BC Hydro
Power smart

EV Fast Charging

Design & Operational Guidelines

FOR PUBLIC FAST CHARGING STATIONS IN BRITISH COLUMBIA

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The Power of Trust. **The Future of Energy.**

In consultation with:

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Chapter 1: Overview

1. The role of EVs in GHG emission reductions

We're proud to power transportation electrification with clean and renewable electricity and to support British Columbia's 2030 CleanBC goal of reducing province-wide greenhouse gas emissions to 40% below levels recorded in 2007.

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 anticipate some of the challenges we faced.

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. EV adoption in B.C.

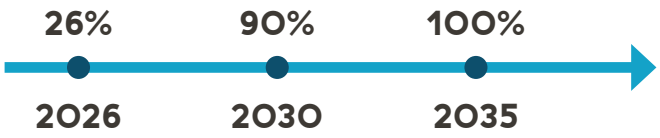
Electric vehicles are becoming an increasingly popular choice among consumers. In B.C. alone, the number of registered electric vehicles—which includes battery electric vehicles and plug-in electric vehicles—grew from 5,500 at the end of 2016 to almost 110,000 by the end of 2022. And in 2023, EVs accounted for almost 21% of all new cars sold in B.C., making per capita EV adoption in B.C. among the highest of any region in North America.

However, there is a long way to go before we meet the Province of B.C.'s Zero-Emission Vehicles (ZEV) Act, which requires that ZEV light duty vehicles account for 100% of new vehicle sales by 2035.

ZEV ACT

A 2023 Government of British Columbia's ZEV Act amendment now require automakers to meet an escalating annual percentage of new light-duty ZEV sales and leases, reaching 26% of light-duty vehicle sales by 2026, 90% by 2030 and 100% by 2035, five years ahead of the original target.

ZEV sales target 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 adoption.

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. That means we need to work together to remove barriers to EV adoption and growth.

ABOUT THE GUIDELINES

By the end of 2023, there were over 150 chargers in BC Hydro's EV charging network. With a new goal of installing 3,000 ports across the province by 2030, BC Hydro has evolved its approach by regularly consulting with EV drivers.

These guidelines will be useful to any organization considering installing one or a network of public 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.

WHAT'S THE RIGHT ROLE FOR YOUR ORGANIZATION?

Building, owning and operating public EV charging is a significant undertaking. Based on BC Hydro's extensive and ongoing experience in deploying stations across B.C. these guidelines provide a picture of the financial and organizational commitment required. If you conclude that you can't take on the full commitment, but still want to provide the benefits of public charging, consider serving as a host for a BC Hydro public charging station at your site(s).

If you're interested in this option, contact BC Hydro at **evservices@bchydro.com**.

Chapter 2: A quick primer

1. The customer journey

Although these guidelines are focused on public fast charging only, it's 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.

EV awareness	Think about buying an EV	Buying an EV	Choosing charging options	Charging an EV		EV end-of-life
	Discovery	Purchase	Installing a home Level 2 charger	Charging at home		
	Decision	Ownership	Preparing to use a public charger	Using a public charger		
				Level 1 and Level 2	DC fast charging	

If you decide to commit to providing EV charging on your property, 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 and charging station design, and the more it will be used.

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 or more 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), except for Teslas, which use their North American Charging Standard (NACS) plug but can use a J plug with an adapter. For Level 1 charging, a car's J plug cable can be plugged into a standard wall outlet as it comes with a grounded three-prong plug on the opposite end of the J plug. For level 2 charging, EVs are plugged in via a charger's J plug cable. Alternating current (AC) is delivered to the on-board charger in the EV and 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 three types of plugs available:

- **CCS** Used by most manufacturers including BMW, General Motors and Volkswagen
- **CHAdeMO** Used by Mitsubishi and Nissan.
- **NACS** The proprietary plug type used by Tesla, but with the use of an adaptor, can be converted for CHAdeMO, CCS, or J plug use.

Level 1: Wall outlet charging	Level 2: AC charging	DC fast charging
Power output: 1.4kW Involves plugging an EV into a standard 120V wall socket with a 3-prong plug, and a J plug into the car,	**Power output:** 3 to 20 kW, but typically 6 kW Requires single-phase power input at 208V or 240V	**Power output:** 25 to 350kW + Anything above 50kW requires 3-phase high-power input
 Wall outlet	 J1772 or 'J plug'	 NACS  CHAdeMO  CCS

See **Appendix 2** for details.

4. Three business models. Which one is right for you?

Before 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. Here are the three options available, followed by questions and considerations that should inform your choice.

THREE BUSINESS MODEL OPTIONS TO CHOOSE FROM IN B.C.

- **BC Hydro built, owned, and operated.** Communities provide the land, and BC Hydro pays for build, maintenance and operations. Offers reliability and consistency with the B.C. charging ecosystem.
- **Site host built, owned, but operated by an EV service partner.** Examples include a municipality using FLO, ChargePoint or another provider. Communities cover capital and operating costs, and generally contract with an EV services provider. Reliability dependent on budget and resourcing, and any operational losses are covered by communities.
- **Private EV service provider built, owned and operated.** Examples include Tesla and Electrify Canada. Private capital investment, with sites and logistics based on private entity's goals. No cost risk for communities, which may be able to generate tax revenue.

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, or light rail?

HAVE YOU DONE AN ORGANIZATIONAL AND FINANCIAL ASSESSMENT?

- Do you have the financial resources and capacity to meet at least a 10-year commitment? Expect the cost to operate and maintain a charging site over 10 years to be similar to the initial total capital cost to build it. Costs vary widely from site to site, so if you want more information on potential costs, talk to us via **evservices@bchydro.com**.
- What cost recovery or subsidization model have you considered? Sustainment, operations and maintenance of fast charging stations require a sufficient annual budget.
- How pivotal are provincial and federal incentives, and low carbon fuel standard (LCFS) credits, to the financial assessment?
- 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-sourcing to another vendor? Think of functions such as customer support, maintenance and repairs, and network management.

WHICH CHARGING LEVELS ARE BEST FOR YOUR CUSTOMERS?

Regardless of the business model you choose, think about how you want EV drivers to use and interact with the charging station on your site. Knowing your goals and knowing who you are trying to attract to your station will result in more drivers using the station.

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. But also popular at shopping centres and leisure complexes.
Charge times[1]	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). Some jurisdictions, including the City of Vancouver, require a "cord cover license" to ensure a cable crossing a sidewalk is properly covered and safe.	The general recommendation is a maximum stay of four hours at a public Level 2 charger. Drivers can leave vehicles plugged in while they shop, see a movie or go for a workout. Drivers are still 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.

[1] 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

While federal (NRCan) and provincial (CleanBC Go Electric) programs can fund a large portion of capital costs, station owners should budget for station operations for up to 10 years or more. Based on BC Hydro's experience with the longevity of certain station components, we now plan to replace equipment after seven years.

The following list of costs isn't comprehensive; it's designed as a reminder of the importance of balancing costs and revenue (should you wish to charge EV drivers to use your station) so that you can operate and maintain 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 ○ 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** ○ 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	○ **Federal (NRCan)** & **Provincial (Clean BC Go Electric)** DCFC incentives, and **low carbon fuel standard (LCFS) credits** for operating public EV charging stations. ○ Price per charge (time-based, and subject to change)* ○ Parking fees ○ Branding & marketing partnerships ○ Utilization rates *Pending Measurement Canada approval, kWh-based pricing may be an option in the near future

1. Designing things right—what EV drivers want

Your top priority in site location and station design should be the driver experience. Include both current and potential EV owners in your consultation work.

Here's what we've learned from our own consultations with EV drivers:

- Drivers want more stations, and more chargers at each station.
- Drivers expect chargers to be working all the time.
- Drivers appreciate a station that is safe and provides a comfortable experience.
- Drivers with mobility, sight, or digital interface challenges frequently experience accessibility issues at stations.

a. 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 elements.

I. SAFETY

It’s important to think about safety for drivers once they get out of their cars to charge, or if they decide to wait in their cars while they charge. Provide adequate lighting, security and open sightlines.

II. 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. Sites that are within walking distance to shops, banks, washrooms and other amenities are ideal. Ensure there is adequate cellular coverage in the area, not just for safety but also for reliable operation of chargers and for driver access to charging apps.

III. USER EXPERIENCE

User experience covers everything from available options for charge activation, such as a mobile app or RFID card, to how they will pay to charge, to how easily out–of–town drivers will be able to charge and pay.

IV. ETIQUETTE

A scan of PlugShare comments quickly reveals driver frustrations over charging behaviour of other drivers, and how a lack of awareness of proper EV charging etiquette can lead to conflict. For example, more than 30% 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% have experienced extreme frustration when other EV drivers use a public fast charger to fully charge their vehicle instead of unplugging once it is charged to 80%. It’s a good idea to include etiquette reminders, either as part of station signage or on stickers placed directly on the chargers. Consider also offering reminders in other languages to reflect the needs of drivers at certain locations. 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’re not creating barriers that will make it difficult or impossible to use your stations. We’ve included accessibility considerations throughout our suggested design guidelines, but have also called them out in a section under Designing, building and maintaining a fast charging station.

This BC Hydro fast-charging station in Langley features wider stalls, upgraded lighting, lower-height digital screens, and at-grade (no curb) access to fast chargers.

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

Drivers not only want stations in a greater number of locations, but also want more than one charger at a given location. Since some sites can be much busier than others, adding additional chargers reduces wait times for drivers and increases resiliency. If one charger is down, others are still available.

Drivers are also 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 150 km intervals along highway corridors.

Site locations should be examined in a broader, site-specific context. For example, if a site's location is at a junction for multiple major road corridors, you might want to consider not only the number of fast chargers at that site, but also supplementing the station with other chargers. If your use cases indicate some users might stay for an hour or more, consider installing a Level 2 charger or a lower power 25kW unit.

Align the design 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?

c. 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. A non-operational charging station can erode EV driver confidence not only in the site host, but also in the public charging network. Provide robust maintenance and service support, and prioritize consistency in experience across the charging network.

Here are some 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 station with multiple chargers 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, and provide updates on charging apps such as **PlugShare**.

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.

Here's 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

Create a shortlist of potential site locations and evaluate them against the set of criteria we've created for you.

See **Appendix 4** for a checklist of key considerations you can take with you as you evaluate the suitability of one site against another. The information below provides much more detail and context than the checklist.

I. DRIVER EXPERIENCE

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

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: Assess personal safety by visiting the site after dark. Is this a location where EV drivers would feel comfortable getting out of their vehicles to charge, or while sitting in their vehicles while they charge?

Proximity to amenities

- **Refreshments** Can drivers grab something to eat or drink nearby?
- **Shopping** Can drivers quickly run some errands such as 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 charger or calling for assistance.

Convenience and access

- **24/7/365 access** Are EV drivers going to be able to access the chargers at all times?
- **En route convenience** Is the charging station close to main travel routes, highways or thoroughfares in your community?
- **Arriving and leaving** Will EV drivers be able to easily drive in and out of the site?
- **Waitlist and queuing** Do EV drivers have space to queue/wait, and/or can they use PlugShare to let others know they're next in line?
- **Space to charge** Do you have a minimum of 1.5 stalls per charger to accommodate charging equipment and accessibility requirements? Note that widening stalls may reduce the number of spaces for charging and for adjacent parking.

- **Room to expand** If demand regularly exceeds capacity, is there room to add additional chargers?
- **Accessibility** Are stalls wide enough to fully open doors and for access, all around the vehicle, for those in a wheelchair?
- **Space for other equipment** Is there room for additional lighting, signage, etc.?
- **Space for EVs with trailers** Is a "pull-through" (rather than pull-in) station required to allow for EVs with trailers to use the station?

II. POWER SUPPLY

You will need to work with an electrician and/or your local utility—you can email questions to BC Hydro at **evservices@bchydro.com**—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** Does the proposed location for your chargers have 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 the reliability of electrical service in the area. Is it prone to frequent or extended power outages?
- **Energy costs** Gather information about how much it will cost to power your site, including estimates of any demand (capacity) charges. 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 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** 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.

Keep it in mind: Demand charges can add up

Demand charges are based on a customer's peak power consumption during a short interval of time (usually the highest 15 minute average usage each month), measured in kilowatts (kW). And with fast chargers in particular, they can be hard to predict, as the demand charges depend on how much a station is used and the types of loads.

Demand charge costs vary widely, but in some cases, can account for a significant portion of a charging station's annual energy costs. At sites with low utilization, demand charges can be a much bigger portion of total costs compared to a site that is used much more often.

To get specifics about potential sites, contact your BC Hydro Key Account Manager or **evservices@bchydro.com**.

III. 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? Are there potential synergies with other municipal infrastructure? It's 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?

IV. BACK-UP CHARGING

- **Level 2 as backup:** If a DC charger requires repair, or if there's a long queue for charging, are there Level 2 charging stations nearby to allow EV drivers to charge and get back on the road? 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:

- Level 2 chargers are not a necessity at fast charging sites, but can be included where practical and where the use case makes sense.
- Demand for Level 2 tends to be greater in urban areas rather than for highway/long distance charging. As fast chargers slow down considerably at a certain point in a charging process, a Level 2 charger at a station can be added as an option to free up fast chargers for those who feel they need to charge to 100%.

b. Designing, building, and maintaining a fast charging station

We recommend installing more than one charging unit—and in many cases, enough cables to charge at least four vehicles at the same time—as sites with only one single-cable fast charger will have much higher operating costs and won't likely meet customer demand.

See **Appendix 5** for sample designs and considerations for the equipment included below (main switch kiosk, lighting, wayfinding beacon, informational signage, concrete pads and bollards).

I. SAFETY & SECURITY

Personal safety

- **Station placement** To provide natural surveillance, install charging stations in high pedestrian and/or high vehicular traffic areas with open lines of sight.
- **Lighting** If there isn't enough existing lighting at a site, 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. Follow municipal standards for lighting levels if they're available, or follow these sample minimum lighting requirements—measured in **lux** (the amount of light output in a given area):
  - **Face of charger lighting** 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. Consider signage stating that the charging station does not contain any high-value metals if the station is going to be located in a high-crime area.
- **Landscaping** To mitigate fire risks and maintain accessibility, keep ground vegetation at least half a metre from the charging station. Prune trees so that the trunk and branches are a minimum of 2.5 metres from the station. Make vegetation management part of your charging station maintenance plan.

Communications to station chargers

- **Cellular or hard-wired:** While communication links to chargers are usually through cellular service, there are other options if local coverage is unavailable or unreliable. Test the cell signal when scoping a site, and if weak or zero, consider setting up satellite or wired communication to the charger.

Equipment safety

- **Bollards** Install bollards to protect the equipment from vehicle impacts. Make sure they are bright, reflective and tall enough to be highly visible to drivers. Ensure the distance between bollards is close enough to protect the charger from vehicle damage but wide enough to provide an accessible path for all users—including those in wheelchairs—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 should be flush with (at the same height) as the area around the charger. This makes it easier for a driver in a wheelchair to reach the screen or charging cables.

II. SIGNAGE AND COMMUNICATION

- **PlugShare and ChargeHub** Register your station on the most popular third party EV station listing websites and apps (e.g. 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. When possible, provide real–time data feeds to entities such as PlugShare, ChargeHub and NRCan so the entire ecosystem has this information.
- **Wayfinding** It's 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 to 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 wayfinding signs that provide directional help from nearby roadways and to the exact location in a parking lot or other location.

Municipal wayfinding

Municipalities have jurisdiction over signage within their boundaries. Contact your local municipal office for more information.

See **Appendix 5** for more information.

- **Beacons** It's 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 when there are 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** Post signage reminding drivers to keep their charging time within a maximum allotted time. While 30–40 minutes is generally considered a maximum 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** Increased interoperability (the ability of various charging networks and related software to work together without restriction) streamlines the public EV "fueling" experience. Stations that support activation via various networks reduce barriers for drivers from other jurisdictions. Signage should highlight all compatible networks. Currently, the BC Hydro EV, FLO and ChargeHub networks have roaming interoperability.

BC Hydro EV app

- **Pricing information** Provide clear information about how much it costs to charge (unless it's free) and if parking is extra. Expect that 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.

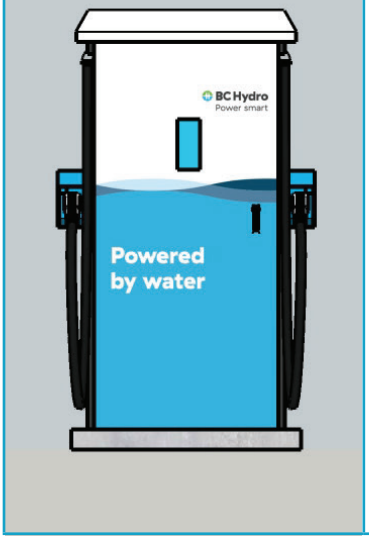
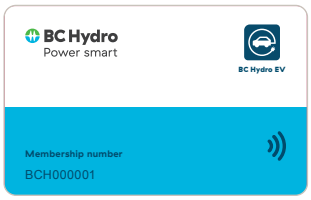
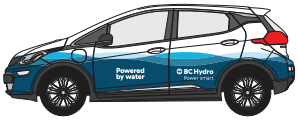
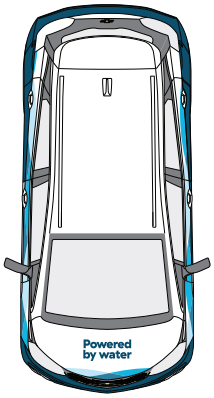
III. BRANDING & IDENTITY

Station branding isn't just the physical wrapping of a charger. Your "brand" is best served by building a standardized and unified experience across sites that effectively supports B.C.'s growing EV charging network.

It's vital that key elements of the driver experience are aligned: accessibility, amenities, customer support, website or mobile app, station reliability and regular maintenance.

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.

Charger wrap	Mobile app	Station stickers	Outreach vehicle
	 		 

IV. OTHER ELEMENTS TO IMPROVE STATION EXPERIENCE

- **Grade** Ensure the entire area, including the charger, is flush to grade and flat. 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 has other mobility challenges.
- **Weather protection** For the installation of a charging station located outside, 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 garbage and recycling receptacles or other assets valuable to drivers, including a place to sit. Include all fixtures in your ongoing operating budget and maintenance plan.
- **Cable management** Charging cables can be damaged by drivers who don't 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, and that 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. Consider installing a cable management system, such as one that retracts not-in-use cables, to prolong the life of cables and improve user experience.

Focus on barrier-free and accessible station 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 the charger, but check local/municipal standards, which can vary. Also ensure there is enough space around the charger to be able to manoeuvre a wheelchair.
- **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** Start by checking local guidelines for minimum width requirements. Design to those specifications, which are likely to call for stalls to be at least 3.7 metres (12 feet) wide, which allows 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's 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 **U.S. Access Board recommendations** of placing the screen, holster and cables at a more accessible height.
- **Weather protection** Wherever possible, and especially in areas prone to extreme weather, provide a single charger roof or other weather protection.

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

Although fast chargers can be installed curbside, in parkades, and in surface lots (see **Appendix 6** for an overview of common layouts), this section focuses on surface lot configurations. For specifics on other layouts and considerations in your area, refer to city and municipal resources such as the **Capital Region Public Electric Vehicle Charging Guide**.

Configuration options

- 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.

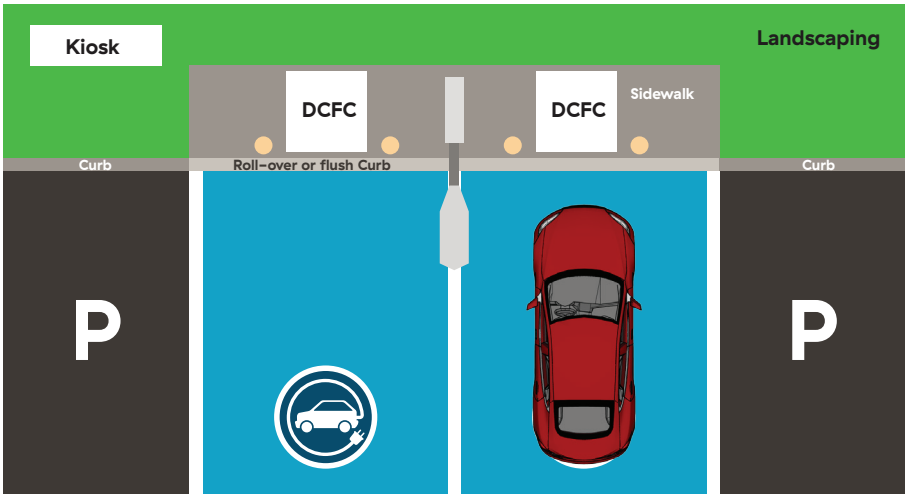
BEFORE CONSTRUCTION

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)

Advantages of this layout

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.

EXAMPLE OF A BC HYDRO STATION, PULL-IN, CHARGERS IN FRONT OF STALL

II. PULL-IN, CHARGERS IN BETWEEN STALLS

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.

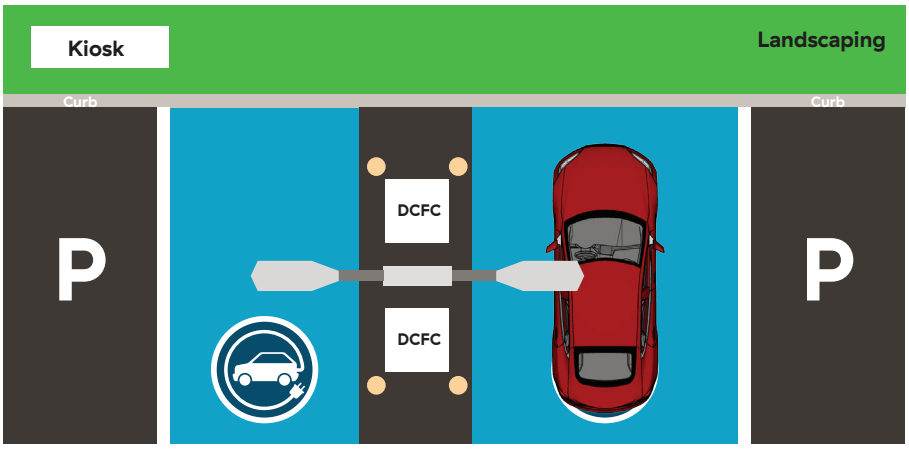
BEFORE CONSTRUCTION

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

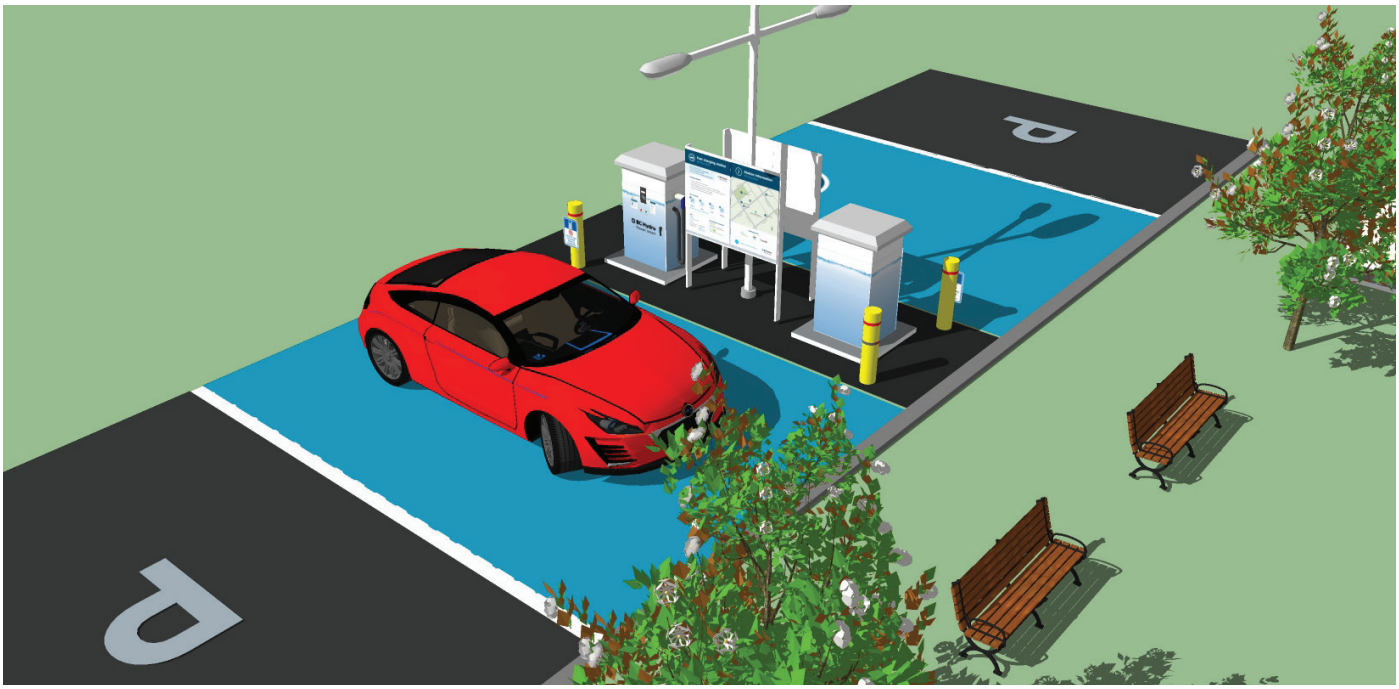
List of upgrades

- Install two chargers
- Convert three stalls into one regular-sized stall and at least 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)



ADVANTAGES OF THIS LAYOUT

While it requires extra space to accommodate the charger and kiosk, it works well for accessibility. 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.

EXAMPLE OF A BC HYDRO STATION, PULL-IN, CHARGERS BETWEEN STALLS

III. PULL-THROUGH, CONVERSION FROM PULL-IN

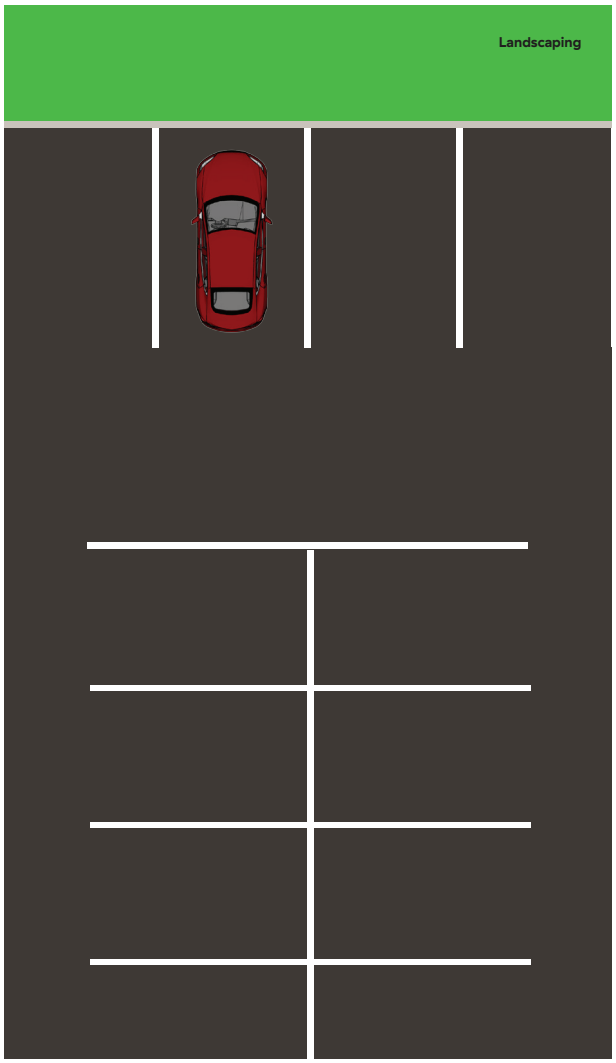
If the site has the space for it, a pull-through design is a great option. It can accommodate larger EVs such as pick-up trucks or EVs pulling trailers. Much like gas stations, drivers can easily park on the side where the charger is closest to their vehicle's charger port. It can also easily accommodate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

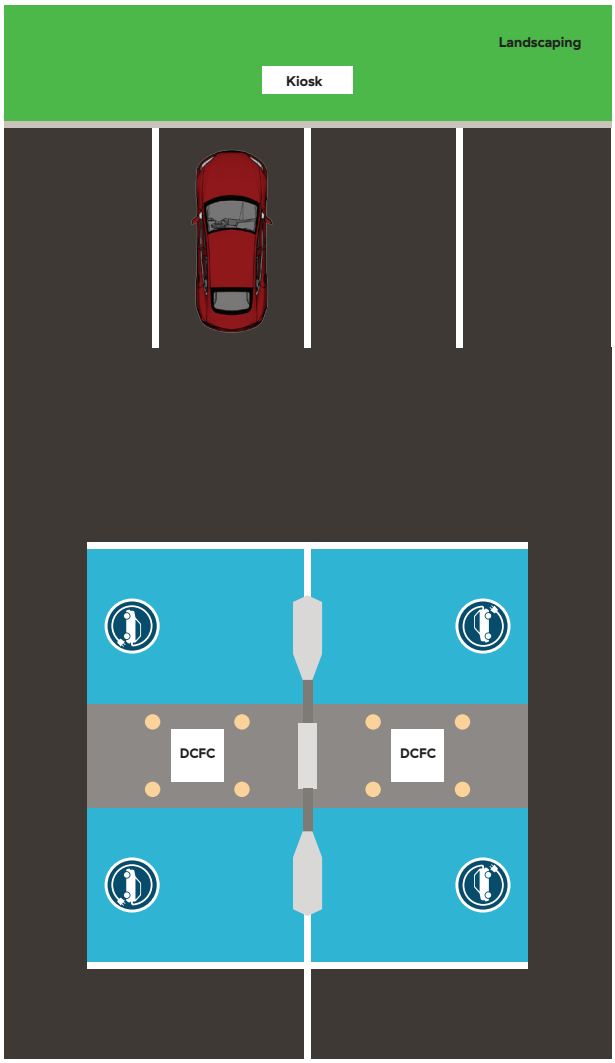
List of upgrades

- 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)



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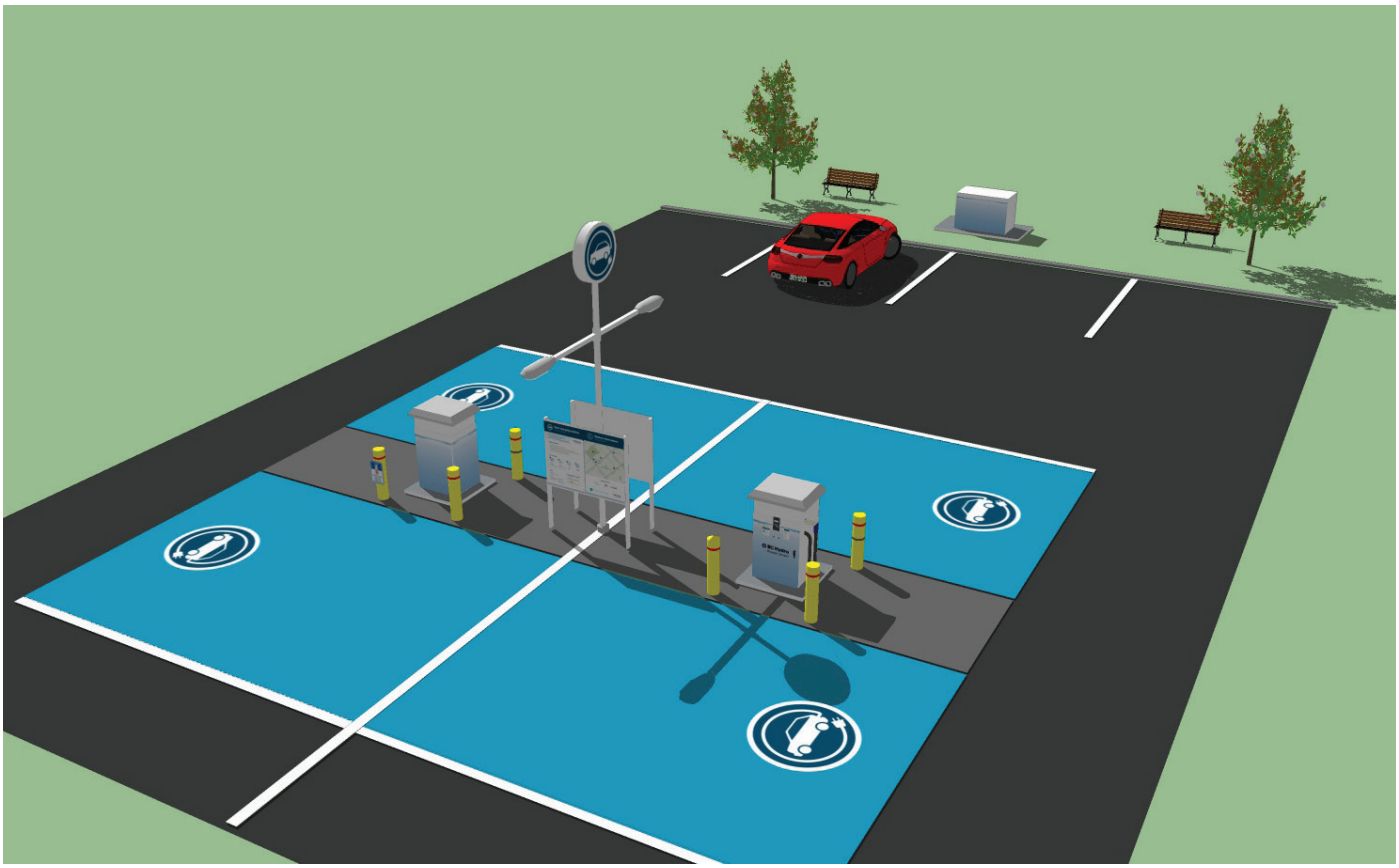
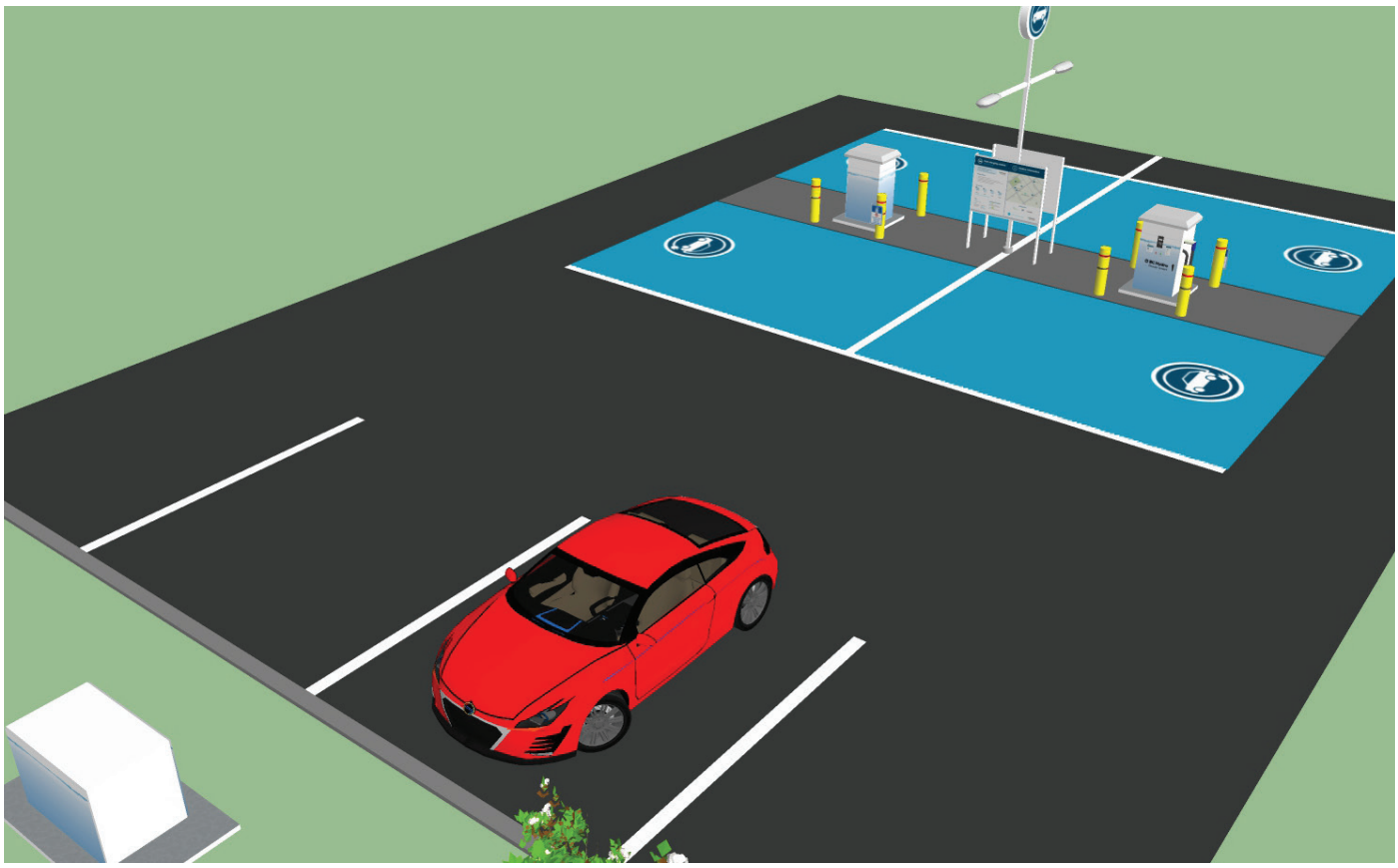




ADVANTAGES OF THIS LAYOUT

This design can accommodate larger EVs such as 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.

For this design, the kiosk is typically installed away from the chargers.

EXAMPLE OF A BC HYDRO STATION, PULL-THROUGH, CONVERSION FROM PULL-IN

IV. PULL-THROUGH, CURBSIDE

Curbside pull-through charging can be a great solution on city streets in particular, at least where existing parking is available. Priority should be made to make several chargers accessible with on-grade access (no curb) or rollover curbs and with space and safety considerations around the vehicle—charging ports in EVs can be on any side of a vehicle—to ensure access for those in wheelchairs. U.S. Access Board (USAB) guidelines also suggest that, where possible, chargers should be provided on both sides of a one-way street to make them more accessible. Consider driver safety and the specifics of the charger's cables—are they too short or unwieldy to easily reach to the far side of a vehicle?—in determining whether chargers on two sides of a one-way street are required.

Here is how the site might look after construction as well as a list of upgrades not reflected in the graphic below.

List of upgrades

- Remove curbs (or build rollover curbs) in several spaces to enable an on-grade surface for accessibility
- Provide enough room on all sides of the vehicle for easy access for those with mobility challenges.
- Install bollards to protect the chargers
- Add overhead lighting
- Add informational signage

EXAMPLE OF BC HYDRO STATION, ACCESSIBLE PULL-THROUGH CURBSIDE LAYOUT

d. Selecting vendors and contractors

You'll need to select which vendors will supply the hardware and services, and which contractors will help you assess, install and maintain your charging station. After your charging station is installed, you will need to decide which part(s) of the operations you intend to outsource. 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 8** for an equipment 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, accessible communication features (e.g. meets **US Access Board 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 including: BC Hydro EV, FLO, ChargePoint, Shell Recharge (formerly Greenlots)
- 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)	Separate vendor for EV network (IT) and hardware (charger)
Pros	○ 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	○ 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	○ 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 terminates operations ○ Software customization features may not be possible or can be more difficult to realize for the owner (this is different from configuration options)	○ 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

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, including minimum and recommended service levels.

Category / Tasks	Minimum service levels	Recommended service levels
Maintenance		
Pro-active inspections ○ 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	Less than 24 hours ○ Plow lot any time more than 15 cm of snow falls	Less than 12 hours ○ Plow lot any time more than 10 cm of snow falls ○ Hand-shovel snow around charger, and salt around charger and on EV charging stalls
Spare part / inventory management ○ Ensure inventory of critical spare parts such as connector cables ○ Proactively order 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 ○ Vehicle accident related to station ○ Charger or kiosk electrical safety issue	Less than 15 minutes of report ○ Call fire department ○ If applicable, call BC Hydro to report emergency: **1 800 BCHYDRO**	Less than 5 minutes of report ○ 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 ○ Charger is operational; minor repair is required ○ No safety issues; e.g. fan is loud and needs maintenance	Within 30 calendar days ○ Post a status message on PlugShare/ ChargeHub within 3 business days	Within 10 business days ○ Post a status message on PlugShare/ ChargeHub within 1 business day
Repair Tier 2 ○ Charger is functional but has network Issues ○ Minor electrical work needed ○ Fee not being charged	Within 7 days ○ Post a status message on PlugShare/ChargeHub within 1 business day	Within 48 hours ○ Repair triage same business day ○ Post a status message on PlugShare/ChargeHub within 4 business hours
Repair Tier 3 ○ Charger not functional ○ Major repair required	Within 2 days ○ Post a status message on PlugShare/ChargeHub within 1 business day	Within 24 hours ○ At sites with only 1 charger, repair triage on the same business day. ○ At sites with 2 chargers or more, where other chargers are working, seek to repair chargers within 48 hours. ○ Post a status message on PlugShare/ ChargeHub within 4 business hours
Replace (beyond repair)		
Complete swap of DCFC or kiosk ○ Beyond reasonable on-site Repair Tier 3 ○ Full replacement/use of backup equipment	Station with only 1 charger: within 30 days Station with at least 1 other working charger: within 90 days ○ Station owner should have financial or insurance means to completely replace stations beyond repair within a reasonable time period	Station with only 1 charger: within 24 hours (following Repair Tier 3 attempt) Station with at least 1 other working charger: within 10 days ○ Assumes backup equipment available in inventory in B.C.

Category / Tasks	Minimum service levels	Recommended service levels
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: within 24 hours reactive ○ 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: within 8 hours ○ Dispatch electrical contractor as per Repair Tier categorization (see above)
Error notification	n/a, OR Within 2 business days if services are part of vendor service agreement	Network operator notification: within 24 hours ○ 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: within 8 hours ○ Consult with charger manufacturer or network vendor, as required ○ Dispatch electrical contractor as per Repair Tier categorization (see above)

Category / Tasks	Minimum service levels	Recommended service levels
RFID/scanning	n/a, OR Within 2 business days if services are part of vendor service agreement	○ 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: within 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 ○ Toll-free number ○ Able to remotely initiate charging session ○ Able to provide member/ payment support	6 am—midnight, 7 days a week ○ Repair triage by next business day ○ Immediate emergency support	24/7, 365 days a year ○ Repair triage same business day ○ Immediate emergency support
Contact centre metrics ○ First call resolution % (FCR) ○ Average wait time in min (AWT) ○ Customer satisfaction top box score % (CSAT)	○ FCR: Greater than 60% ○ AWT: Less than 5 mins average wait time ○ CSAT: 70% satisfied	○ FCR: Greater than 80% ○ AWT: Less than 2 mins average wait time ○ CSAT: 80% satisfied
Crowd-sourced platform monitoring & response ○ PlugShare ○ ChargeHub	Within 1 business day ○ Monitor and respond to user comments and photos ○ Target to maintain PlugShare scores above 7.0	Less than 4 hours M-F, next day weekends and holidays ○ Monitor and respond to user comments and photos ○ Target to maintain PlugShare scores above 9.0
Social media monitoring ○ X (formerly Twitter) ○ Others as applicable	○ Within 1 business day ○ Monitor user comments and photos ○ Proactively post/triage to other channels	○ Same day ○ Monitor user comments and photos ○ Proactively post/triage to other channels

Chapter 4: Planning for the future

While it's difficult to predict what the e-mobility industry will look like 10 to 20 years from now, all current forms of ground transportation will likely be electrified to some degree. To keep your charging stations relevant, plan for emerging and future EV types and transportation markets.

Stations that aren't upgraded to align to a changing e-mobility environment will likely need to be decommissioned. Take the time to 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, snowmobiles 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 10 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.
- While most automakers other than Tesla have adopted the CCS combo connector type for DC fast charging, most are planning to move to NACS. Most public fast charging stations in B.C. still include a CHADEMO plug option as well, but as more vehicles adopt NACS, expect the CHADEMO connectors to be phased out over time. BC Hydro expects to move towards a mix of NACS and CCS, but that could also change as NACS standardization evolves.
- 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 as we evolve them over time.

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

Interested in becoming a BC Hydro site host? **Get more information** and **submit a site proposal.**

Appendices

Appendix 1 Electric vehicle technologies

Appendix 2 Electric vehicle charging levels

Appendix 3 Etiquette

Appendix 4 Site evaluation checklist

Appendix 5 Station equipment

Appendix 6 Overview of common charging station layouts

Appendix 7 Technical recommendations for station layouts

Appendix 8 Equipment procurement requirements example

1. Electric vehicle technologies

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

Vehicle type	How it works	Battery range	Other information
Battery electric vehicle (BEV or more commonly, EV)	A BEV is powered entirely by a battery and single or dual electric motors There is no gas back-up Has to be plugged into a charger	100 km for first generation BEVs and up to 830 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)	Runs mostly on batteries 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	Typical PHEVs drive for 30–80 km using only electricity before they start using gasoline, and some can drive up to a combined range of 1,000 km, depending on the size of the tank and the car's efficiency.	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, and some more than 1,100 km	HEVs should not be confused with PHEVS. HEVs are not plug-ins, as they can't be recharged from the power grid.
Fuel-cell electric vehicle (FCEV)	Uses on-board fuel cells to generate electricity from hydrogen and oxygen to power an electric motor All the energy comes from hydrogen fuel	Today's commercially available FCEVs have a range of up to 600 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 hours to 5 days ○ 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: 2–13 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, ideally a member of the **BC Hydro Alliance of Energy Professionals**.
DC fast charging	25 to 350kW + output Requires 3–phase high–power input	Charges 200–250 km/hour at 50kW, up to 460 km/hr at 100 kW, and up to 830 km/hr at 180 kW ○ BEV: 1–4 hours at 50 kW ○ PHEV: 15 min–3 hours	○ Businesses ○ En route charging ○ Common areas	○ Requires installation of DC fast charger (DCFC) ○ There are currently three types of connectors that connect DCFCs to vehicles: CHAdeMO (Japanese standard), SAE Combo/CCS (USA standard) and NACS (Tesla). ○ Drivers without compatible connectors in their EV may be able to purchase adaptors to charge at a DCFC ○ Drivers recommended to only charge to 80%, as DCFC rate slows after 80% to prevent battery damage.

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:

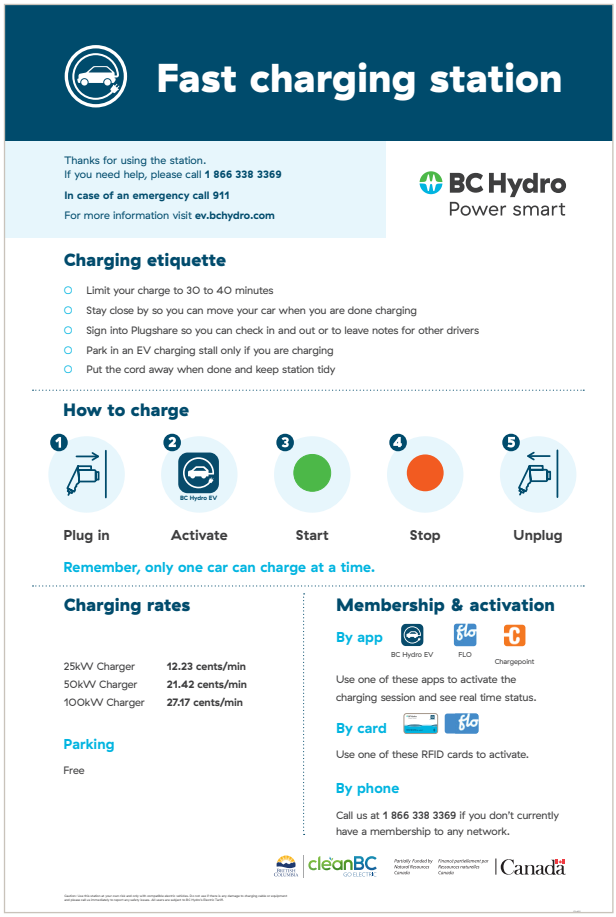
1. Take only what you need, and limit your charge to 30–40 minutes*
2. Stay close by in case you need to move your vehicle to let someone else charge
3. Don't park in an EV charging stall if you're not charging or waiting to charge
4. Put the charging cord away, and keep the station tidy
5. Don't unplug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

* **Note:** 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.

BC Hydro examples

Charging station stickers

Information panel



4. Site evaluation checklist

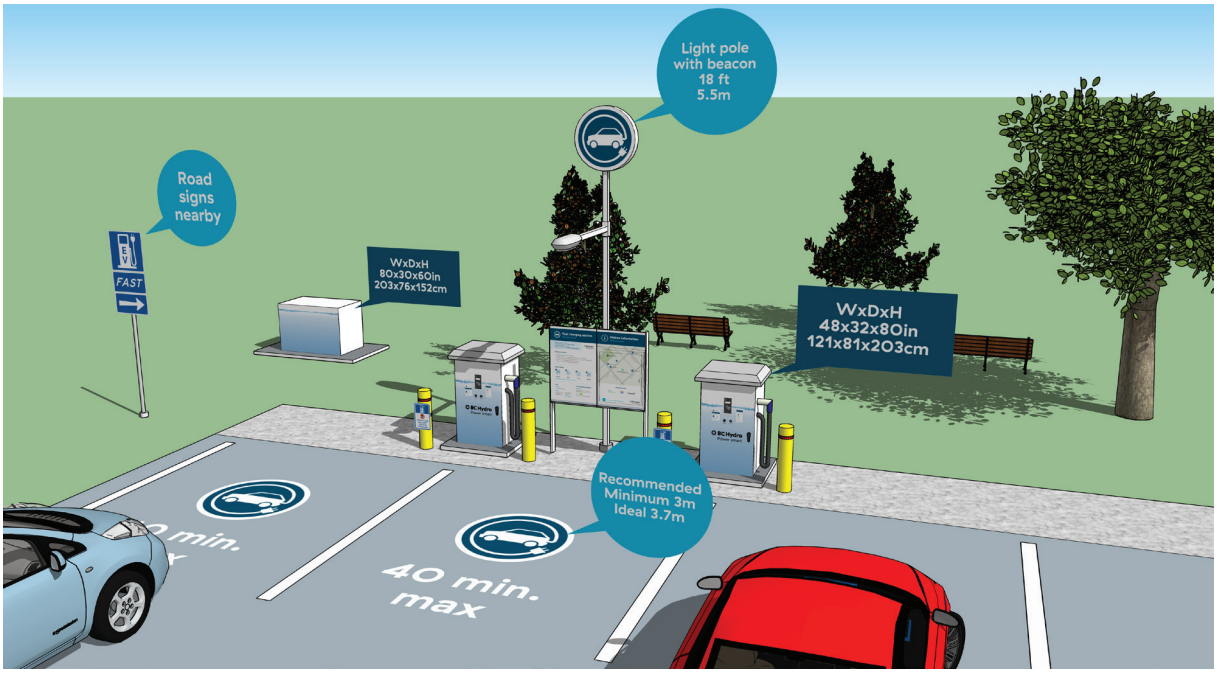
Take this checklist with you when assessing potential charging station sites.

	Site 1	Site 2	Site 3
Driver experience			
Personal safety			
○ Adequate lighting			
○ Open sightlines			
○ Foot traffic			
Proximity to amenities			
○ Refreshments			
○ Shopping/banking			
○ Washrooms			
○ Cellular/Wi-Fi/Hotspot			
Access			
○ 24/7/365 access			
○ En route convenience			
○ Ingress/egress			
Space requirements			
Space for a minimum of two chargers, with room to expand. Where budget allows, the recommended space requirements are:			
○ 8–14 vehicle spaces for urban sites (to fit 6–12 charging stalls)			
○ 8–10 spaces for sites in southern B.C. (to fit 4–8 charging stalls)			
○ 3–6 spaces for sites in northern B.C. (to fit 2–4 charging stalls).			
Power supply			
○ Access to power			
○ Available capacity			
Community planning			
○ Future development			
○ Economic growth			
Back-up charging			
○ Nearby DC fast charging			
○ Nearby Level 2 charging			
○ Adequate charging, not backup required			
Other accessibility requirements			
○ Surface is on-grade (no slope)			
○ Surface is paved (or can be paved)			
○ No curb (or curb can be removed)			

5. Station equipment—sample designs and considerations

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 examples are for reference only. Specifications for your particular station need to reflect the latest federal, provincial and/or municipal guidelines and 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

Lighting & wayfinding

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.

LUMINAIRES

Luminaires should be selected to provide optimal station light distribution, for safety as well as for an enhanced charging experience after dark. For example, options with a low backlight distribution pattern can be a good fit for installation in front of residential buildings where light distribution towards the building is not desirable. Options with a high backlight distribution pattern can be a good fit for darker parking lots where light distribution is required over a wide area.

PHOTOCELLS

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

WAYFINDING BEACONS

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 DC fast chargers.

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

Figure 2: Example of a BC Hydro light pole assembly

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 a good fit where real estate is limited.

SIDE–BY–SIDE

Figure 3: BC Hydro side–by–side informational signage at an EV charging station

BACK–TO–BACK POLE–MOUNTED

Figure 4: 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.

- **Pros and cons:** 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.
- **Pour-in-place alternative:** A 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.

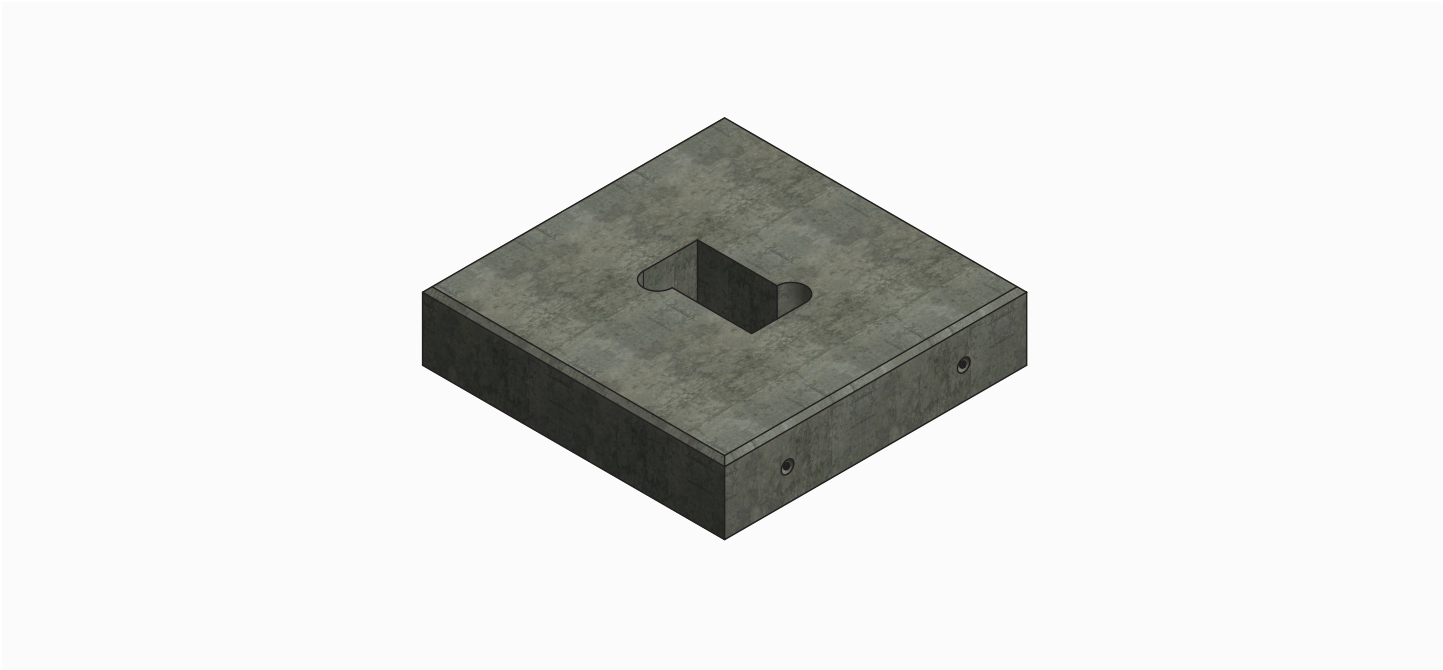

Figure 5: BC Hydro DC fast charger precast pad—shallow design

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.

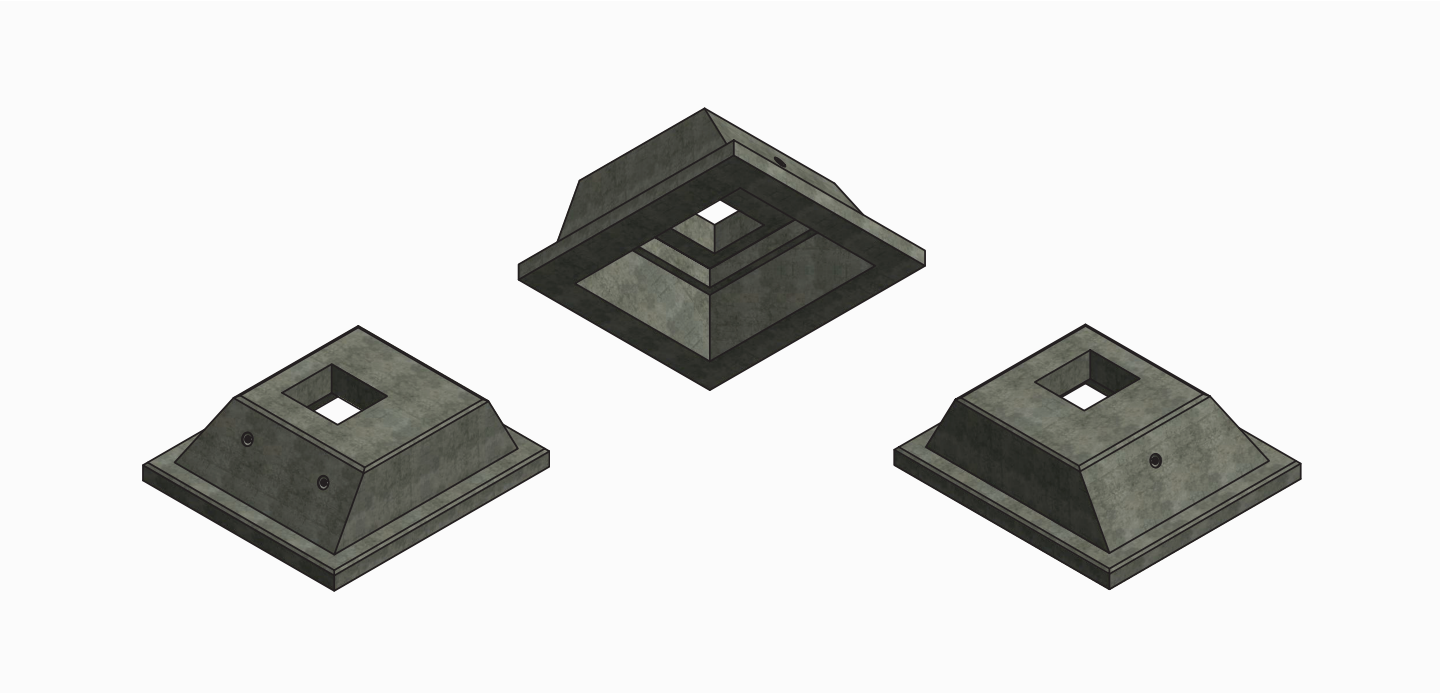

Figure 6: BC Hydro DC fast charger precast pad—pyramid design

KIOSK PRECAST PAD – LOW SEISMIC DESIGN

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

Figure 7: Kiosk precast pad—low seismic design

KIOSK PRECAST PAD – LOW SEISMIC DESIGN

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

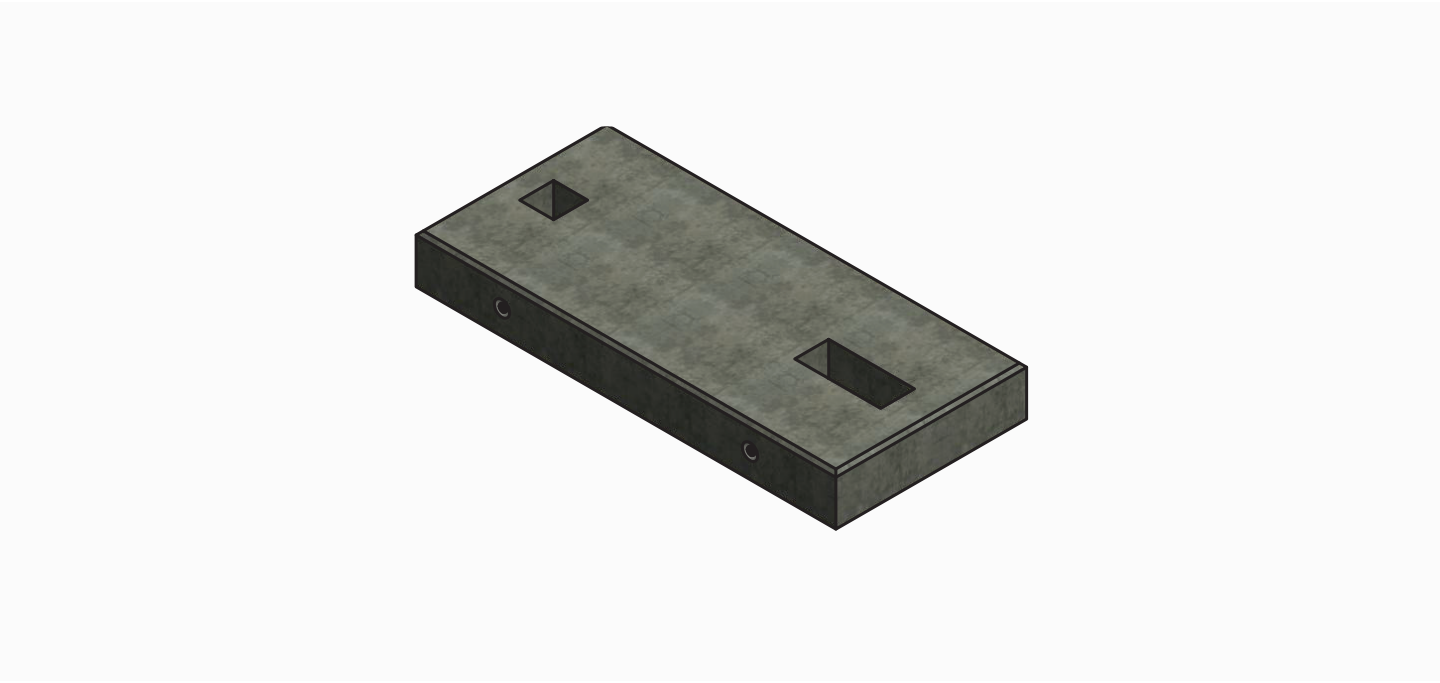

Figure 8: Kiosk precast pad—high seismic design

LIGHT POLE PADS

The height and base size of light pole precast pads differ based on seismic, soil and wind conditions and the different sites. The most common design is the pyramid design with a height of 1.2 metres (see figure below). If soil conditions are unstable, deeper and wider pole base designs are available.

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

Figure 9: Light pole precast pad

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.

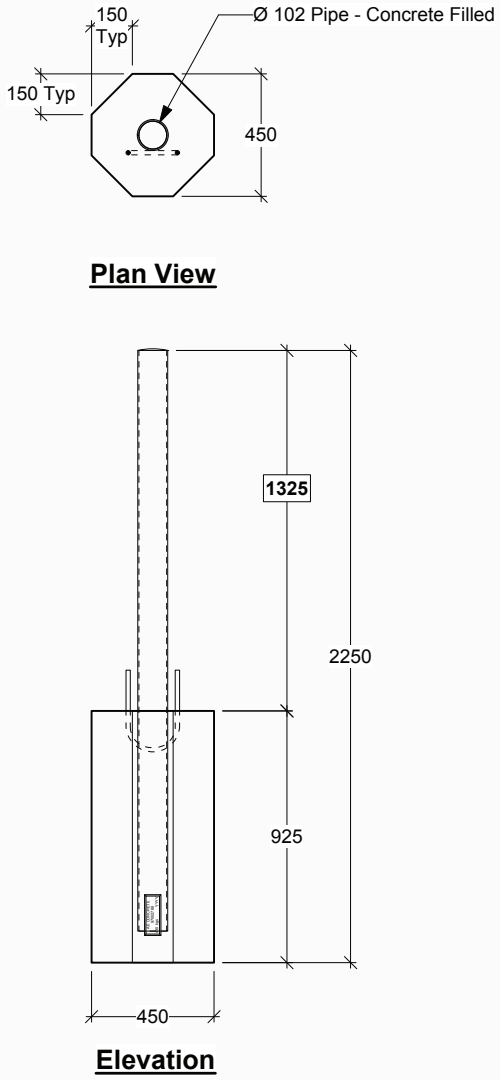

Figure 10: BC Hydro precast bollard

6. 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. You should also consult local city and municipal resources such as the excellent **Capital Region Public Electric Vehicle Charging Guide**.

Attributes	Considerations	Challenges
Recommended layouts		
Pull–in, charger in front	○ 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	○ 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	○ 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)	○ Drivers are exposed to elements without weather protection
Pull–through	○ 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)	○ 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	○ 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	○ 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
Curbside—angled	○ 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	○ 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	○ 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	○ 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

7. Technical recommendations for all station layouts

SPACING

- At sites with curbs, whenever possible, install a roll–over curb or ramp to meet accessibility needs.
- Where curbs are still present, 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
- Minimize, or remove, wheel stops to provide accessibility corridors around the vehicle.

8. 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, CHAdeMO and NACS (Tesla)
- Required safety standard testing and certification: CSA or other applicable technical safety authority, lead-free, asbestos-free

DATA NETWORK SPECIFICATIONS

- Communication network standard: OCPP or OCPI compliant, wireless cellular/LTE connection, 5G
- 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.