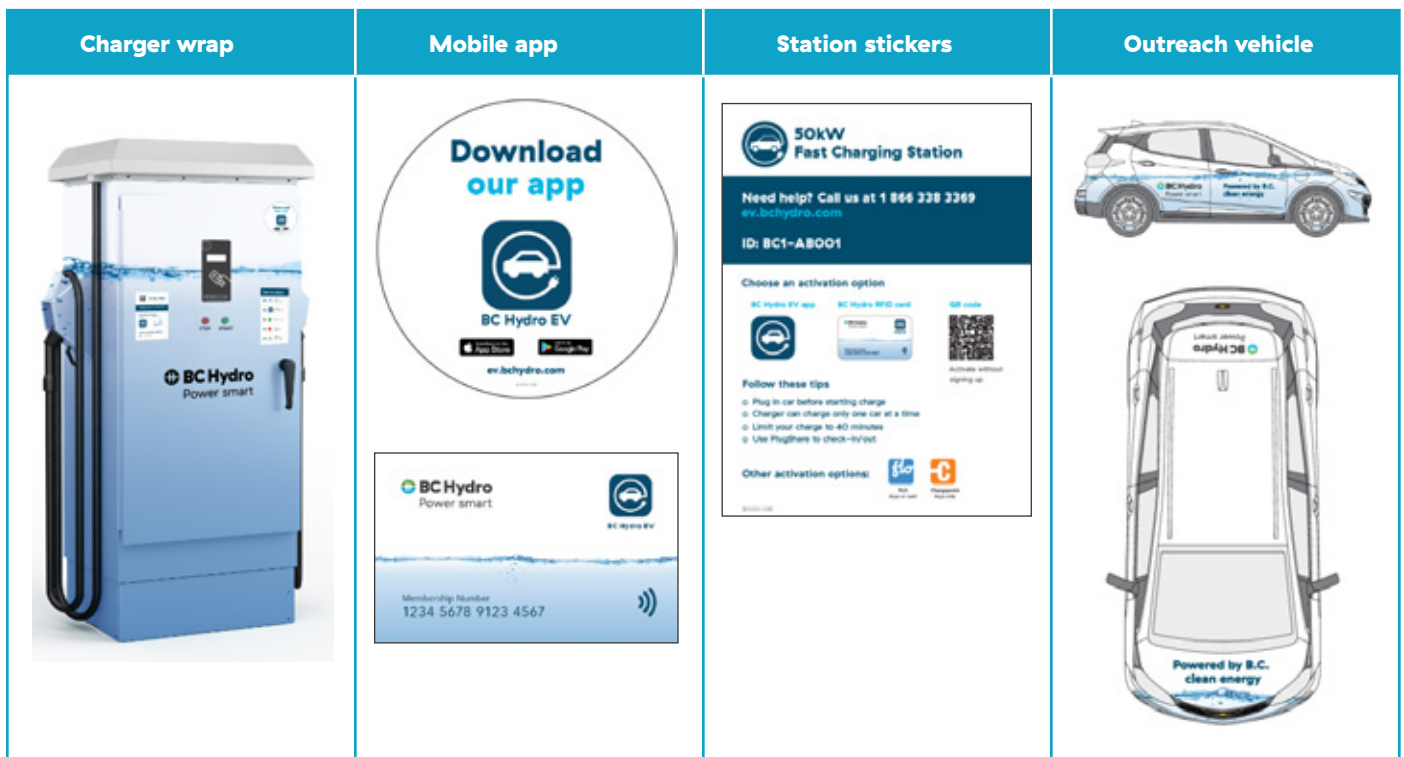
iii. Branding & identity

Station branding is not just the physical wrapping of a charger but also represents the overall identity of your organization and how it supports B.C.'s growing EV charging network. When you brand the physical experience of your station, ensure all of the other elements of the driver experience are aligned: accessibility, amenities, customer support, website or app, station reliability and regular maintenance.

If you decide to brand your chargers, remember that this represents a visual deployment of your strategy and you will want to ensure that your ability to deliver a good driver experience is aligned with brand quality. Be mindful of the EV driver experience you want to create and how you will maintain this long-term.

BC Hydro example

The BC Hydro EV charging network has a consistent look and feel. For example, we wrap our fast chargers to align with our branding and marketing messages. We also align our mobile app, website and customer service and other EV programs to this experience.



Petro-Canada example

In late 2019, Petro-Canada completed a network of electric vehicle fast charging stations across Canada at its locations along the Trans-Canada, called the Electric Highway™. The chargers are capable of charging at a rate of up to 350kW (CCS) and 100kW (CHAdeMO). Drivers have the choice of activating a charge either through a custom Petro-Canada EV app, or through contactless payment on the charger. The stations feature an illuminated canopy and charger to provide ample lighting, as well as access to amenities such as stores, restaurants and car washes at selected retail locations.



LeadingAhead Energy example

LeadingAhead Energy has built a demonstration station in Squamish, B.C. that incorporates best practices in accessibility and barrier-free station design. The overall identity of the station includes Coast Mountain visual elements. LeadingAhead Energy uses the open protocol startup network, SWITCH.



Photo credit: Fast charging station in Squamish B.C., LeadingAhead Energy, 2020.

iv. Other elements to improve station experience

- **Grade** Ensure the entire area, including the charger, is on grade. Some drivers might experience difficulty transporting the charging cable even if there is a minor slope.
- **Surface** The parking stall and area around the charger must be paved so that it doesn't hinder movement, particularly if the driver is in a wheelchair or if the driver has other mobility issues.
- **Weather protection** If you are choosing to install a charging station outside and if you have the budget for it, consider providing weather protection for drivers while they are charging or waiting to charge. Ensure there is clearance from the roof or ability to open the roof when you need to crane chargers in and out.
- **Other fixtures** Consider adding fixtures such as garbage and recycling receptacles or other assets that are valuable to drivers such as a place to sit. Each additional fixture should be added to your ongoing operating cost to ensure proper and ongoing maintenance.
- **Cable management** Charging cables can be damaged by drivers who do not put them away properly. And when left on the ground, they can pose a tripping hazard. Cables also need to be long enough to reach an electric vehicle's charge port which adds weight to the cable. Cables will also get heavier with higher-powered charging stations. This creates challenges for drivers who struggle with the weight of the cables or those who use mobility aids. Prolonging the life of cables and improving user experience can be addressed by installing a cable management system, like the ones at certain gas stations where the cable retracts when not in use.

Focus on barrier-free and accessible station design elements

Here is a summary of guidelines to create a barrier-free and accessible station*:

- **Bollards** A distance of about 1.2 metres (4 feet) to 1.7 metres (5.5 feet) between bollards should protect the charger from damage and allow for access to station. Also ensure there is enough space around the charger to be able to manoeuvre a wheelchair, for example.
- **Surface** The parking stall surface and the area around the charger should have a firm, slip-resistant and level surface using concrete or asphalt. Do not use gravel.
- **Concrete pad** When using a precast concrete pad for a fast charger, the pad should be elevated flush with grade so as to not make it difficult to reach the screen or charging cables. If the concrete pad cannot be flush with the grade, consider an access ramp.
- **Signage** All signage and instructions for using the charger should use a clear and easy-to-read font.
- **Accessible stall dimensions** If you have the space, ensure the stall is at least 3.7 metres (12 feet) wide which includes at least 1.5 metres (5 feet) for entering and leaving a vehicle. This will provide adequate space for parking and an access aisle for reaching the charger. Even if your stall is an accessible one, it is not necessary to paint an "accessibility parking space marking" in the stall. This way, the charging stall will remain open to all drivers wanting to charge.
- **Charger** Purchase a charger that meets US ADA requirements of placing the screen, holster and cables at a more accessible height.

* Our list is not an exhaustive one so be sure to take the time to consult any relevant municipal, provincial or federal accessibility codes and guidelines as they are being updated regularly.

c. Putting it all together—sample layouts

Now that we have provided guidance around selecting an ideal site and designing a user-friendly station, here are some station layouts that incorporate the design elements described in the previous section.

Although fast chargers can be installed curbside, in parkades and surface lots—see [Appendix 7](#) for an overview of common layouts, their attributes and challenges to designers and drivers—we will focus on some surface lot configurations.

- Pull-in, chargers in front of stall
- Pull-in, chargers in between stalls
- Pull-through

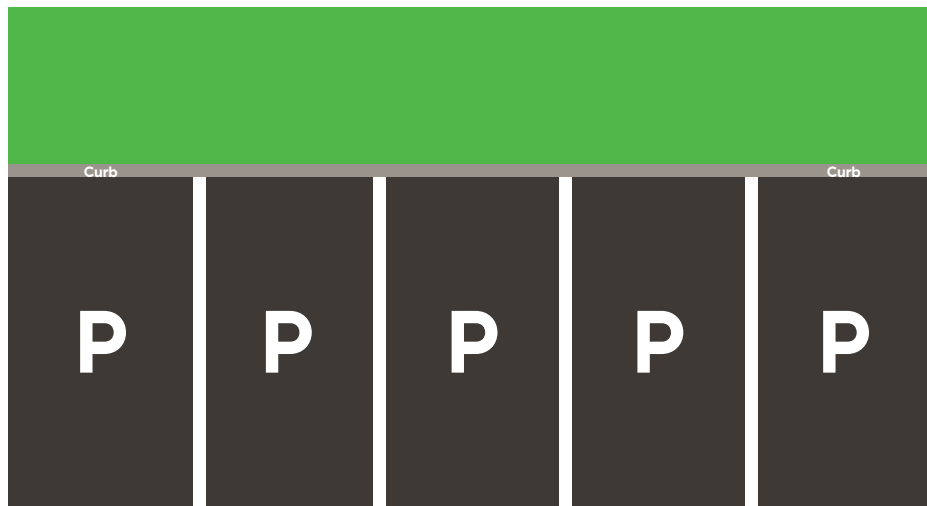
For each layout, we provide a “before” and “after” illustration to give you an idea of what changes and upgrades need to be made.

i. Pull-in, chargers in front of stall

This layout is a good choice for a surface lot location. Although we’ve provided a two-charger configuration, this design allows you to add additional chargers.

BEFORE CONSTRUCTION

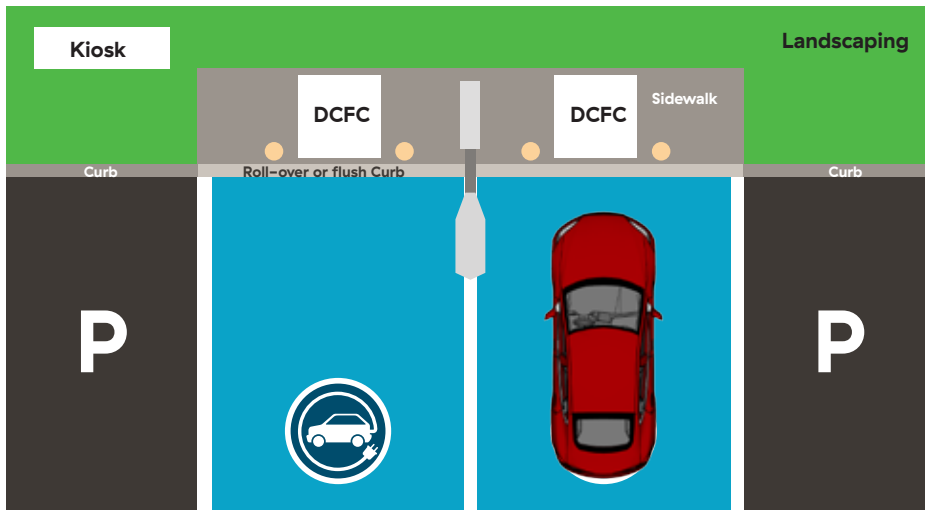
Here is how the site might look like before construction as well as a list of upgrades you should consider making to it:



List of upgrades

- Install two chargers
- Convert three stalls into two accessible-sized ones
- Replace existing curb with a roll-over or flush curb to make it easy to access the chargers
- Place chargers on paved, on grade surface to enable accessibility
- Install bollards to protect the chargers
- Paint stalls and add an EV charging logo to indicate stalls are for EV charging only
- Add overhead lighting
- Add informational signage

AFTER CONSTRUCTION (BIRD'S-EYE VIEW)



AFTER CONSTRUCTION (PERSPECTIVE)



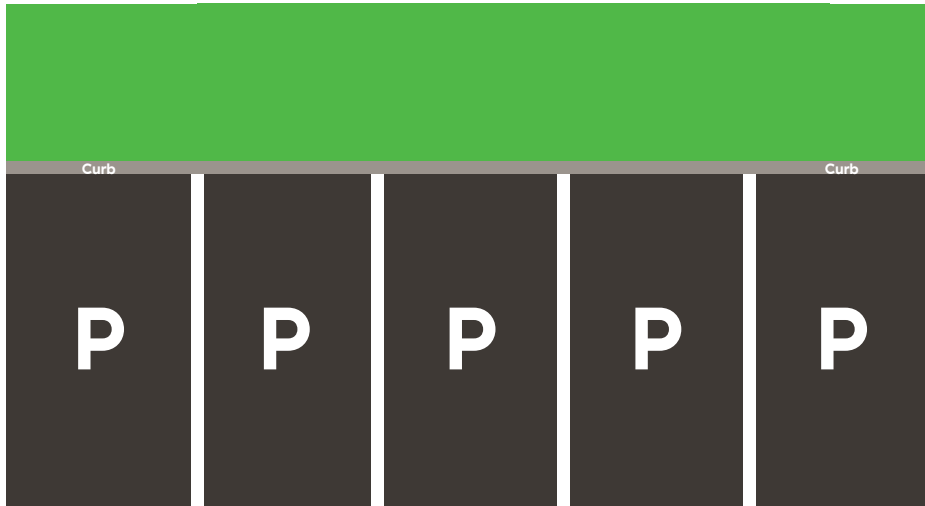
See [Appendix 8](#) for detailed specs.

ii. Pull-in, chargers in between stalls

Similar to the pull-in design above, this layout is also a good choice for a surface lot location. Instead of chargers at the front of the station, this one has chargers in between stalls. If you have three stalls, you can create one regular and one accessible stall. If you have four stalls, you can create a fully-accessible station without having to install a roll-over or flush curb to enable easy access to the chargers.

BEFORE CONSTRUCTION

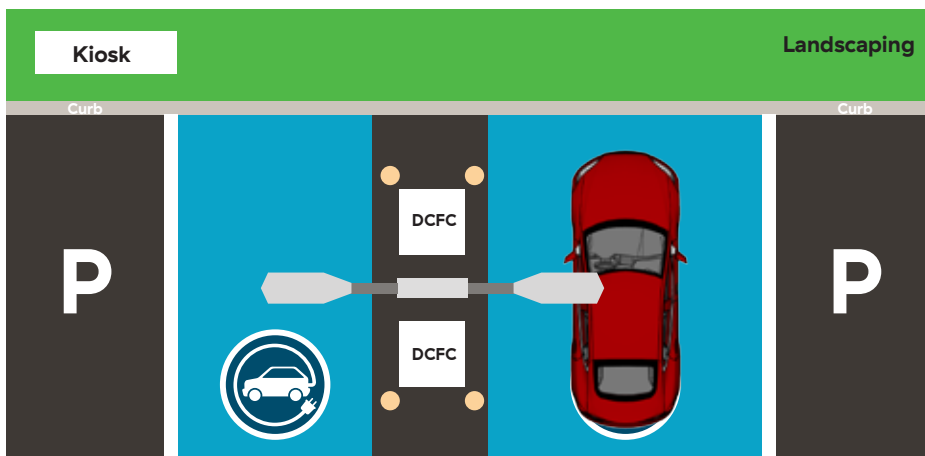
Here is how the site might look like before construction as well as a list of upgrades you should consider making to it:



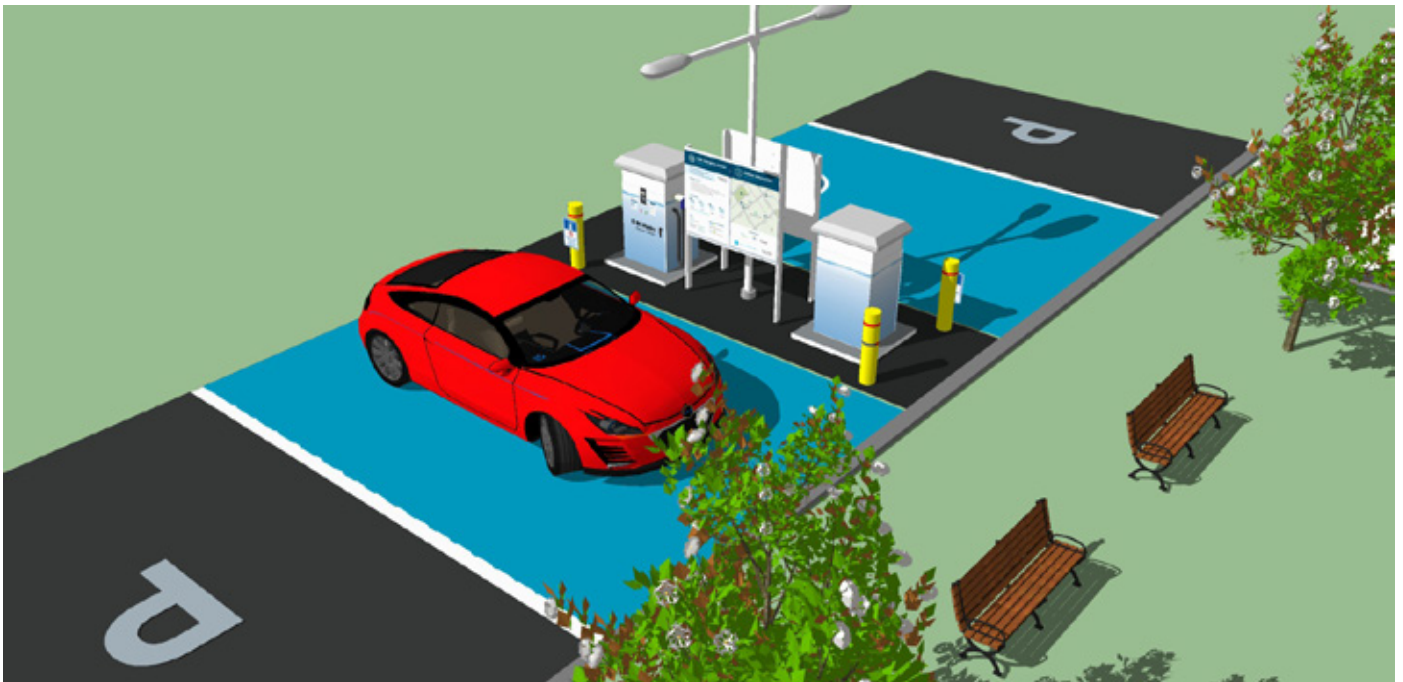
List of upgrades

- Install two chargers
- Convert three stalls into one regular-sized stall and one accessible-sized stall (if you are able to take four stalls this will enable you to create two accessible-sized stalls)
- Place chargers on paved, on grade surface to enable accessibility
- Install bollards to protect the chargers
- Paint stalls and add an EV charging logo to indicate stalls are for EV charging only
- Add overhead lighting
- Add informational signage

AFTER CONSTRUCTION (BIRD'S-EYE VIEW)



AFTER CONSTRUCTION (PERSPECTIVE)



See [Appendix 9](#) for detailed specs.

iii. Pull-through

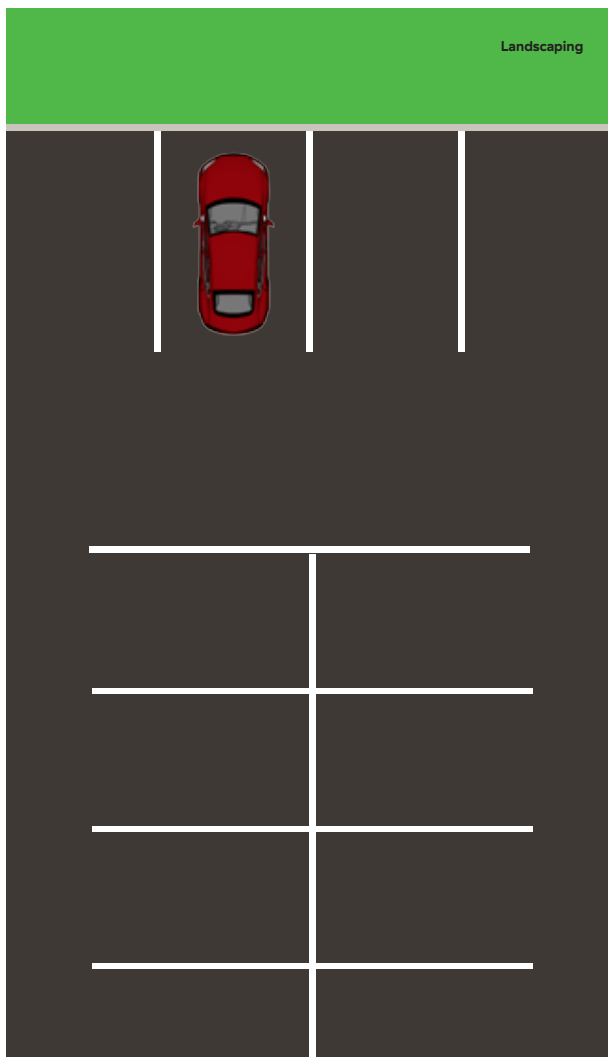
If your site has the room for it, a pull-through design is great option. It can accommodate larger EVs like pick-up trucks or EVs pulling trailers. Much like gas stations, drivers can easily park on the side where the station is closest to their vehicle's charge port. It can also easily accommodate accessibility requirements.

Here is how the site might look like before construction as well as a list of upgrades you should consider making to it:

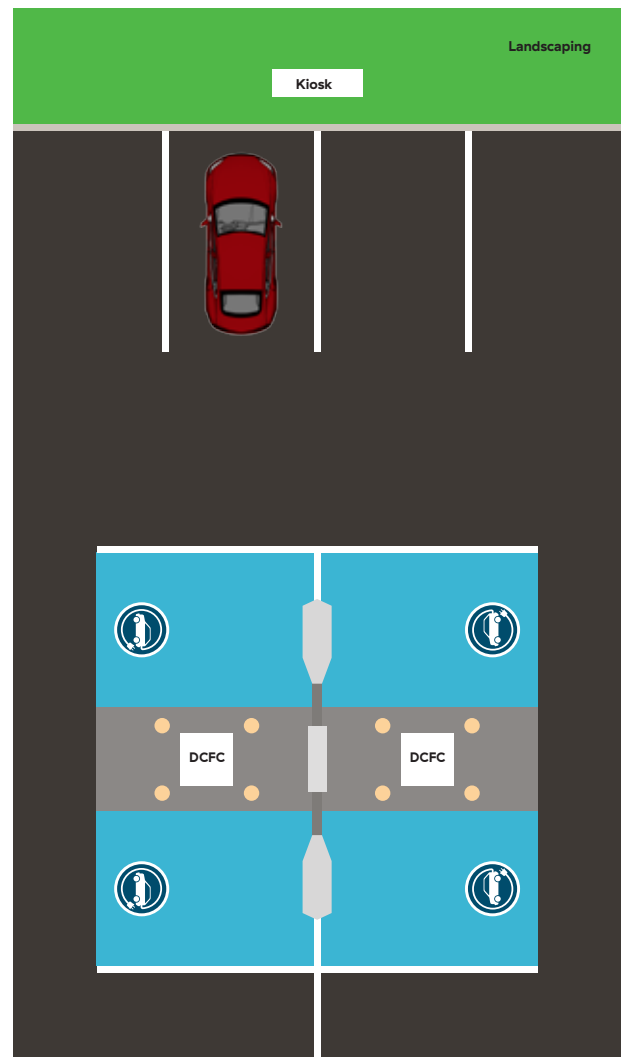
List of upgrades

- Install two chargers
- Convert six stalls into two accessible pull-through lanes
- Place chargers on paved, on grade surface to enable accessibility
- Install bollards to protect the chargers
- Paint stalls and add an EV charging logo to indicate stalls are for EV charging only
- Add overhead lighting
- Add informational signage

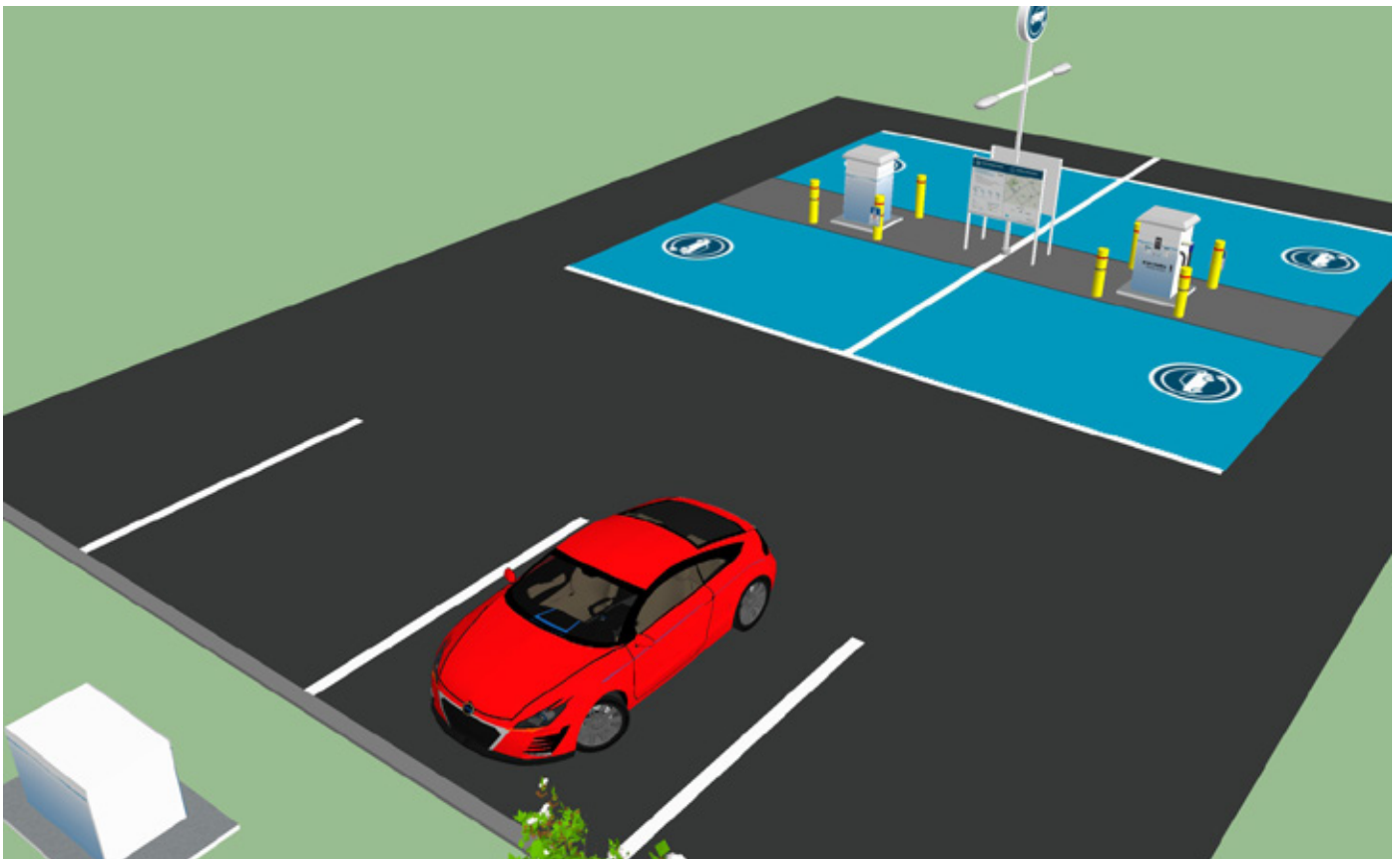
BEFORE CONSTRUCTION



AFTER CONSTRUCTION (BIRD'S-EYE VIEW)



AFTER CONSTRUCTION (PERSPECTIVE)



See [Appendix 10](#) for detailed specs.

d. Selecting vendors and contractors

As you go about selecting which vendors will supply the hardware and services and which contractors will help you assess, install and maintain your charging station, you should decide which part(s) of the operations you intend to outsource after your charging station is installed. See the next section on [Operating a fast charging station](#) for a list of ongoing maintenance and support tasks.

To help you with your vendor selection process, see [Appendix 11](#) for procurement example.

i. Selecting an EV charging equipment vendor

Tip Always make your hardware and network selections in tandem as they are mutually dependent.

WHAT TO LOOK FOR WHEN EVALUATING A VENDOR

- Business is in good standing
- Track record of deployment in Canada
- Strong supply chain of equipment components
- Ability to provide range of services required (from basic to fully managed)
- Strong warranty program including firmware updates
- Ability to adhere to B.C. and Canadian laws and standards (e.g. electrical safety, privacy, security)

WHAT TO LOOK FOR WHEN EVALUATING CHARGING EQUIPMENT

- Meets or exceeds applicable electrical safety and engineering standards
- Durable enough to withstand frequent use and seasonal changes
- Can be serviced on-site (e.g. modular components)
- Spare parts available in B.C. and/or can be shipped within 24 hours for the life of the charger (at least five years)
- Cables, connectors and cable management built for durability, accessibility and reliability
- Supports multiple activation options—mobile app, RFID card, credit card—and works with selected network
- Accessible interface with easy-to-reach buttons, no screen glare (e.g. meets US ADA standards)
- Support of Open Charge Point Protocol (OCPP) and other standards as appropriate (**Note:** OCPP support within hardware does not guarantee automatic and seamless integration with your selected network. If your hardware and network vendors are different, you must hold them accountable to work together to ensure they meet service level requirements.)
- Upgradeable hardware
- Strong network connectivity and upgrade path (e.g. LTE today, 5G and OCPP 2.0.1 in the future)

ii. Selecting a network management vendor

Tip: Always make your hardware and network selections in tandem; they are mutually dependent.

WHAT TO LOOK FOR WHEN EVALUATING AN EV NETWORK VENDOR

- Proven network track record of network operations (EV driver-facing and operations)
- Solid product roadmap (e.g. proven track record of features and functionality enhancements)
- Multiple activation options (mobile app, RFID card, credit card)
- Roaming with other key networks in B.C. to make it easy for EV drivers (BC Hydro EV, FLO, ChargePoint, Greenlots & potential future ones)
- Privacy & security approach (stores data in Canada, adheres to B.C. privacy laws, has a strong cyber security practice)
- Flexible payment options including member-based options such as mobile app or card, one-time credit card use (either via website or physical credit card reader), call centre, roaming
- If you are looking for a fully-serviced network, the ability to manage the network end-to-end from call centre, operations/triage, case management, repair dispatch through to inventory management
- Ability to push remote firmware upgrades to chargers

Vertically integrated versus de-coupled solutions

There are two possible paths an EV station owner can take when sourcing vendors and equipment: vertically integrated versus de-coupled solutions. This is an important decision that will set the stage for your station operations, customer experience and costs for 5 to 10 years. The following table summarizes the pros and cons of each.

	Vertically integrated solutions	De-coupled solutions
Definition	Same vendor for both EV network (IT) and hardware (charger)	Same or separate vendor for EV network (IT) and hardware (charger)
Pros	<ul style="list-style-type: none"> ○ One vendor relationship for both hardware and software ○ Packaged solution ○ Strong alignment, compatibility and service agreement between hardware and software ○ Less complexity for site owners with less experience or smaller networks ○ Generally large user base and high user experience built-in ○ Full service offering ○ Potential ability to purchase packaged white-label network solutions ○ Most vertically integrated solutions moving towards OCPP compatibility ○ Payment solution between hardware and software is fully aligned 	<ul style="list-style-type: none"> ○ Flexibility in choosing hardware and software from separate vendors ○ Choose service components à la carte ○ Ability to create your own network ecosystem ○ Potentially lower vendor cost if you have the internal resources to develop your solution and align hardware and software experience ○ All open standard solutions that are OCPP framework compliant ○ Offers potentially higher resilience if one network's connection is no longer available ○ Potential ability to purchase packaged turn-key solutions
Cons	<ul style="list-style-type: none"> ○ Not as flexible (potentially unable to de-couple hardware and software) ○ Potentially higher vendor costs for full-service offering (lower internal resource cost) ○ Possibility of stranded assets if proprietary service terminated operations ○ Software customization features may not be possible or can be more difficult to realize for the owner (this is different from configuration options) 	<ul style="list-style-type: none"> ○ Hardware and software may not work perfectly together (even if both follow the OCPP protocol) if you don't buy a prepackaged turnkey solution. ○ Internal resource requirements to coordinate between vendors and handle technical issues (e.g. network or hardware firmware issues) ○ Payment solution between hardware and software may not be aligned and may require additional effort to align

iii. Selecting a contractor to manage the installation

A contractor should be able to do the following for you:

- Act as a general contractor with a proven ability to manage the details
- Determine voltage and amperage requirements of selected charging equipment
- Work with your local electric utility to verify electrical capacity for additional load and recommend any necessary property or electrical service upgrades
- 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
- Be certified to provide required services and approved by Safety Inspectors

e. Operating a fast charging station

Creating a consistent and reliable experience for EV drivers is key to supporting B.C.'s ZEV goals. Drivers expect charging stations to be operating and supported 24/7, 365 days a year. And if something does go wrong, drivers expect a quick resolution.

Here is a list of tasks involved in operating a station along with minimum and recommended service levels.

Category / Tasks	Minimum service levels	Recommended service levels
Maintenance		
Pro-active inspections <ul style="list-style-type: none"> ○ Wipe screen, check cables ○ Visually inspect charger, cables and station area ○ Conduct test charge with EV ○ Confirm parking lot lights are working 	Monthly	Weekly: Urban / high-usage areas Bi-weekly: Less frequent usage areas
Graffiti removal	Within 10 days of being reported	Within 1 business day of being reported
Snow removal / salting	<24 hours <ul style="list-style-type: none"> ○ Plow lot any time > 15cm of snow falls 	<12 hours <ul style="list-style-type: none"> ○ Plow lot any time >10 cm of snow falls ○ Hand shovel snow around charger, and salt around charger and on EV charging stalls
Spare part / inventory management <ul style="list-style-type: none"> ○ Ensure inventory of critical spare parts such as connector cables ○ Pro-active order of priority spare parts ○ Ensure backup plan for complete hardware failures or damage 	Quarterly: Small fleet of stations Monthly: Larger fleet of stations	Monthly: Small fleet of stations Weekly: Larger fleet of stations
Emergency		
Public safety issue <ul style="list-style-type: none"> ○ Vehicle accident related to station ○ Charger or kiosk electrical safety issue 	<15 minutes of report <ul style="list-style-type: none"> ○ Call fire department ○ If applicable, call BC Hydro to report emergency: 1 800 BCHYDRO 	<5 minutes of report <ul style="list-style-type: none"> ○ Call fire department ○ If applicable, call BC Hydro to report emergency: 1 800 BCHYDRO

Category / Tasks	Minimum service levels	Recommended service levels
Repairs		
Repair Tier 1 <ul style="list-style-type: none"> ○ Charger is operational; minor repair is required ○ No safety issues; e.g. fan is loud and needs maintenance 	Within 30 calendar days <ul style="list-style-type: none"> ○ Post a status message on PlugShare/ChargeHub within 3 business days 	Within 10 business days <ul style="list-style-type: none"> ○ Post a status message on PlugShare/ChargeHub within 1 business day
Repair Tier 2 <ul style="list-style-type: none"> ○ Charger is functional but has network issues ○ Minor electrical work needed ○ Fee not being charged 	<7 days <ul style="list-style-type: none"> ○ Post a status message on PlugShare/ChargeHub within 1 business day 	<48 hours <ul style="list-style-type: none"> ○ Repair triage same business day ○ Post a status message on PlugShare/ChargeHub within 4 business hours
Repair Tier 3 <ul style="list-style-type: none"> ○ Charger not functional ○ Major repair required 	<2 days <ul style="list-style-type: none"> ○ Post a status message on PlugShare/ChargeHub within 1 business day 	<24 hours <ul style="list-style-type: none"> ○ Repair triage same business day ○ Post a status message on PlugShare/ChargeHub within 4 business hours
Replace (beyond repair)		
Complete swap of DCFC or kiosk <ul style="list-style-type: none"> ○ Beyond reasonable on-site Repair Tier 3 ○ Full replacement/use of backup equipment 	Station with only 1 charger: <30 days Station with at least 1 other working charger: <90 days <ul style="list-style-type: none"> ○ Station owner should have financial or insurance means to completely replace stations beyond repair within a reasonable time period 	Station with only 1 charger: <24 hours (following Repair Tier 3 attempt) Station with at least 1 other working charger: <10 days <ul style="list-style-type: none"> ○ Assumes backup equipment available in inventory in B.C.
Network operations & station monitoring (utilization of system tools and dashboards)		
Remote monitoring	n/a, OR Within 2 business days if service is part of vendor service agreement	Customer-reported issues: <24 hours reactive <ul style="list-style-type: none"> ○ Investigate/triage: Use system tools (e.g. Network / hardware management systems) ○ Dispatch field staff to perform site check/test charge: Same business or next business day ○ Update social media platforms—Plugshare/ChargeHub: <8 hours ○ Dispatch electrical contractor as per Repair Tier categorization (see above)

Category / Tasks	Minimum service levels	Recommended service levels
Error notification	n/a, OR Within 2 business days if services is part of vendor service agreement	Network operator notification: <24 hours reactive <ul style="list-style-type: none"> ○ Review system tools/dashboards: Network/hardware management systems ○ Investigate/triage: Use system tools (e.g. Network/hardware management systems) ○ Dispatch Field Service Rep to perform site check/test charge ○ Update social media platforms—Plugshare/ChargeHub: <8 hours ○ Consult with charger manufacturer or network vendor, as required ○ Dispatch electrical contractor as per Repair Tier categorization (see above)
RFID/scanning	n/a, OR Within 2 business days if services is part of vendor service agreement	Customer-reported issues: <24 hours reactive <ul style="list-style-type: none"> ○ Review system tools/dashboards: Network/hardware management systems ○ Investigate/triage: Use system tools (e.g. Network/hardware management systems) ○ Dispatch Field Service Rep to perform site check/test charge ○ Update social media platforms—Plugshare/ChargeHub: <8 hours ○ Consult with charger manufacturer or network vendor, as required ○ Dispatch electrical contractor as per Repair Tier categorization (see above)
Customer support		
Contact centre hours and capabilities <ul style="list-style-type: none"> ○ Toll-free number ○ Able to remotely initiate charging session ○ Able to provide member/ payment support 	6 am – midnight, 7 days a week <ul style="list-style-type: none"> ○ Repair triage by next business day ○ Immediate emergency support 	24/7, 365 days a year <ul style="list-style-type: none"> ○ Repair triage same business day ○ Immediate emergency support

Category / Tasks	Minimum service levels	Recommended service levels
Contact centre metrics <ul style="list-style-type: none"> ○ First call resolution % (FCR) ○ Average wait time in min (AWT) ○ Customer satisfaction top box score % (CSAT) 	<ul style="list-style-type: none"> ○ FCR: >60% ○ AWT: <5 mins average wait time ○ CSAT: 70% satisfied and very satisfied 	<ul style="list-style-type: none"> ○ FCR: >80% ○ AWT: <2 mins average wait time ○ CSAT: 85% satisfied and very satisfied
Crowd-sourced platform monitoring & response <ul style="list-style-type: none"> ○ PlugShare ○ ChargeHub 	Within 1 business day <ul style="list-style-type: none"> ○ Monitor and respond to user comments and photos ○ Target to maintain PlugShare scores above 7.0 	<4 hours M-F, next day weekends and holidays <ul style="list-style-type: none"> ○ Monitor and respond to user comments and photos ○ Target to maintain PlugShare scores above 9.0
Social media monitoring <ul style="list-style-type: none"> ○ Twitter ○ Others as applicable 	<ul style="list-style-type: none"> ○ Within 1 business day ○ Monitor user comments and photos ○ Proactively post/triage to other channels 	<ul style="list-style-type: none"> ○ Same day ○ Monitor user comments and photos ○ Proactively post/triage to other channels

Chapter 4: Planning for the future

Although it is difficult to predict with absolute certainty what the e-mobility industry will look like 10 to 20 years from now, all current forms of transportation will likely be electrified. If you want to ensure your charging stations remain relevant, you need to plan for emerging and future EV types and transportation markets.

Stations that are not upgraded to align to changing e-mobility environment will likely not be relevant after 5 to 10 years and will need to be decommissioned. Ensure you build upgrading or decommissioning costs into your business case.

Emerging EV-related scenarios and trends

- EV pickup trucks and SUVs
- Trailers that might be carrying recreational vehicles that also require charging (e-bikes, ATVs, snow mobiles or personal watercraft)
- Commercial fleet electrification
- Autonomous EVs
- Ride-hailing EVs
- Charging hubs that support all types of electric transportation
- 350kW fast chargers which can charge EVs in as little as ten minutes
- Wireless charging

EV fast charging station design and equipment will change over time

- Larger fast chargers—such as 350kW chargers—will likely not directly replace 50kW chargers. Larger chargers will have a higher impact on the distribution system and a separate process for assessment and connection will most likely be required by the Utility. To upgrade a station from 50kW to 350kW, assume you will need a complete rebuild. Also, these high power architectures will likely move toward centralized electrical equipment cabinets to allow for smaller footprint dispensers.
- Charger cables will look different as chargers get larger and more powerful. We may start to shift to using cables that are water-cooled. Charger cables may get longer or shorter depending on charger and vehicle technologies, and station layouts.
- Finally, charging locations and sites that are suitable for today's EV fleet may not be adequate in the future.

Let's work together

We support the evolution of transportation electrification in B.C. This requires a coordinated effort across government, private sector and other organizations. Finding innovative solutions means bringing together the best ideas. We hope you find these guidelines helpful and welcome your feedback we evolve them over time.

Do you have questions? Email us at evsupport@bchydro.com or call 1 866 338 3369.

Appendices

- Appendix 1** Electric vehicle technologies
- Appendix 2** Electric vehicle charging levels
- Appendix 3** Etiquette
- Appendix 4** Site evaluation checklist
- Appendix 5** Station equipment—sample technical specifications
- Appendix 6** Wayfinding signage
- Appendix 7** Overview of common charging station layouts
- Appendix 8** Detailed charging station layout—Pull-in, charger in front
- Appendix 9** Detailed charging station layout—Pull-in, charger in between stalls
- Appendix 10** Detailed charging station layout—Pull-through
- Appendix 11** Equipment procurement requirements example
- Appendix 12** Powertech Labs and electric vehicle infrastructure

1. Electric vehicle technologies

Here is an overview of different electric vehicle technologies. However, these guidelines are applicable only to the first two: BEVs and PHEVs.

Vehicle type	How it works	Battery range	Other information
Battery electric vehicle (BEV or more commonly, EV)	<p>A BEV is powered entirely by a battery and single or dual electric motors</p> <p>There is no gas back-up</p> <p>Has to be plugged into a charger</p>	100 km for first generation BEVs and up to 600 km for today's extended range BEVs	BEVs can also recharge their batteries through regenerative braking. This means that instead of using the brakes, the electric motor(s) slows down the vehicle, captures that energy and feeds it back into the battery.
Plug-in hybrid electric vehicle (PHEV)	<p>Runs mostly on batteries</p> <p>Has a gas-powered internal combustion engine that recharges the battery and/or replaces the electric motor when the battery is low and more power is required</p>	Typical PHEVs drive for 30–80 km using only electricity before they start using gasoline, and can then drive for about 500 km depending on the size of the fuel tank	PHEVs are often cheaper and cleaner to run than traditional hybrid vehicles (HEVs) because they can be recharged by the power grid. You'll still need to buy gas—but far less frequently.
Hybrid electric vehicle (HEV)	Has two drive systems that run simultaneously: a gas-powered engine and fuel tank, along with an electric motor and a battery	Most HEVs have a range of about 900 km	HEVs should not to be confused with PHEVs. HEVs are not plug-ins, as they can't be recharged from the power grid.
Fuel-cell electric vehicle (FCEV)	<p>Uses on-board fuel cells to generate electricity from hydrogen and oxygen to power an electric motor</p> <p>All the energy comes from hydrogen fuel</p>	Today's commercially available FCEVs have a range of about 500 km	Takes a few minutes to refuel and emits only water from its exhaust.

2. Electric vehicle charging levels

Here is an overview of various EV charging levels, power requirements and where they are commonly found.

Charging level	Power	Time to charge	Used for	Comments
Level 1: Wall outlet charging	1.4kW output Requires standard 120V/15A wall socket 1.9kW available with a NEMA 5-20 plug on a 20A circuit	Charges 8 km/hour ○ BEV: 12-20 hours ○ PHEV: 6-12 hours	○ Home ○ Emergency charging	○ Typical household outlet
Level 2: AC charging	6.6 – 7.2 kW output Requires 208V or 240V power input	Charges 30-40 km/hour ○ BEV: 2-8 hours ○ PHEV: 1-2.5 hours	○ Home ○ Businesses ○ Common areas	○ Requires a 30A or 40A circuit, similar to those used by a typical household appliance such as an oven or clothes dryer ○ Requires installation by a qualified electrician
DC fast charging	25 to 350kW + output Requires 3-phase high-power input	Charges 200-250 km/hour at 50kW ○ BEV: 1-4 hours ○ PHEV: 15 min-3 hours	○ Businesses ○ En route charging ○ Common areas	○ Requires installation of DC fast charger (DCFC) ○ There are currently two types of connectors that connect DCFCs to vehicles: CHAdeMO (Japanese standard) and SAE Combo (USA standard) ○ Vehicles that don't have either of these two standard connectors need to purchase adaptors to charge at a DCFC






















3. Etiquette

To come up with a list of etiquette rules, we reviewed PlugShare comments and polled a number of EV drivers to identify the biggest complaints around charging behaviour.

Here are our suggestions to help encourage good behaviour at charging stations:

1. Take only what you need, and limit your charge to 30–40 minutes⁷
2. Stay close by in case you need to move your vehicle to let someone else charge
3. Don't park in an EV charging stall if you're not charging or waiting to charge
4. Put the charging cord away, and keep the station tidy
5. Don't unplug others, unless there's a note that gives you the green light
6. Use PlugShare to keep others informed

BC Hydro examples

Charging station stickers	Information panel
<div style="text-align: center;">  <p>50kW Fast Charging Station</p> </div> <div style="background-color: #0072bc; color: white; padding: 5px; text-align: center;"> <p>Need help? Call us at 1 866 338 3369 ev.bchydro.com</p> </div> <div style="background-color: #0072bc; color: white; padding: 5px; text-align: center;"> <p>ID: BC1-AB001</p> </div> <div style="padding: 10px;"> <p>Choose an activation option</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>BC Hydro EV app</p>  </div> <div style="text-align: center;"> <p>BC Hydro RFID card</p>  </div> <div style="text-align: center;"> <p>QR code</p>  <p>Activate without signing up</p> </div> </div> <p>Follow these tips</p> <ul style="list-style-type: none"> o Plug in car before starting charge o Charger can charge only one car at a time o Limit your charge to 40 minutes o Use PlugShare to check-in/out <p>Other activation options:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>FLO App or card</p> </div> <div style="text-align: center;">  <p>Chargepoint App only</p> </div> </div> <p style="font-size: small; margin-top: 10px;">BCH20-269</p> </div>	<div style="background-color: #0072bc; color: white; padding: 10px;"> <div style="display: flex; justify-content: space-between; align-items: center;">  <div> <p>Fast charging station 1705 Campbell Way, Port McNeill, BC</p> </div> </div> </div> <div style="padding: 10px;"> <p style="font-size: x-small;">Thanks for using the station. If you need help, please call 1 866 338 3369 In case of an emergency call 911 For more information visit ev.bchydro.com</p> <div style="text-align: right;">  <p>BC Hydro Power smart</p> </div> <p>Charging etiquette</p> <ul style="list-style-type: none"> o Limit your charge to 30 to 40 minutes o Stay close by so you can move your car when you are done charging o Sign into Plugshare so you can check in and out or to leave notes for other drivers o Park in an EV charging stall only if you are charging o Put the cord away when done and keep station tidy <hr/> <p>How to charge</p> <div style="display: flex; justify-content: space-around; text-align: center;"> <div> <p>1</p>  <p>Plug in</p> </div> <div> <p>2</p>  <p>Activate</p> </div> <div> <p>3</p>  <p>Start</p> </div> <div> <p>4</p>  <p>Stop</p> </div> <div> <p>5</p>  <p>Unplug</p> </div> </div> <p style="font-size: x-small; color: #0072bc;">Remember, only one car can charge on each charger at a time.</p> <hr/> <div style="display: flex;"> <div style="flex: 1;"> <p>Cost</p> <p>Charging</p> <p style="font-size: x-small;">Free introductory charging</p> <p>Parking</p> <p style="font-size: x-small;">Free</p> <p>Funding partners</p> <div style="display: flex; align-items: center; font-size: x-small;">   </div> </div> <div style="flex: 1; border-left: 1px dashed #ccc; padding-left: 10px;"> <p>Membership & activation</p> <p>By app</p> <div style="display: flex; justify-content: space-around; font-size: x-small;">     </div> <p style="font-size: x-small;">Use one of these apps to activate the charging session and see real time status.</p> <p>By card</p> <div style="display: flex; align-items: center; font-size: x-small;">   </div> <p style="font-size: x-small;">Use one of these RFID cards to activate.</p> <p>By phone</p> <p style="font-size: x-small;">Call us at 1 866 338 3369 if you don't currently have a membership to any network.</p> </div> </div> </div>

⁷Note: This is our recommendation at fast charging stations, but the maximum charge time might vary based on the speed of the charge and how long you want people to stay.

4. Site evaluation checklist

Take this checklist with you when assessing potential charging station sites.

	Site 1	Site 2	Site 3
Driver experience			
Proximity to amenities <ul style="list-style-type: none"> <input type="checkbox"/> Refreshments <input type="checkbox"/> Shopping/banking <input type="checkbox"/> Washrooms <input type="checkbox"/> Cellular/Wi-Fi/Hotspot 			
Personal safety <ul style="list-style-type: none"> <input type="checkbox"/> Adequate lighting <input type="checkbox"/> Open sightlines <input type="checkbox"/> Foot traffic 			
Access <ul style="list-style-type: none"> <input type="checkbox"/> 24/7/365 access <input type="checkbox"/> En route convenience <input type="checkbox"/> Ingress/egress 			
Space requirements			
<ul style="list-style-type: none"> <input type="checkbox"/> Space for two chargers <input type="checkbox"/> Space for accessible stall(s) <input type="checkbox"/> Room to expand <input type="checkbox"/> Space for other equipment 			
Power supply			
<ul style="list-style-type: none"> <input type="checkbox"/> Access to power <input type="checkbox"/> Available capacity 			
Community planning			
<ul style="list-style-type: none"> <input type="checkbox"/> Future development <input type="checkbox"/> Economic growth 			
Back-up charging			
<ul style="list-style-type: none"> <input type="checkbox"/> Nearby DC fast charging <input type="checkbox"/> Nearby Level 2 charging 			
Other accessibility requirements			
<ul style="list-style-type: none"> <input type="checkbox"/> Surface is on-grade (no slope) <input type="checkbox"/> Surface is paved (or can be paved) <input type="checkbox"/> No curb (or curb can be removed) 			

5. Station equipment—sample technical specifications

BC Hydro and Powertech Labs (see [Appendix 12](#) for more information about Powertech Labs) have evolved the technical specifications for fast charging station elements over the past six years.

In addition to a DC fast charger, you'll need:

- Main switch kiosk
- Lighting
- Wayfinding beacon
- Informational signage
- Concrete pads for the charger, kiosk and lighting
- Bollards

LIST OF FIGURES

Important—Engineer Review Required

The following designs are for reference only. Specifications for your particular station needs should be reviewed and stamped by a qualified engineer.

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Main switch kiosk

The main switch kiosk cabinet provides space for a main breaker to disconnect electrical power to the charging station, as well as transformers to step down/up voltage to supply the DC fast chargers, station lighting and auxiliary loads.

Here is an example of a BC Hydro kiosk cabinet.



Figure 1: BC Hydro kiosk for EV charging station

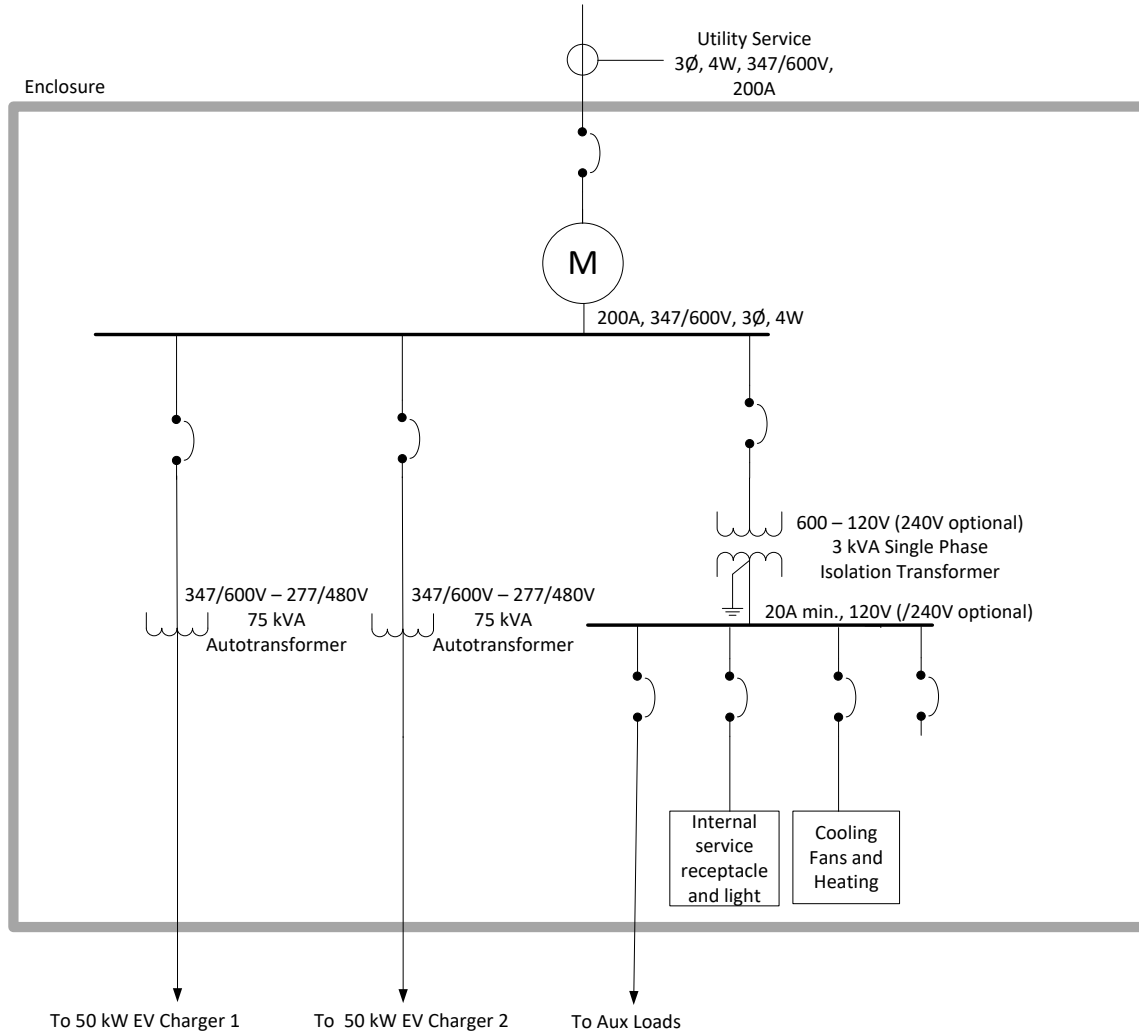
On the next page, we include three, single-line diagrams for kiosk designs that we currently use.

- Design A – Suited for 600V incoming service
- Design B – Suited for 208V incoming service
- Design C – Future-proofed for higher-powered fast charging





DESIGN A – SUITED FOR 600V INCOMING SERVICE

Two 75kVA transformers supply two 50kW DC fast chargers, and one 3kVA transformer supplies auxiliary loads including station lighting, internal receptacles, and kiosk heating and cooling systems.

**“Design A”: Kiosk Single Line Diagram
600V Incoming Service, 75 kVA Xfmrs, 2x50kW EV Chargers**



Legend

-  Circuit Breaker
-  BC Hydro Electrical Meter
-  Isolation Transformer
-  Autotransformer


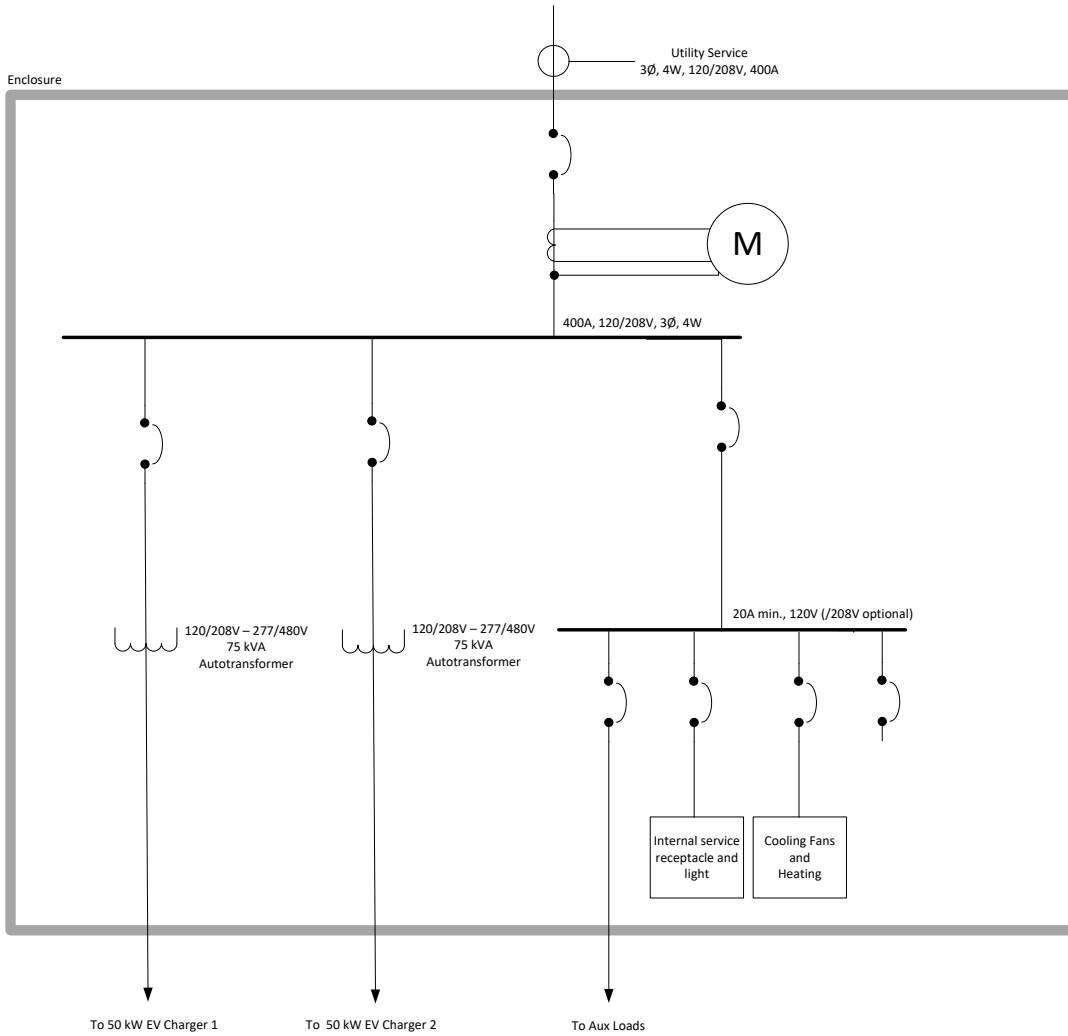
Powertech 	
Date:	2019-01-09
Created By:	EV Infrastructure Team

Figure 2: Kiosk design for 600V incoming service

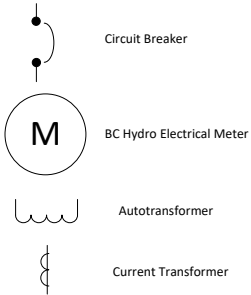
DESIGN B – SUITED FOR 208V INCOMING SERVICE


Two 75kVA transformers supply two 50kW DC fast chargers, and one 3kVA transformer supplies auxiliary loads including station lighting, internal receptacles, and kiosk heating and cooling systems.

“Design B”: Kiosk Single Line Diagram 208V Incoming Service, 75kVa Xfmrs, 2x50kW EV Chargers



Legend



Powertech 

Date: 2019-01-09

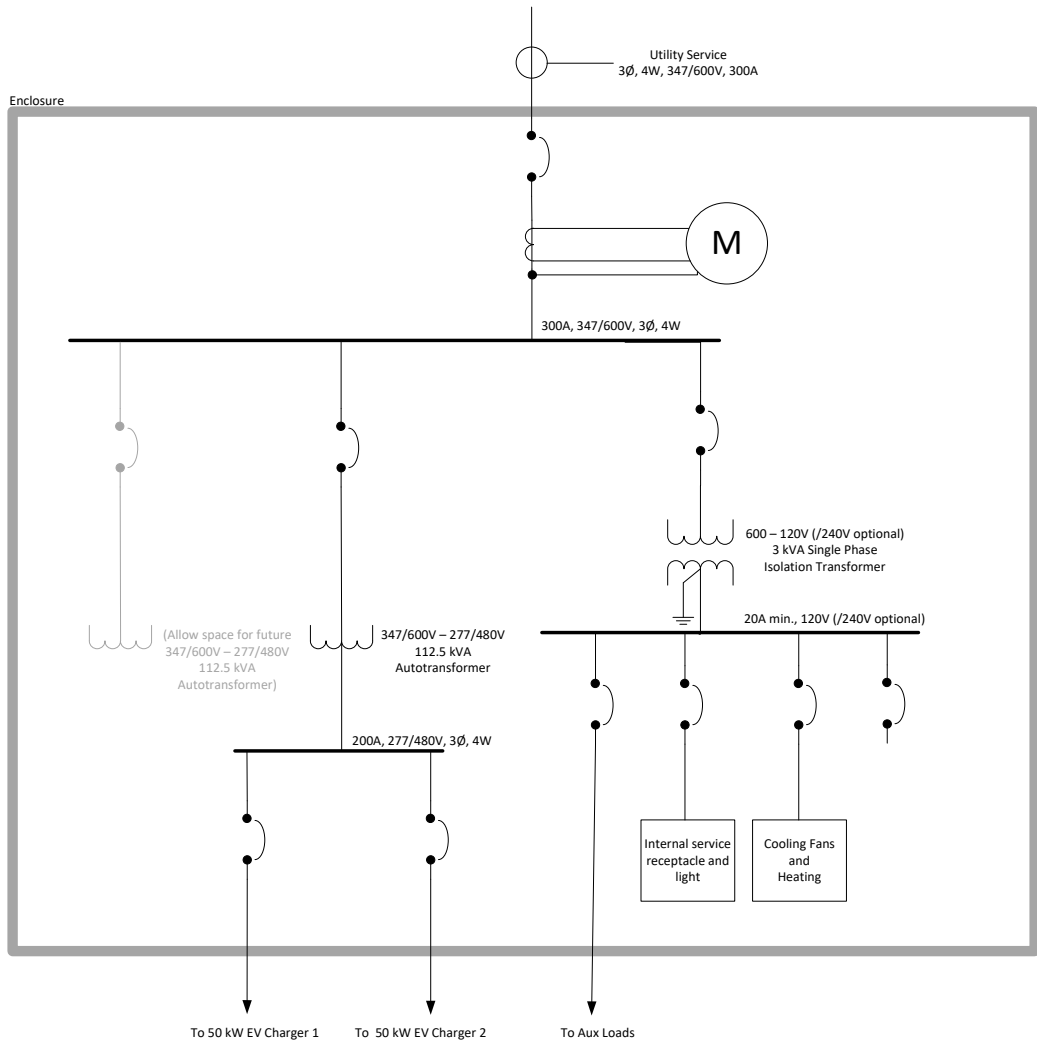
Created By:
EV Infrastructure Team

Figure 3: Kiosk design for 208V incoming service

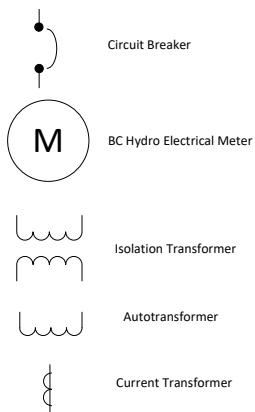
DESIGN C – FUTURE-PROOFED FOR HIGHER-POWERED FAST CHARGING

Two 112.5 kVA transformers can supply up to four 50 kW DC fast chargers or two 100kW EV chargers.

“Design C”: Kiosk Single Line Diagram 600V Incoming Service, 112.5kVa Xfmr, 2x50kW EV Chargers



Legend



Date: 2019-01-09	Revision: 0
Created By: EV Infrastructure Team	

Figure 4: Kiosk design for higher-powered fast charging

Lighting

We use two different light pole sizes at our EV charging stations: 17 foot and 14 foot poles. 17 foot poles are installed at most of our stations, while 14 foot poles are installed at stations with overhead limitations such as utility power lines. Both sizes provide appropriate lighting density without excessive glare.

Below is an example of one of our light pole assemblies.



Figure 5: Example of a BC Hydro light pole assembly

Luminaires

Luminaires are selected to provide optimal station light distribution, for safety as well as an enhanced charging experience after dark. Below is a typical luminaire we use at our stations.

NXT™ SERIES

NXT-C SPECIFICATIONS

Housing: Single piece, die-cast A360 premium aluminum alloy with <0.6% copper content

Operating Temperature: -40 °C to +40° C (-40 °F to +104 °F)¹

Mounting: 1.625" - 2.375" (42 - 60 mm) O.D. Tenons

Mounting Methods: Horizontal Entry or Post-Top Mount

Weight: 12 lbs (5.4 kg)

EPA Rating: <0.34 ft² (< 0.032 m²)

Lens Material: IK09 Rated Glass

Ingress Protection: Power Supply and optical module are located inside chamber rated IP66 per IEC 60529/ANSI C136.25. Luminaire is rated for wet locations.




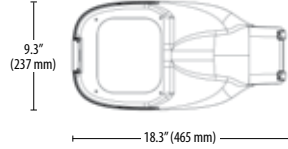
Finish: Durable polyester powdercoat topcoat


Available Colors:

GREY (RAL 7035)

BRONZE (RAL 7022)

BLACK (RAL 9005)



NXT-C (12 LEDs)						
ELECTRICAL						
Drive Currents (mA)	525	700	850	1050	1200	1250 ⁴
Power Consumption (W)	22	27	34	42	48	50
Input Voltage (V)	120 - 277V (Standard)					
Surge Protection	Meets the requirements of ANSI C-High (10kV / 10kA)					
Power Factor	>0.90					
OPTICS & PERFORMANCE						
Photometry (Distribution)	2ES, 4AH					
Color Temperature (CCT)	4000K (Standard) 3000K & 5000K (Optional)					
Color Rendering Index (CRI)	~70					
3000K Fixture Efficacy (Lm/W)	101	99	96	88	84	83
4000K Fixture Efficacy (Lm/W)	105	104	99	94	90	88
3000K Fixture Output (Lm)	2,020	2,760	3,250	3,700	4,000	4,130
4000K Fixture Output (Lm)	2,300	2,800	3,368	3,930	4,300	4,400
LED L70 (Hours)	> 100,000 hours (@ maximum drive current)					
PHOTOCELL & CONTROLS						
Photocell Options	20-year life photocell available.					
Control & Monitoring	Dimming power supply (1-10V) is standard equipment. We offer a complete range of control and monitoring solutions					

¹ 1250mA maximum temperature is 40 °C - 40 °C for fixed installation only.
 ² Not all model configurations are DLC qualified - consult factory for details.
 ³ Only products with a CCT of 3000K (or less) meet International Dark Sky Association requirements.
 ⁴ 1250mA drive current only available with UL Certification option.

Values shown are subject to ±5% tolerance.
 Color temperatures shown are ±300K type 2ES distribution.
 If post-top version is specified, add 5.4" (137 mm) to overall length dimension.
 Illustrated Above: NXT-C in grey (RAL 7035).
 All information provided is subject to change without notice.

Figure 6: BC Hydro Luminaires for EV charging stations

We currently use 3LB and 3HB luminaires. As seen in the figure below, 3LB light has a low backlight distribution pattern, which is a good fit for installation in front of residential buildings where light distribution towards the building is not desirable. The 3HB light has a high backlight distribution pattern which is a good fit for darker parking lots where light distribution is required over a wide area.

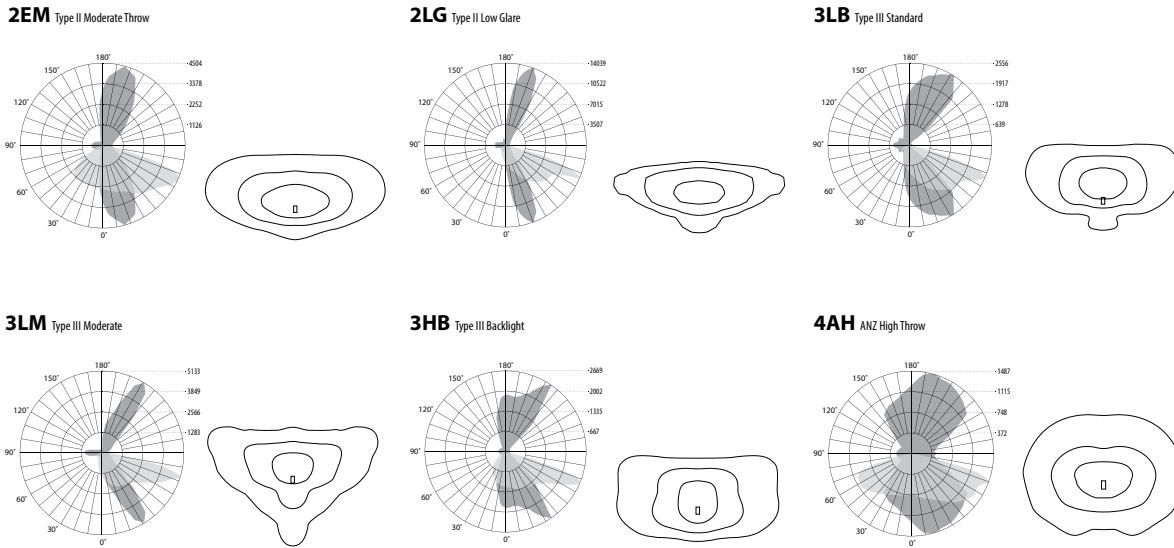


Figure 7: 3LB and 3HB luminaires

Photocells

Photocells are installed on top of the luminaires to sense ambient light levels and automatically turn on station lighting as required.

PHOTOCELL

LRL65223-LF PHOTOCELL SPECIFICATIONS



AMBIENT LIGHT SENSING

Light Detection Sensor	Silicon-integrated photo-diode and amplifier with spectral and angular response approximating that of an accurate color-corrected cosine photometer.
Directionality	Accurate omni-directional ambient light sensing photocell

MECHANICAL / ELECTRICAL

Operating Voltage	Operating Voltage: 105 to 305 volts (50/60 Hz)
Load Rating	1800VA, 1000W
Load Current (Continuous)	16 amps, (50/60 Hz AC)
Load Current (Inrush)	168 amps, 60 Hz 1 cycle
Circuitry	Micro-controlled circuitry for control of sensing time delays
Surge Suppression	Surge Protection: 320 volt, 320 joule (2ms) Metal Oxide Varistor (Other MOV ratings incorporated upon request)
Power Consumption	Power Consumption: < 350mW nominal @ 230V AC
Testing/Certification	UL 773, and CSA C22.2 No. 55 Compliant for use in USA and Canada. 105-305 Voltage Range CE Certification

SWITCH

Type	Relay Assisted Triac (RAT)
On Light Level	16 Lux standard, other light levels on request
Switch On: Switch Off Ratio	1:1.5 (inverse ratio) standard, other ratios on request
On Time Delay	15 seconds standard, other time delay settings on request
Off Time Delay	15 seconds standard, other time delay settings on request
Failure Mechanism	Fail-On Protection

ENVIRONMENTAL

IP Rating	IP67 sealed enclosure
Temperature Range	-40°F to +158°F (-40°C to + 70°C)
Enclosure Material	DIAKON™ acrylic conical cover

PRODUCT LIFE

Life Rating and Warranty	A proven lifetime expectancy of 25 years with a full 10 year manufacturer's limited warranty.
--------------------------	---

Other photocell models are available including those with side-facing window. Please contact your sales representative for details and specifications.

Figure 8: Photocell installed at BC Hydro EV charging stations

Wayfinding beacon

Wayfinding beacons are typically installed on top of our light poles to help EV drivers visually locate our charging stations. Wayfinding beacons can also be installed on top of the DC fast chargers.

The figure below represents our wayfinding beacon set-up.

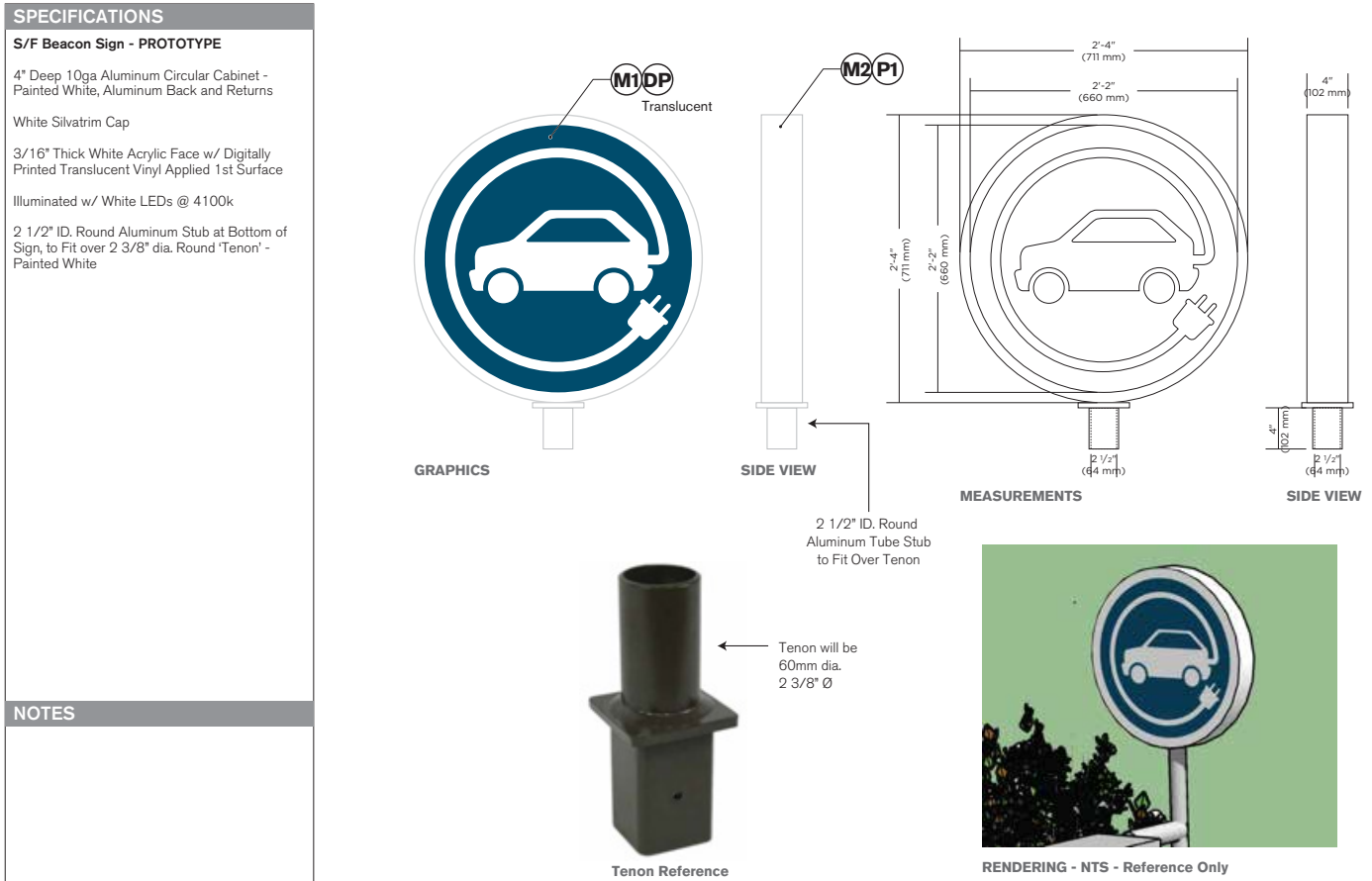


Figure 9: BC Hydro wayfinding beacon at an EV charging station

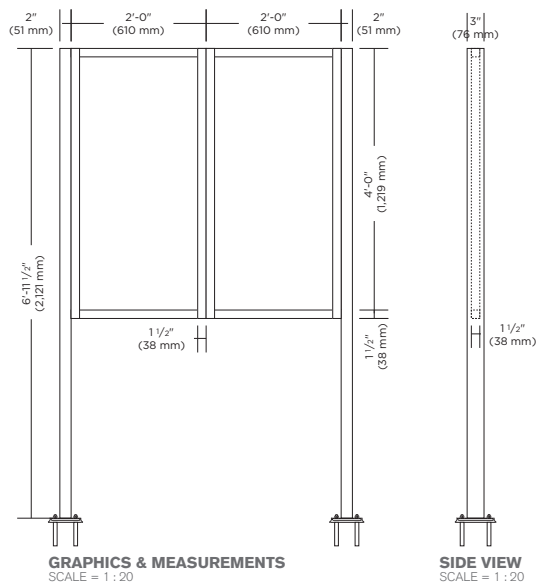
Informational signage

Station signage can provide important information to EV drivers such as charging etiquette, local amenities, a map of the area, and information about the host and funding partners.

We use two types of signage housings at our stations: side-by-side and back-to-back pole-mounted. Side-by-side is more expensive since it requires a separate concrete pad, while the back-to-back can be installed directly on the light pole. Back-to-back pole mounted signage is also good fit where real estate is limited.

SIDE-BY-SIDE

SPECIFICATIONS
S/F Help/Info Sign - PROTOTYPE
Single Face Post & Panel Sign
Two 2' x 4' Alupanel Signs Supplied by Others
Sign Supports - KS Supply Two 2" x 3" x 0.25" Aluminum Posts w/ Aluminum Base Plates
1 1/2" x 1 1/2" Aluminum Angle Frame, Screwed to Aluminum Posts
Panels Mounted Face over Frame w/ SS Screws through Face
All Painted White
<i>As Discussed w/ BP</i>
NOTES



RENDERING - NTS - Reference Only

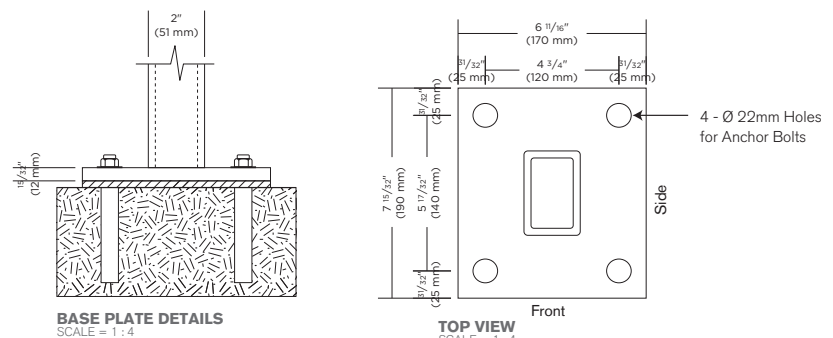


Figure 10: BC Hydro side-by-side informational signage at an EV charging station

BACK-TO-BACK POLE-MOUNTED

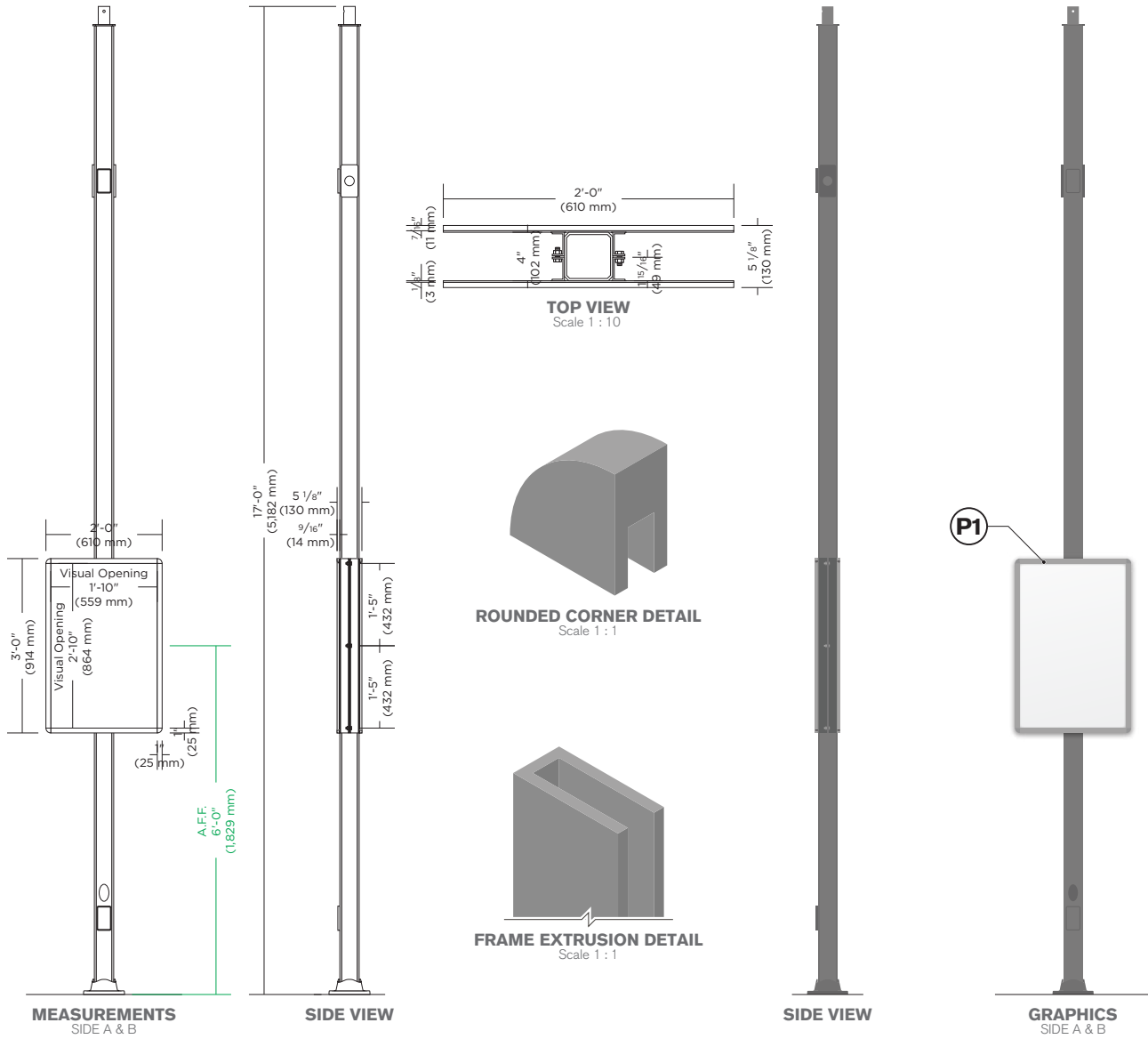


Figure 11: BC Hydro back-to-back pole-mounted informational signage at an EV charging station

Precast concrete pads

Precast concrete pads are designed to hold the weight and structure of charging infrastructure such as the DC fast charger, kiosk and light pole. When building a concrete pad, several factors are considered such as maximum weight of equipment, seismic zone, soil condition, wind load, etc. Precast pads are built in a controlled environment and are inspected before shipping to the charging station site. They come with the advantage of economies-of-scale, consistent manufacturing quality, and lower manufacturing costs. Conversely, precast pads are expensive to ship and are not customizable.

An alternative option to precast pads is pour-in-place foundation. The pour-in-place foundation is constructed on-site and must be custom-engineered based on site-specific conditions such as layout, equipment weight, drainage, soil, seismic zone and wind conditions. Rebar installation and concrete pour are done on-site and the concrete should be left to properly cure before equipment is placed on the slab. Design and manufacturing costs for pour-in-place pads are typically more than precast pads, however, pour-in-place can be a good solution for sites where a custom transition between the sidewalk and the rest of the parking lot is required.

DC FAST CHARGER PRECAST PAD – SHALLOW DESIGN

BC Hydro’s DC fast charger precast pad is designed to be compact and relatively easy to manufacture and ship. The asymmetrical pass-through is designed to accommodate incoming wireways for several different DCFC models.

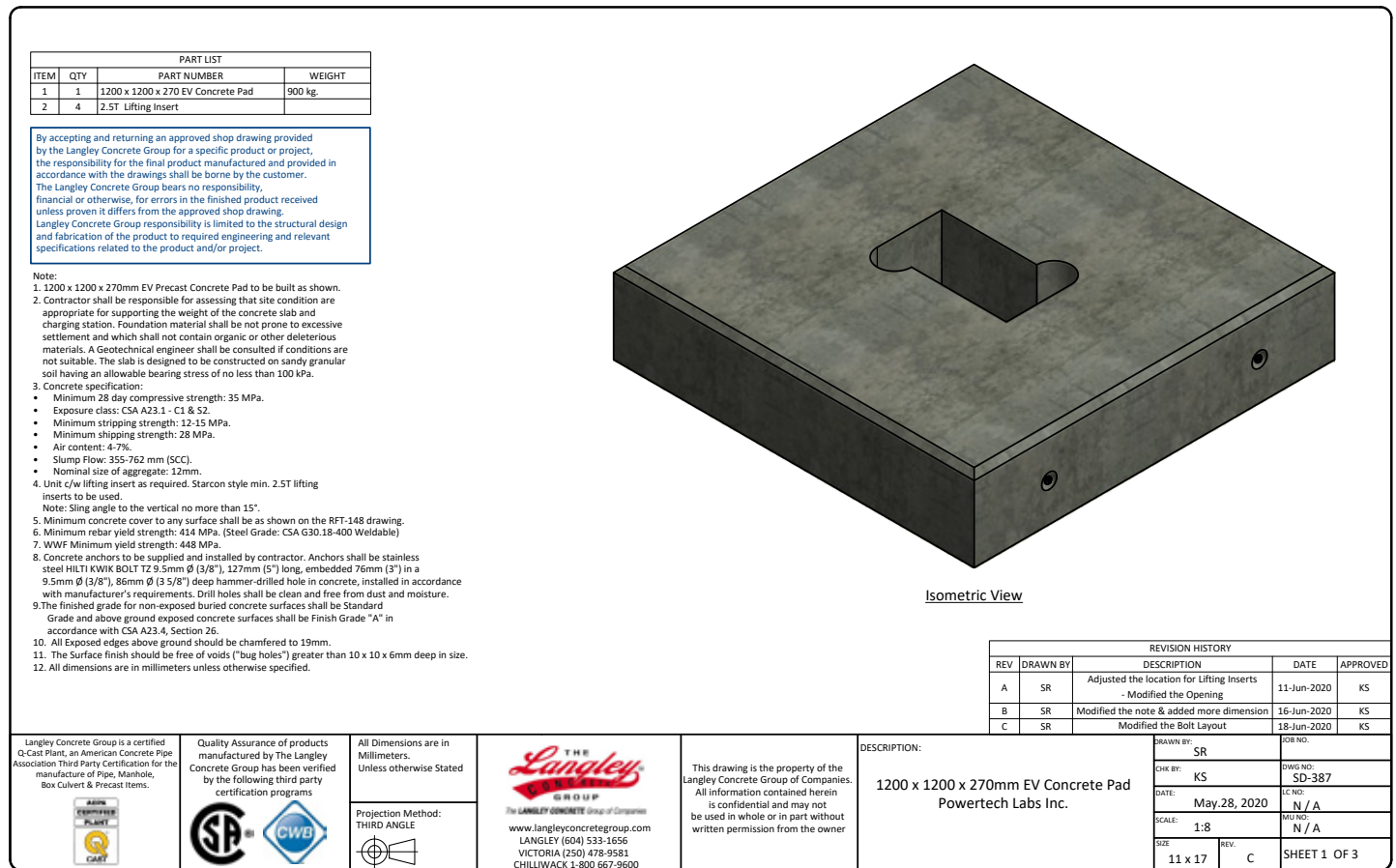


Figure 12: BC Hydro DC fast charger precast pad – shallow design

DC FAST CHARGER PRECAST PAD – PYRAMID DESIGN

The pyramid DC fast charger pad is designed for areas in B.C. with a high risk of large earthquakes and high levels of spectral acceleration.

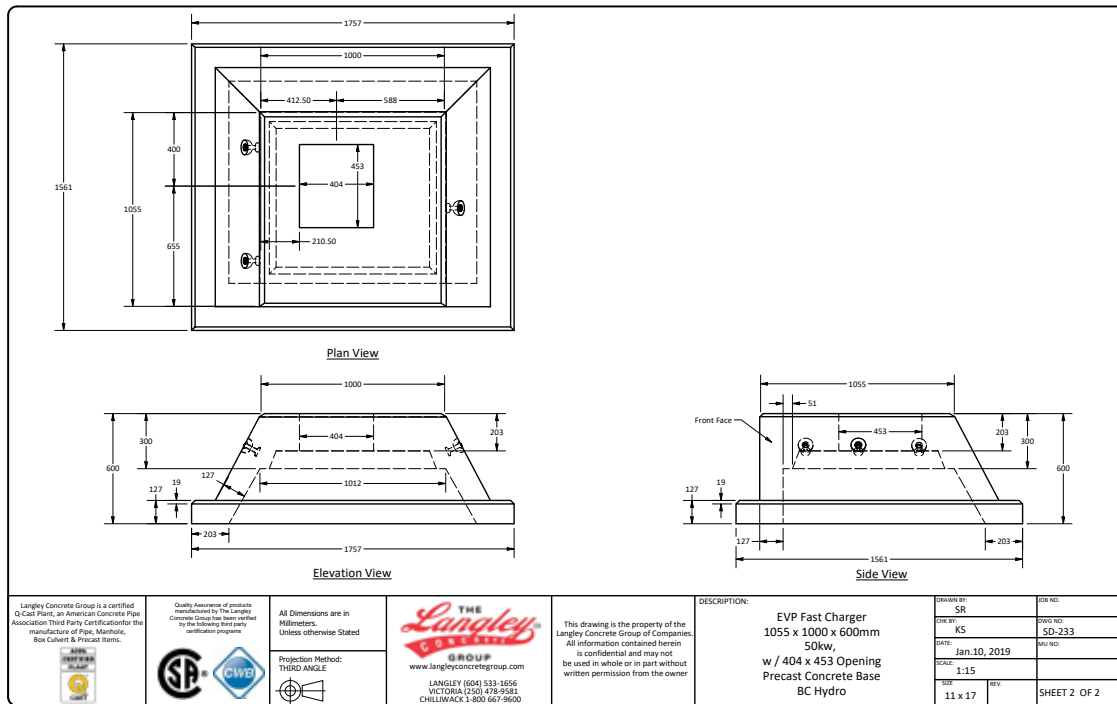
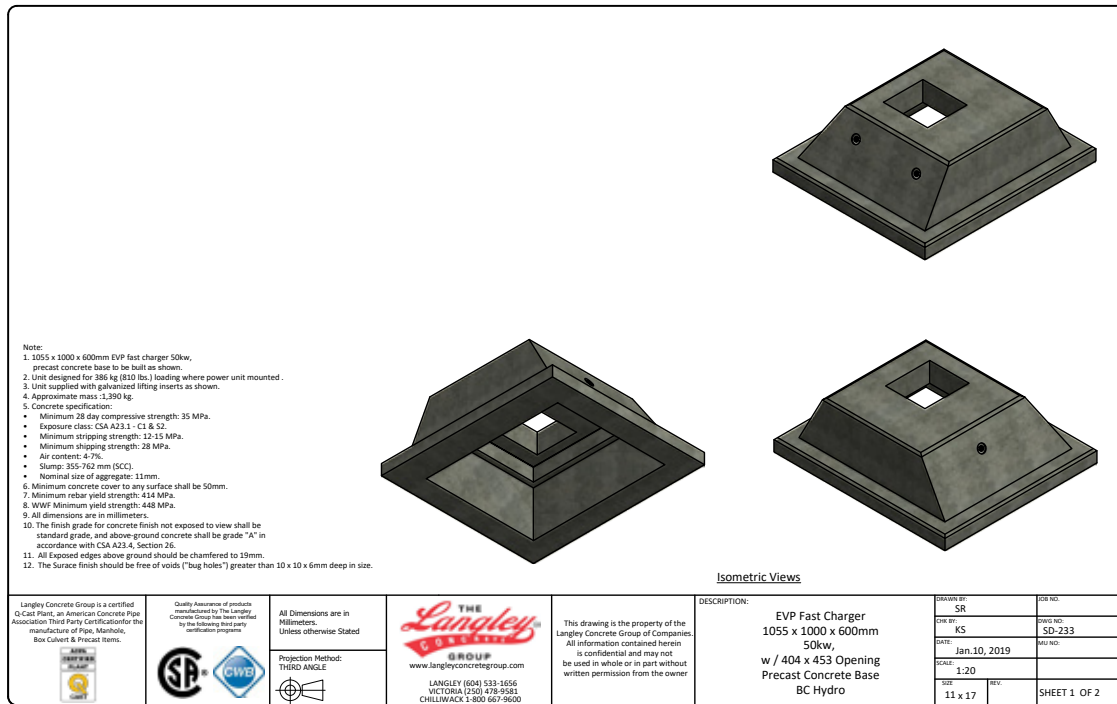


Figure 13: BC Hydro DC fast charger precast pad – pyramid design

KIOSK PRECAST PAD - LOW SEISMIC DESIGN

The kiosk pad is designed to handle the weight and structure of kiosk. The main kiosk pad design has several incoming and outgoing wireways, as illustrated below.

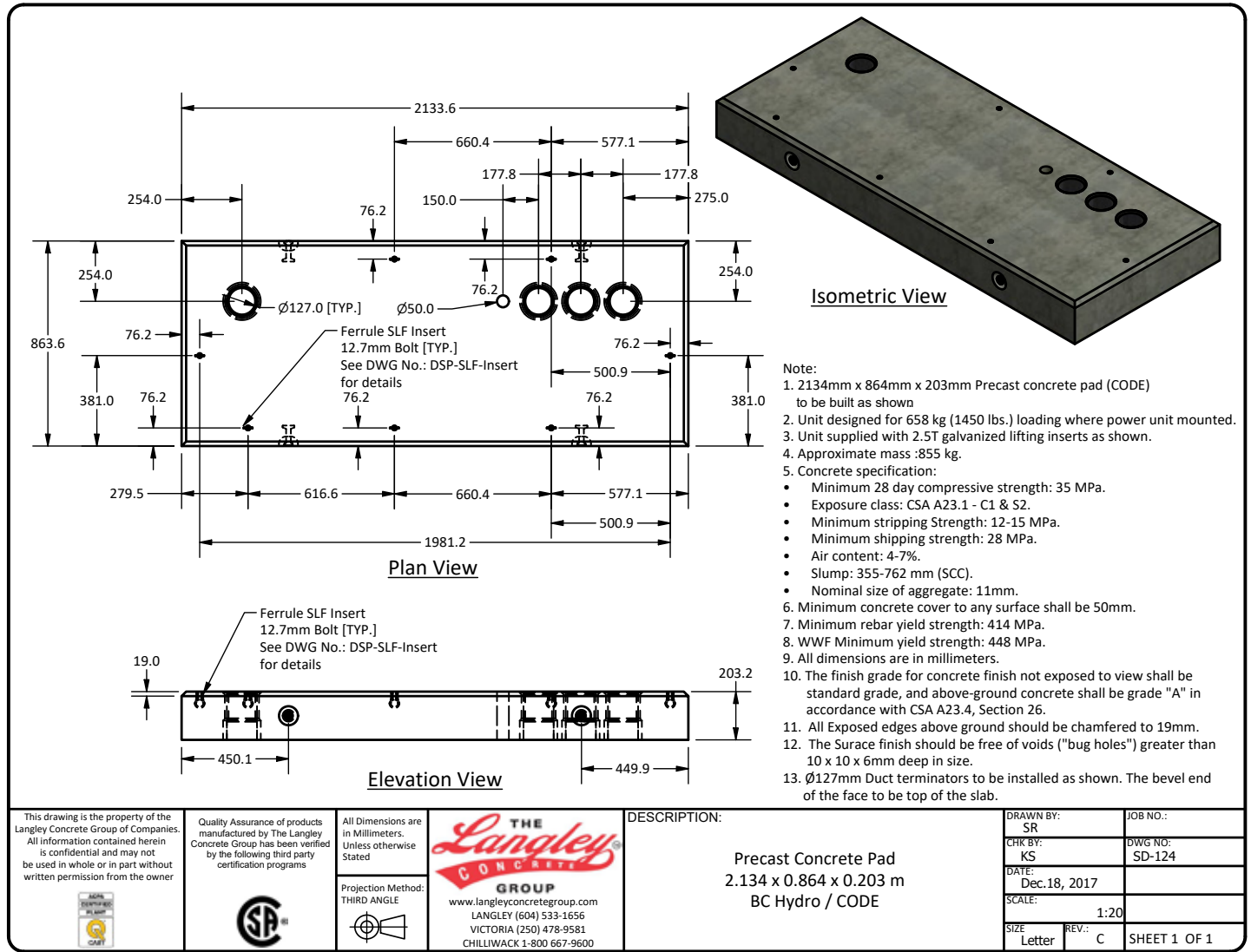


Figure 14: Kiosk precast pad – low seismic design

KIOSK PRECAST PAD – HIGH SEISMIC DESIGN

The modified kiosk pad design will soon be adopted for the installation of larger and heavier kiosks in order to support higher powered charging. The slot holes provide more flexibility for incoming and outgoing conduit placement.

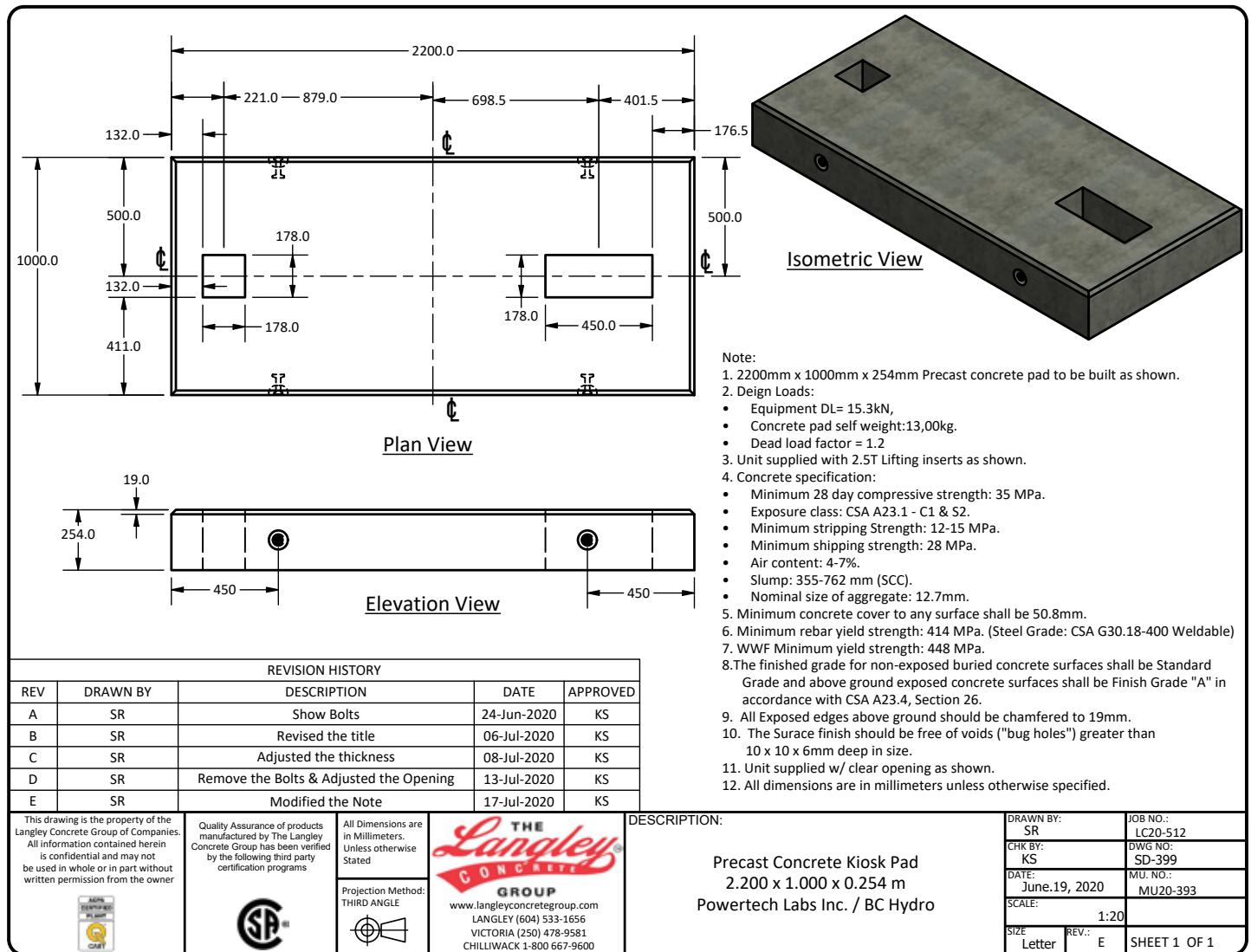


Figure 15: Kiosk precast pad – high seismic design

LIGHT POLE PADS

Figures 16 through to 19 illustrate the different light pole precast pad designs available to us. The height and base size of the pads differ based on seismic, soil and wind conditions and different sites. The most common design is the pyramid design with a height of 1.2 metres (see Figure 17). If soil conditions are unstable, deeper and wider pole base designs are available as shown below.

The light pole base includes 4 anchor bolts to connect and hold the light pole on top of the base.

PART LIST			
ITEM	QTY	PART NUMBER	WEIGHT
1	1	1200 Sq Base	800 kg.
2	2	27mm PVC Conduit	
3	2	2.5T Lifting Insert	
4	4	19 x 610 J Rod	

By accepting and returning an approved shop drawing provided by the Langley Concrete Group for a specific product or project, the responsibility for the final product manufactured and provided in accordance with the drawings shall be borne by the customer. The Langley Concrete Group bears no responsibility, financial or otherwise, for errors in the finished product received unless proven it differs from the approved shop drawing. Langley Concrete Group responsibility is limited to the structural design and fabrication of the product to required engineering and relevant specifications related to the product and/or project.

Isometric View

Notes:

1. 1200 mm Precast Parking Lot Pole Base as shown.
2. Unit Supplied with Required Anchor bolts, spacing & PVC Conduits as required.
3. Minimum concrete strength: 30 MPa.
4. Welded wire mesh min. yield strength: 448 MPa.
5. Minimum rebar yield strength: 414 MPa.
6. All dimensions are in millimeters unless otherwise specified.

REVISION HISTORY				
REV	DRAWN BY	DESCRIPTION	DATE	APPROVED
A	SR	Revise the Bolt & Conduits Location	Apr.16, 2019	KS
B	SR	Revised Bolts	29-Nov-2019	KS
C	SR	Revised the Note & Title	06-Jul-2020	KS
D	SR	Revised the Bolt	08-Jul-2020	KS

	Quality Assurance of products manufactured by The Langley Concrete Group has been verified by the following third party certification programs	Langley Concrete Group is a certified Q-Cast Plant, an American Concrete Pipe Association Third Party Certification for the manufacture of Pipe, Manhole, Box Culvert & Precast Items.	DESCRIPTION: <p style="text-align: center; font-weight: bold;">Precast Concrete Pole Base (NON-MMCD) 1200 Parking Lot Pole Powertech Labs</p>	DRAWN BY: SR CHK BY: KS DATE: Apr.11, 2019 SCALE: 1:10 SIZE Letter	JOB NO.: LC19-210 DWG NO.: DWG19-379 MU NO.: MU19-204 REV.: D SHEET 1 OF 2	
This drawing is the property of the Langley Concrete Group of Companies. All information contained herein is confidential and may not be used in whole or in part without written permission from the owner		<p style="font-size: 8px;">www.langleyconcretegroup.com LANGLEY (604) 533-1656 VICTORIA (250) 478-9581 CHILLIWACK 1-800 667-9600</p>	Projection Method: THIRD ANGLE 		All Dimensions are in Millimeters. Unless otherwise Stated	

Figure 16: Light pole precast pad

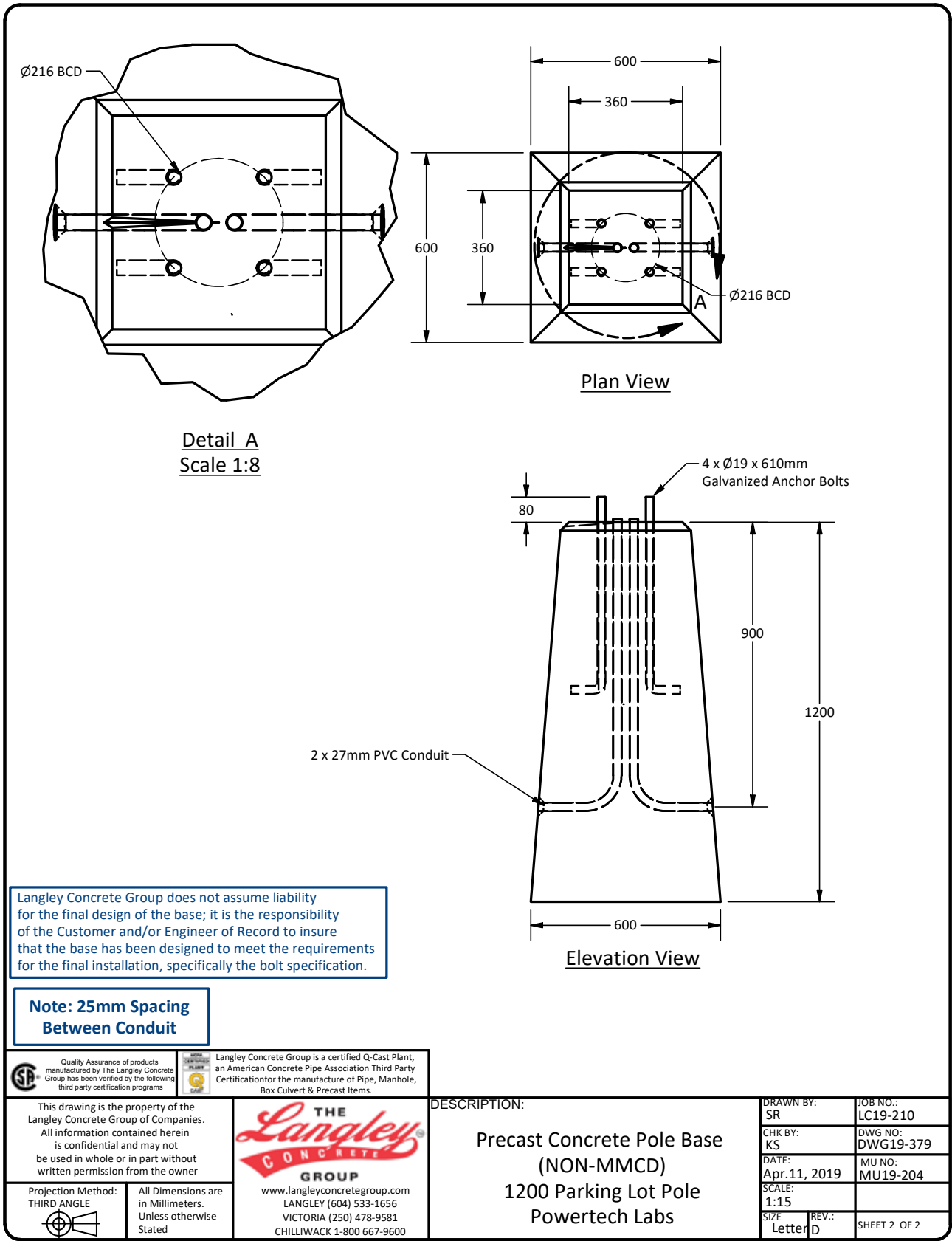


Figure 17: Light pole precast pad – 1.2 metres

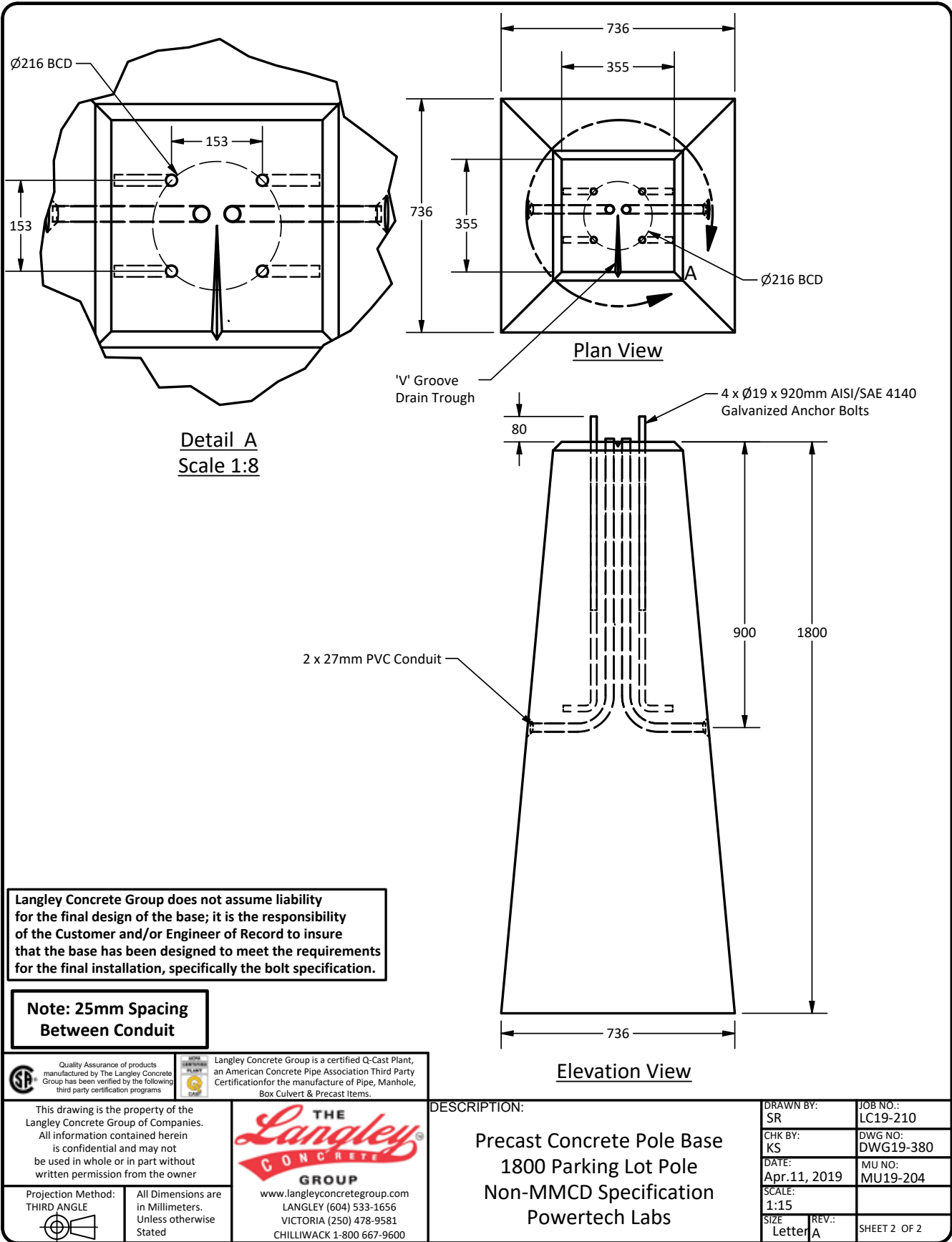


Figure 18: Light pole precast pad – 1.8 metres

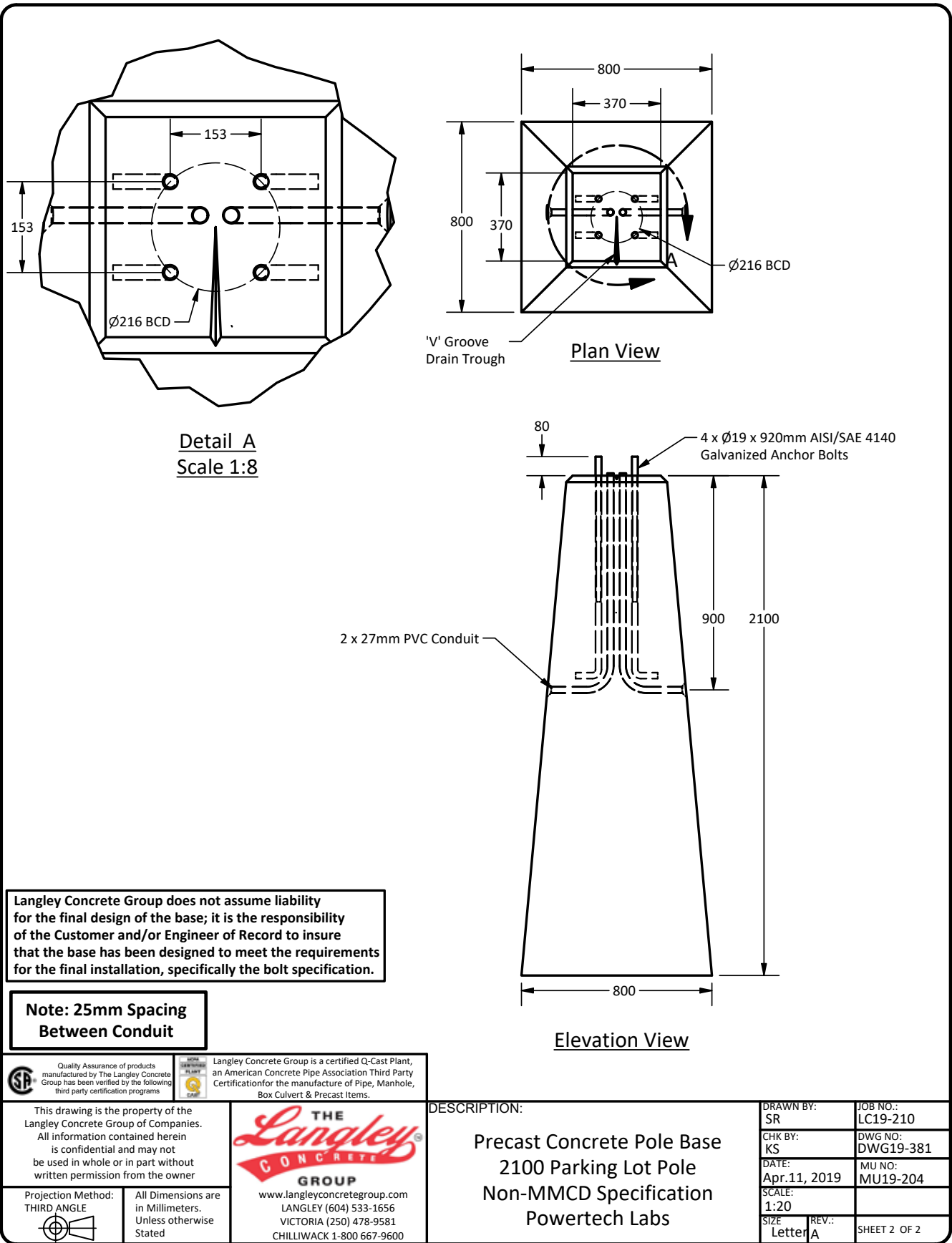


Figure 19: Light pole precast pad – 2.1 metres

Bollards

Bollards protect the charger and main switch kiosk against damage from vehicular traffic. There are two types of bollards: precast and pour-in-place.

Precast bollards are pre-constructed and shipped to the site (see figure below). Like precast concrete pads, precast bollards are associated with a more consistent manufacturing quality and lower manufacturing costs, and are more expensive to ship. Pour-in-place bollards are built on-site by filling galvanized pipes with concrete. If the site requires a pour-in-place concrete pad, it is more cost-effective to install pour-in-place bollards since the concrete is already available on-site.

To enhance visibility, paint the bollard yellow or cover it with a yellow sleeve.

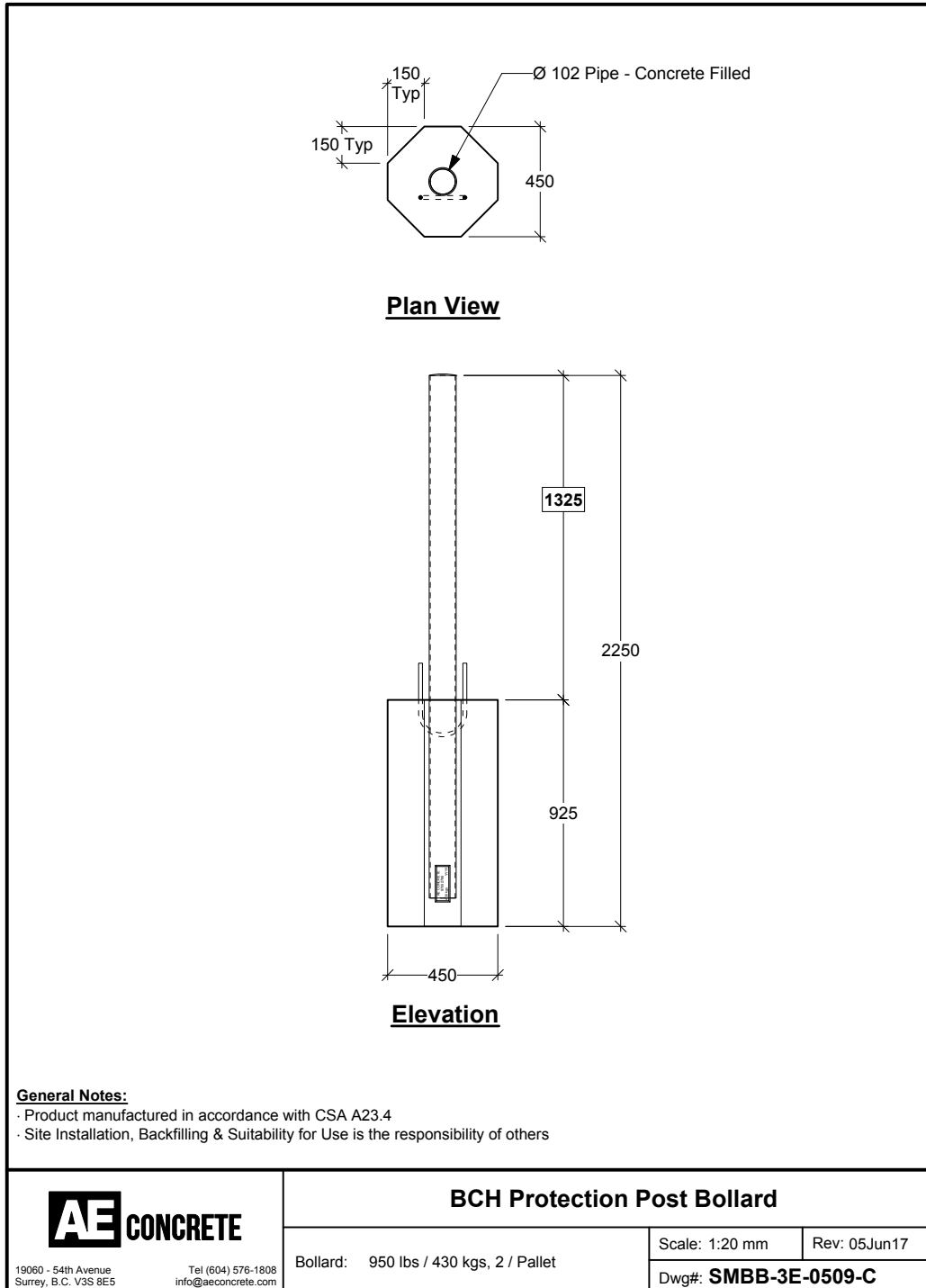


Figure 20: BC Hydro precast bollard

Putting it all together

Our EV charging stations have a similar layout, dimensions, and components to enhance interoperability. Since our DC fast chargers are connected to a few networks with different authentication requirements, we worked with network providers to reduce the number of apps or RFID cards needed to authenticate. This allows drivers to be able to use one app or RFID card to activate chargers at all our site locations.

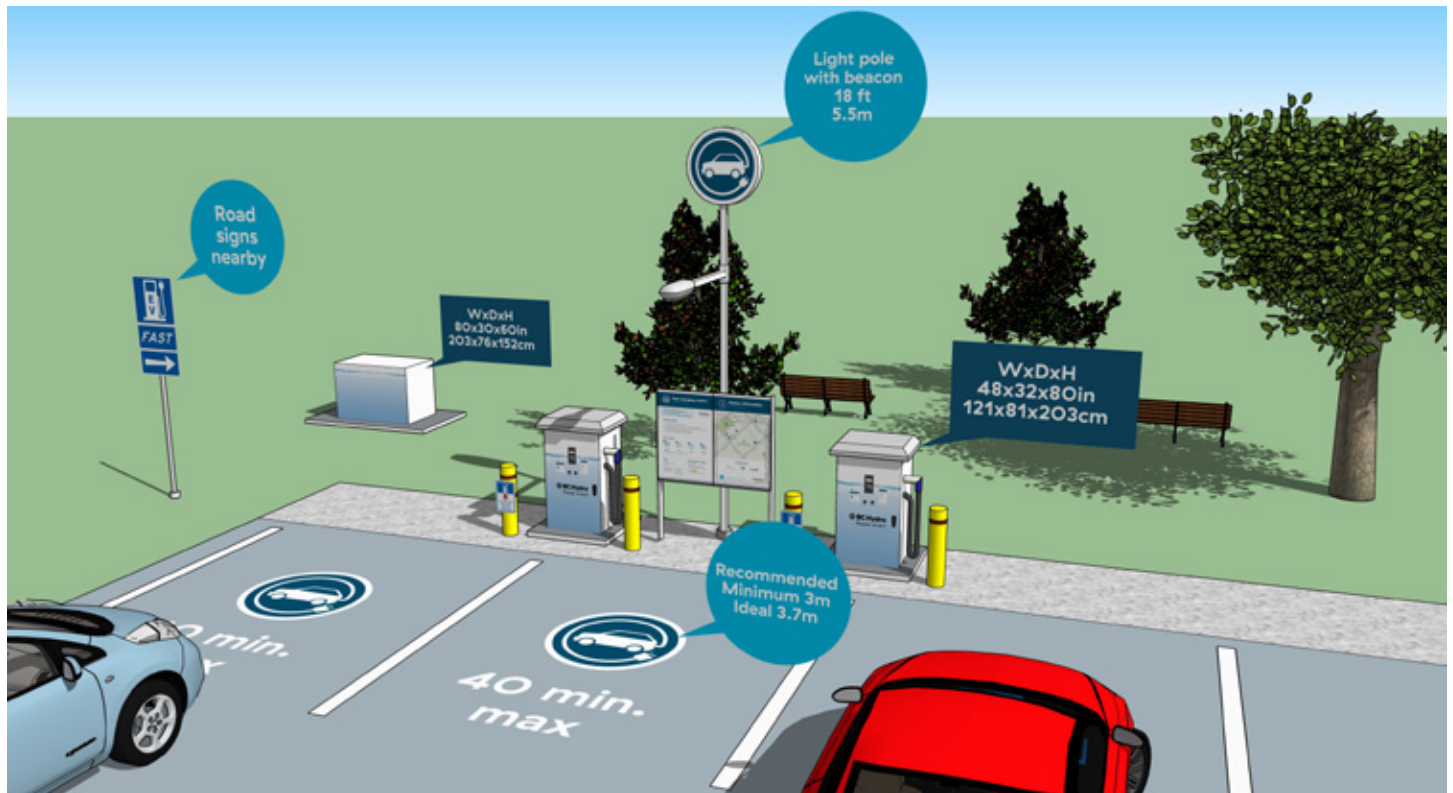


Figure 21: 3D view of a sample charging station

6. Wayfinding signage

The B.C. Ministry of Transportation (MOTI) maintains signage standards for B.C. highways and roads. Currently, highway EV charging signage is permitted for fast charging stations 50kW and above. Contact the Traffic and Engineering group regarding wayfinding signage for fast charging stations.

Signage standards are available the [Ministry of Transportation website](#):

- Local road size: 230 x 230mm
- Arterial road size: 600 x 600mm
- Expressway size: 900 x 900mm

Samples:



7. Overview of common charging station layouts

In addition to the recommended layouts described in the guidelines document, we've added other potential layouts along with some considerations and challenges for each.

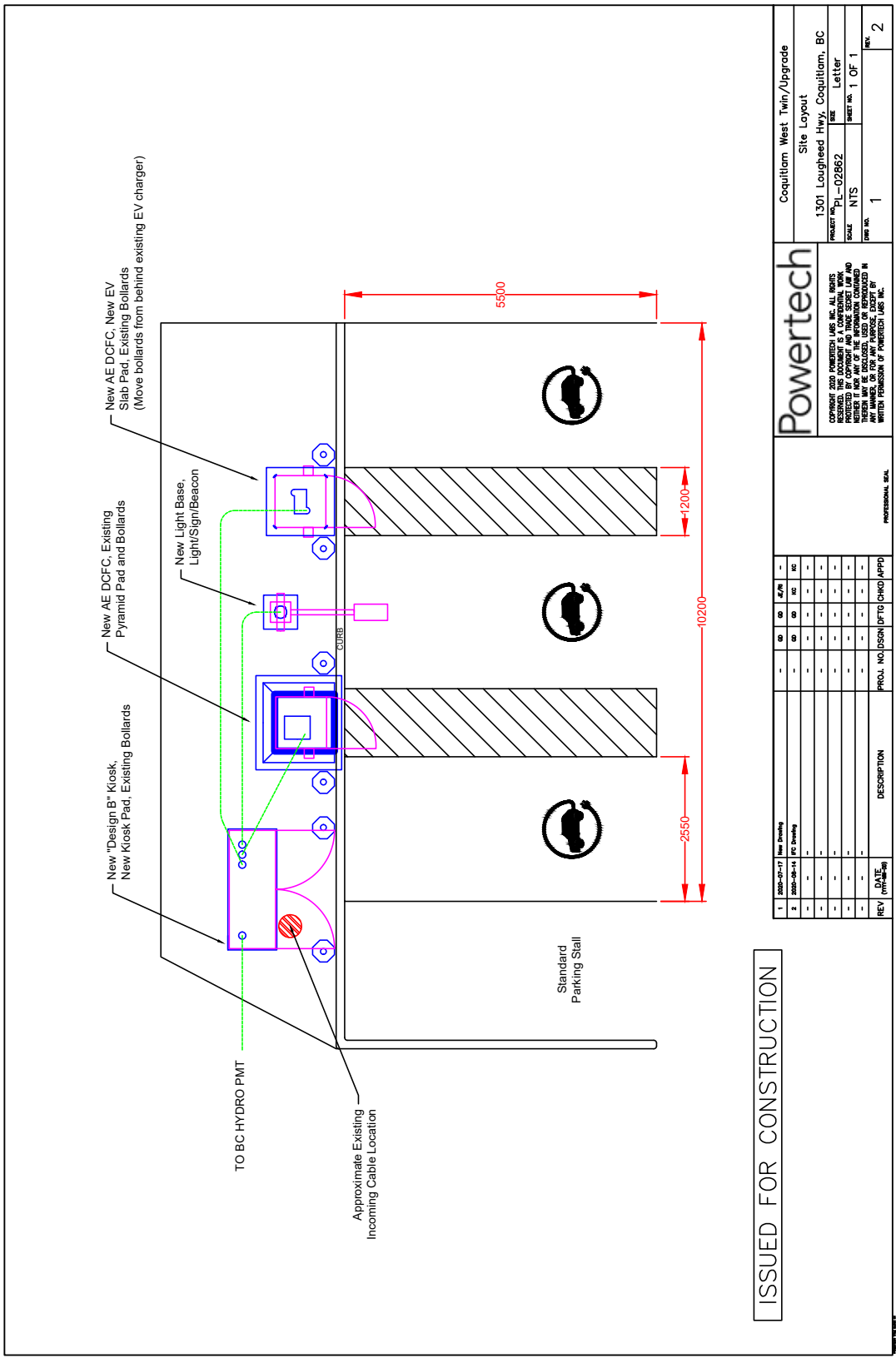
Attributes	Considerations	Challenges
Recommended layouts		
Pull-in, charger in front	<ul style="list-style-type: none"> ○ This is the most common design and can be supported in most existing parking lots ○ Ensure a sufficient number of stalls are leveraged to increase accessibility and provide room for expansion 	<ul style="list-style-type: none"> ○ Drivers are exposed to the elements without weather protection ○ If the charging station is on a curb, be sure to provide a ramp or a roll-over curb to allow for accessibility
Pull-in, charger between stalls	<ul style="list-style-type: none"> ○ Easier to design for accessibility ○ Drivers can easily park on the side where the EV charge port is closest to the charger (much like a gas station layout) 	<ul style="list-style-type: none"> ○ Drivers are exposed to elements without weather protection
Pull-through	<ul style="list-style-type: none"> ○ Accommodates larger EVs like pickup trucks and EVs pulling trailers ○ Easiest to design for accessibility ○ Drivers can easily park on the side where the EV charge port is closest to the charger (much like a gas station layout) 	<ul style="list-style-type: none"> ○ Allocation of more stalls are required as well as ingress and egress space ○ Drivers are exposed to the elements without weather protection
Other layouts		
Curbside – parallel	<ul style="list-style-type: none"> ○ Curbside is a reasonable option for urban environments where there are no parking lots with space for charging stations ○ Consider using a curb bulge or indentation to protect the station and EV drivers from vehicular traffic 	<ul style="list-style-type: none"> ○ Safety issues – Depending on the location of the charge port, drivers may be forced to plug-in on the side that exposes them to vehicles and cyclists ○ Accessibility – Drivers with mobility issues may be prevented from using these stations due to limited space and difficulties in getting onto a curb (if it has not been changed to a roll-out curb) ○ Damage to cord – If the charge port is located on the opposite side of the curb, this puts undue stress on the connector and the connector interface with the charge port

Attributes	Considerations	Challenges
Curbside – angled	<ul style="list-style-type: none"> ○ Similar to Curbside – parallel, Curbside – angled is an option for urban environments ○ This option may have the capability to provide better safety and accessibility design compared to Curbside – parallel stations 	<ul style="list-style-type: none"> ○ Some municipal bylaws might prevent backing into a stall which makes it difficult to charge a car with a charge port located in the rear of the EV (e.g. Tesla vehicles)
Parkade	<ul style="list-style-type: none"> ○ Can provide weather protection ○ Ground level is preferred in order to avoid any structural or roof deck membrane issues ○ Easier to plan for in a brand-new build versus a retrofit 	<ul style="list-style-type: none"> ○ Parkades are a more complex install ○ Will need to hire a structural engineer ○ Will need to consider a separately metered service ○ Depending on the location may create some safety issues

8. Detailed layout—Pull-in, charger in front

This design is a typical EV charging station layout where space is limited, stalls are perpendicular to the curb, or the stalls are extra-wide. The driver can nose-in or back-in based on the location of the charging port. Two stalls in front of each charger provide one space for charging and one space for waiting.

Here is a sample “pull-in, charger in front” design drawing.



Technical specification recommendations

SPACING

- Install chargers as close to the curb as possible to maximize effective cable reach.
- Allocate space between the two bollards to allow access to the cable/HMI (human machine interface) and for maintenance.
- Allocate enough space between the chargers and light pole to allow for accessibility.
- Install information signage and parking signage in visible locations such as on the bollards, light pole or dedicated sign pole(s).

LIGHTING

- Install the light pole in the centre of the charging station. Position the light pole base so that the lighting fixture is over the stalls for proper lighting.
- Provide lighting that balances user experience (safety, security, visibility and usability) with energy consumption and keeps light pollution to a minimum. Fixtures capable of dimming are recommended. Consider occupancy sensing dimming where appropriate. Lights should be on from dusk to dawn.

BEACON

- Install a beacon on top of the light pole for maximum visibility or on a short arm if there are overhead hazards or obstructions. If neither of these are feasible, consider installing the beacon on top of the DC fast charger. To ensure visibility at night, the beacon lights up from dusk to dawn.

ACCESSIBILITY

- If there is a curb, install a roll-over curb or ramp to meet accessibility needs.
- Minimize, or remove wheel stops to provide accessibility corridors around the vehicle.

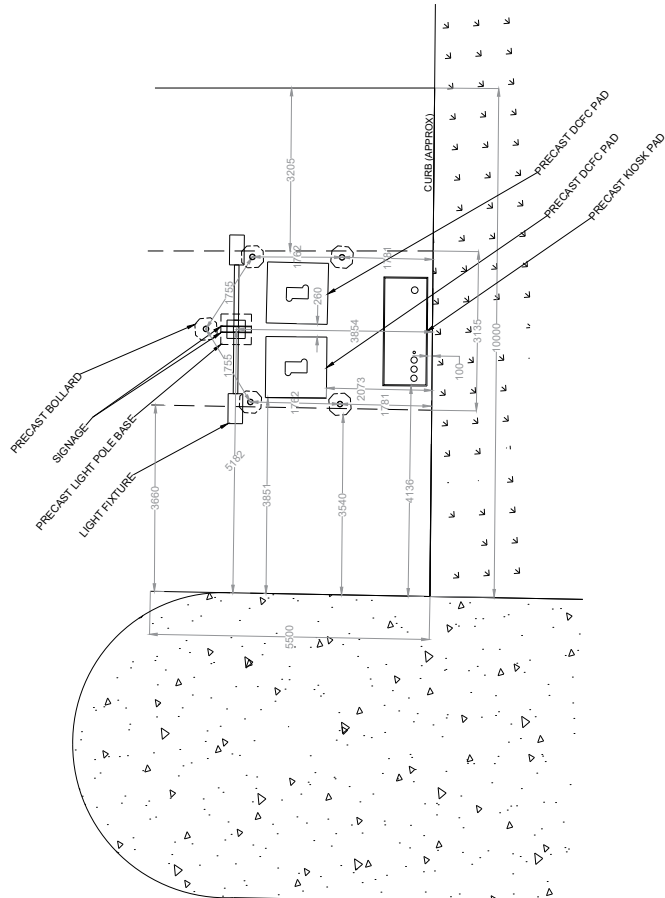
Here is a photograph of one of our stations using the “pull-in, charger in front” design.



9. Detailed layout—Pull-in, charger between stalls

While this layout requires extra space to accommodate the charger and kiosk, it works well from an accessibility perspective. And since the charger is between stalls, cable reach is less of an issue. The driver can nose-in or back-in based on the EV charging port location. A stall on either side of the charger provides a space for charging and a space for waiting. The charging equipment is installed at the same grade as the parking lot to enhance accessibility.

Here is a sample of a “pull-in, charger between stalls” design drawing.



See [Appendix 8](#) for a list of recommendations around technical specifications.

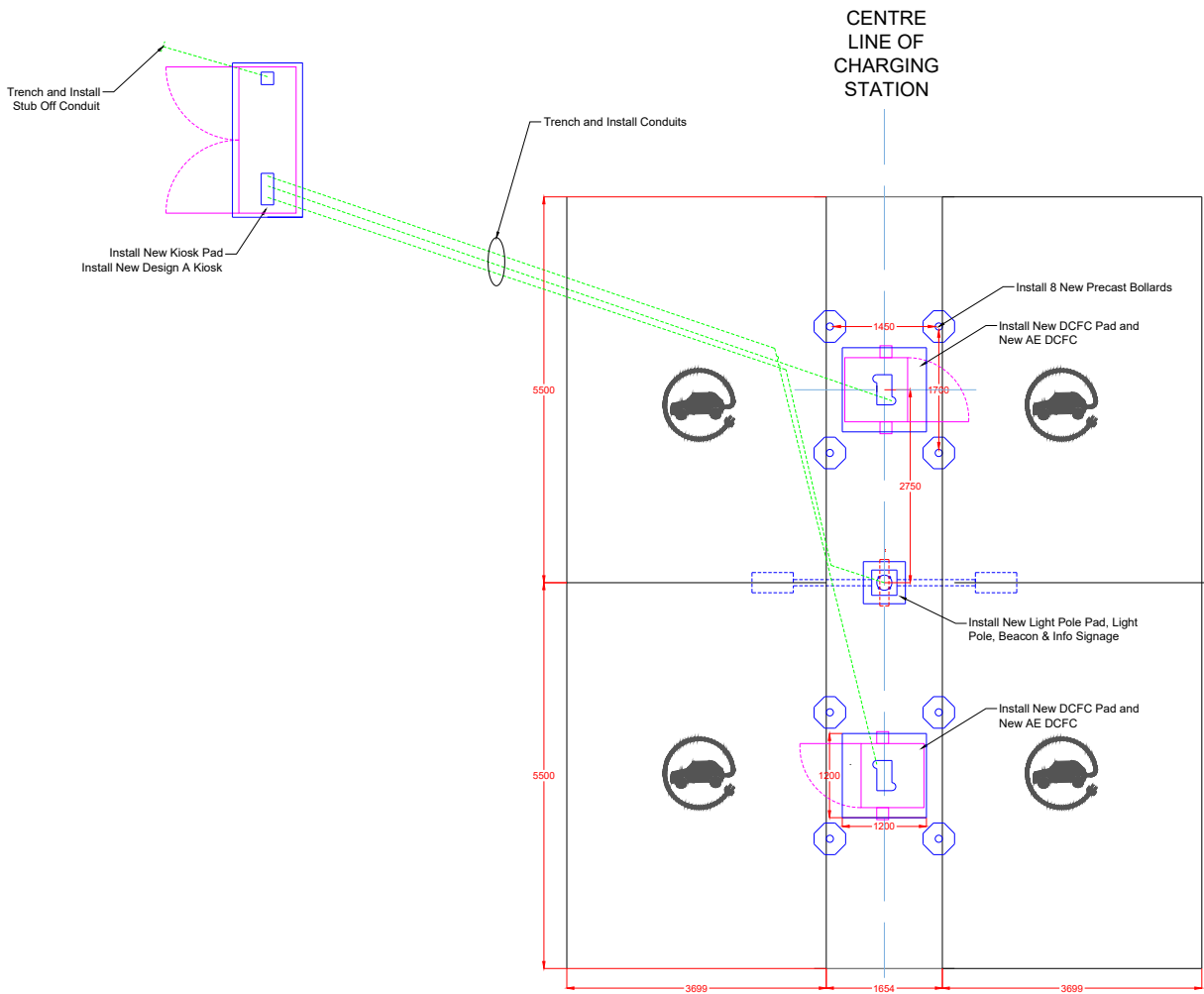
Here is a photograph of one of our stations using the “pull-in, charger between” design.



10. Detailed layout—Pull-through

This design has many advantages such as being able to accommodate larger EVs like pickup trucks and EVs pulling trailers. It is also the easiest to design for accessibility. Since the charger is located in an open area, the driver can easily align the EV's charging port with the charging cable. If the charger is in use, this design provides space for EVs to wait around the island until it becomes available.

Here is a sample of a “pull-through” design drawing. For this design, the kiosk is typically installed away from the chargers.



See [Appendix 8](#) for a list of recommendations around technical specifications.

Here is a photograph of one of our stations using the “pull-through” design.



11. Equipment procurement requirements example

BC Hydro follows a standard competitive sourcing process for all major equipment purchases. Tender documents are prepared and uploaded to the public BC Bid website for all suppliers to access.

Providing a well-defined set of specifications is critical to allow for the objective scoring of bids. Transparent evaluation criteria will help ensure suppliers submit quality bids and minimize the number of follow-up questions. The evaluation team should understand that the lowest unit price doesn't always offer the best overall long-term value. Reliability, support, maintenance and other operating costs should always be factored into the evaluation.

This section outlines examples of procurement requirements you may want to consider when selecting equipment vendors for chargers, switchgear, etc. Note that some of the items listed below are examples and your own requirements may be different.

TECHNICAL SPECIFICATIONS

- Power output: 50kW
- Input Voltage Specification: 480 VAC, 60Hz, 3-phase, 4-wire
- Charge cable connector type: CCS and CHAdeMO
- Required safety standard testing and certification: CSA or other applicable technical safety authority, lead-free, asbestos-free

DATA NETWORK SPECIFICATIONS

- Communication network standard: OCPP compliant, wireless cellular/LTE connection
- Required remote troubleshooting features: firmware update, hard reset, performance statistics, etc.
- Support for billing/payment processes

OPERATING ENVIRONMENT SPECIFICATIONS

- Temperature range: -40 °C to +40 °C
- Required enclosure specification: NEMA 3R or equivalent

QUALITY REQUIREMENTS

- Required supplier ISO certification
- Required supplier quality assurance processes

SUPPORT QUESTIONS TO EVALUATE

- Warranty details: What parts are covered under warranty and what is considered normal wear and tear?
- Extended warranty terms
- Recommended spare parts inventory
- Maintenance and repair processes, local manufacturer or contractor support network

PROCUREMENT DETAILS TO INCLUDE

- Required cost breakdown including volume discount quantities and product variants
- Estimated quantities and timeline
- Required delivery schedule
- Bid evaluation criteria
- Required form of submission to ensure objective evaluation
- Required proof of supplier experience and references
- Required supplier interaction guidelines such as Code of Conduct, Ethical Sourcing, etc.

12. Powertech Labs and electric vehicle infrastructure



Powertech is an industry leader in the research, development and testing of EV charging infrastructure and networks. As BC Hydro's prime consultant for their Electric Vehicle Program, Powertech has pioneered the EV charging industry in B.C. assisting with early assessments of customer needs, technology, and operations. Powertech has also assisted several municipalities, large organizations, and institutions with planning for EV deployments, fleet options and GHG benefit estimation. Powertech led the design and installation of B.C.'s first ever direct current fast-charger (DCFC) station has now deployed more than 100 DCFCs around the Province and continues to support BC Hydro in all aspects of DCFC deployment including planning, design, construction, operation, trouble response and interoperability.

Aside from BC Hydro, Powertech has leveraged its expertise to support several other organizations with EV strategy and deployment, including Electrify Canada, The Township of Langley, YVR, Metro Vancouver and Federated Co-Operatives Limited.

Taking advantage of Powertech's unique EV Demo Park which hosts a wide selection of EV technologies, Powertech has also developed and tested innovative EV technologies including high-powered DCFCs (100kW+), demand response, vehicle-to-grid and smart power sharing.

Our EV-related expertise and services include:

- EV DCFC deployment planning and operations
- Energy management systems
- Interoperability/roaming
- Technology upgrades to keep pace with the changing EV market
- Smart charging solutions for workplaces and MURBs
- Testing of battery storage systems, EV charger connectivity and accuracy measurements
- Technical consulting and strategy development
- Research and development

We pride ourselves on adhering to the highest testing (ISO 17025), quality (ISO 9001) and environmental management (ISO 14001) standards. Safety is our top priority and we recently surpassed a milestone of 1,000,000 hours worked without a lost-time incident.

We look forward to the opportunity to further discuss possible collaborations.

FOR MORE INFORMATION, CONTACT:

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About Powertech Labs

Powertech Labs Inc. is one of the largest testing and research laboratories in North America, situated in beautiful British Columbia, Canada.

Our 11-acre facility offers 15 different testing labs for a one-stop-shop approach to managing electrical utilities, and testing gas components, pressure vessels and systems.

Outside of the utilities industry, Powertech provides routine testing capabilities, product development, research and consulting services to support an array of industrial-type operations, electrical equipment manufacturers and automotive original equipment manufacturers.

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