



Considerations for Public-Sector Electric Vehicle Charging Station¹ Deployment for Core Government and the Broader Public Sector

Produced by the Climate Action Secretariat
In consultation with BC Hydro and Natural Resources Canada

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¹ A charging station in this document is referred to as electric vehicle supply equipment (EVSE). This term is in line with industry standards.

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Introduction

This document contains recommendations for and observations on electric vehicles (EVs) and electric vehicle supply equipment (EVSEs). The purpose is to capture the information in one location, to share this knowledge, and to encourage collaboration as new EV technology grows. The intended audience is public sector fleet and site managers, employees who drive EVs, and other public sector users. We suggest that readers use this document as a compendium of best practices and information.

This document is not comprised of policy, directives, or rules, but rather best practices, suggestions, basic information, and recommendations.

This document is a “point in time” document. It represents the best information available to us as of the date of publication.

The information captured in this document is based on information from the following sources: Plug-in BC, BC Hydro, Natural Resources Canada (NRCan), peer-reviewed academic research, and interviews with electricians, EVSE installers, and public sector fleet and property managers.

Types of EVSE

Electric Vehicle Supply Equipment (EVSE): Charging stations and associated immediate infrastructure (e.g. transformers, etc.) excluding building electrical infrastructure such as electrical panels, conduit/raceways, overprotection devices, wires and pull boxes.



Top Left: **Level 1 Charger** (J-1772 plug).
Top Middle: **Level 2 Charger** (J-1772 plug).
Top Right: **Level 3 DC Fast Charger** (CHAdeMO plug).
Bottom Left: Shows a vehicle charge port with CHAdeMO port on the left and J-1772 port on the right. Note that Tesla uses completely different plugs, not pictured here, which can use adapters to work with these standard adapters.

Level 1 chargers use a normal 120-volt connection, which draws upon a standard household or office outlet. Level 1 chargers are typically not installed as “stations” but are rather short extension cords with a wall-plug at one end and a standard (J-1772) EV charging plug at the other.² Vehicles charging with a level 1 charger take hours to days to complete a full charge.

Level 2 chargers use a higher-output 240-volt power source, like the ones used for ovens or clothes dryers. They are typically installed as “stations” and use the same J-1772 EV plug. On average, level 2 chargers provide around 30 km of driving distance per hour of charging, but there is considerable variability. For many makes and models, a couple of hours’ worth of charging at a level 2 charger is sufficient to complete shorter trips.

The Climate Action Secretariat (CAS) strongly suggests that public sector organizations (PSOs) install level 2 chargers as the default EVSE option for vehicles.

Level 3 are Direct Current Fast Chargers (DCFC) and are also referred to as “fast chargers” or “DC fast chargers”. They use high-voltage (440+ volt) direct current technology to charge vehicles at a very fast pace. For many EV makes and models, it takes 30-40 minutes to boost a battery charge from 20% to 80%. There are numerous public level 3 chargers available across the Province.³

For the purposes of this guidance document, the assumption is that a charging unit includes:

- Level 2 charging capacity
- One pedestal, with two charging cables and plugs (an example shown at right)
- J-1772 plugs, used by most EVs (other than Tesla⁴)
- Installation of equipment that complies with local, provincial and federal requirements.



² If an agency intends on using level 1 chargers on a regular basis, the recommendation is to install it as a proper station and label it as a level 1 charger, with an explanatory sign that gives users an indication of charge rate (kW/h). This option might work for special use vehicles, such as golf carts and small electric utility campus vehicles.

³ Many fast chargers are located on the property of local government institutions, such as carparks and libraries, and are the result of partnerships between BC Hydro and local governments.

⁴ Tesla drivers have adapters that work with the J-1772 plug.

Recommendation: Avoid Ad Hoc Level 1 Chargers

According to electricians and approved EVSE installers, there are several safety and management-related concerns with ad hoc usage of Level 1 chargers in the public sector:

Level 1 chargers are typically a manufacturer-supplied special use cable that plugs into a 120-volt electrical wall outlet. To reach the outlet, the cable is often attached to an extension cord. This practice creates **serious fire risks** as many cords become overheated due to long exposure to electrical current. The use of an extension cord can also create **serious tripping hazards**. WorkSafe BC requires safe working places and parking facilities.⁵



Situations where extension cords are used should be avoided.

- According to approved EVSE installers and electricians, best practices associated with the installation of Level 2 charging stations requires **site assessments, lighting considerations, parking availability, electrical considerations, and grid management**, none of which are observed when Level 1 chargers are used in an ad hoc manner (i.e. not installed as proper stations). Stations ensure compliance with industry standards around **cable management and surge protection**.⁶
- Unregulated and ad hoc usage of Level 1 chargers also makes it impossible to:
 - a) Charge for any electricity used by a client; and
 - b) Track kilowatt consumption and plug-in data.



According to fleet managers and EVSE installers, “smart chargers” will soon be installed more widely, which track costs and electricity consumption at each EVSE.

- If an organization determines that a Level 1 charger is the only option, then a Level 1 charging station should be installed.

⁵ See <https://www.worksafebc.com/en/health-safety/create-manage>.

⁶ This information is based on interviews conducted in 2020 with EVSE installers and fleet managers.

Site Assessments and Technical Considerations

Accessibility

Accessibility is an essential consideration, as Level 2 charging stations are installed with disabled and low-mobility users in mind. EVSEs should meet Canadian Transportation Agency standards and guidelines for accessibility.⁷

Timing of Installations

It is recommended that PSOs install EVSEs prior to the arrival of fleet EVs.

EV to EVSE Ratio

The ratio of EVs to EVSEs will differ for employee/visitor chargers and fleet-only chargers.

For employee or visitor chargers, the ratio will be relatively low, as users generally charge at home. FLO – which operates many charging stations in BC– lists a ratio of up to 4:1 as “manageable” at workplaces.

For fleet-only chargers, the experience at the City of Vancouver provides some guidance. Vancouver has developed policies on the ratio of EVs to EVSEs for their public sector fleet. Ideally, the City aims to have 1 operating plug for every 1 EV, so a ratio of 1:1, at every new site (to the maximum available power supply). When adding additional EVs to a site with existing EVs, the aim is for a ratio of 2:1 (vehicles to plugs). As more EVs are purchased, the City anticipates more competition for EVSEs, but hopes to avoid any car-to-plug ratio higher than 3:1.

At this time, the Province cannot provide recommendations about EV-to-EVSE ratios, but the evolving policy at the City of Vancouver suggests that PSOs should aim for a ratio as close to 1:1 as possible for fleets in the short term.

⁷ See the Canadian Transportation Agency guidelines: <https://otc-cta.gc.ca/eng/standards-and-guidelines-accessibility-additional-references>.

Placement of Fleet EVSE

- When considering the installation of an EVSE it is important to know where the EV overnights. EVs generally require several hours' worth of charge time to "fill up" when using Level 2 chargers which generally happens overnight.
- Second, PSOs should determine the locations frequently visited by EVs during the day. Even if EVs do not overnight at a given facility, the PSO should select a facility to provide dedicated charging . One example would be a facility that is regularly visited by fleet vehicles during normal business hours yet is located over 50 km from where vehicles typically spend the night. Examples might include a remote transfer station, a rural parks facility, or a utility centre. Such facilities will be useful locations at which EVs can "top up" during business hours.
- Third, consider the potential impacts of a changing climate on parking areas and infrastructure. Natural Resources Canada advises against placing EVSE in areas prone to flooding, for instance.⁸



An additional consideration when placing EVSEs is the effect of a hot or cold climate. Based on nearly 10 million miles of data collected through the EV Project, [researchers at Idaho National Laboratory](#) found that variations in weather can affect the range of plug-in electric vehicles by more than 25%. Other studies have found that ranges can diminish by up to 40%.

Many parts of BC experience cold winters and hot summers that will affect EV performance. The impacts of temperatures should be factored into the selection and management of EVs and EVSEs. For instance, given the diminished range in cold temperatures, PSOs might decide to procure longer-range EVs and/or install additional EVSE at regional or remote facilities to ensure that fleet vehicles have enough power to return to overnighting locations.

Additional research, information and guidelines are available from the Resources page at [Plug-In BC](#).

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https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/transportation/NRCan_GreeningGovFleets_e.pdf#page=46

Site Assessments

The installation of EVSE requires a site assessment by a certified electrician. It also requires close collaboration between property owners, site managers, fleet managers, and installation professionals. Site assessments include reviews of ambient lighting, accessibility, parking availability, cable management, electrical service, grid and load management, and other such considerations.

Natural Resources Canada (NRCan) explains that:

Installation of electric vehicle supply equipment (EVSE) at a facility typically consists of installing new dedicated branch circuits from the central meter distribution panel to a Level 2 AC EVSE. In a fleet, there are typically many such EVSE units in adjacent parking stalls. Proximity to the electrical service is an important factor in locating the parking area as the length and the quantity of the circuit run will have a significant impact on the cost. Fleet managers must also be aware of other equipment to be stored in the vicinity of the EVSE.

Charging electric vehicles requires the use of cables, connectors, and communication protocols. These communication protocols need to be between the vehicles, the EVSE, and the EVSE-grid communication (i.e. the communication between the EVSE and the Distribution System Operator).

The EVSE suitable for electric cars has three main characteristics:

1. Level: the power output of an EVSE outlet
2. Type: the socket and connector being used for charging
3. Mode: the communication protocol between the vehicle and the charger.⁹

For networked stations, it is necessary to ensure any wireless connection has a strong signal. This is particularly important in underground garages, for example. In some scenarios, it may be necessary to place the wireless modem elsewhere, such as in an electrical room, and then run a hard-wired connection to the charging station.

In many cases, the installers approved under the corporate supply arrangement (or CSA, described below) with the Province are also able to help with site assessments. The approved

⁹ See NRCan, "Greening Government Fleets," (2018), pp.35-36.
https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/transportation/NRCan_GreeningGovFleets_e.pdf#page=37,

companies are staffed by certified electricians and have extensive experience in assessing EVSE sites.

Approved Installers

The Province has a corporate supply arrangement (CSA) with specific EVSE installers. As of 2020, there are 4 approved corporate installers, with branches in multiple parts of the Province. See “Additional Links, Resources, and Information” in this document.

It is recommended that PSOs use a CSA installer, as it ensures that installers are vetted, experienced, and capable.

EVSE Costs

In government ministries, the EVSE (a pedestal with two charging plugs) and installation costs are approximately \$15,000 - \$25,000 per station, or \$7,500 - \$12,500 per plug. Costs associated with an EVSE include materials, labour, site, and electrical. The total cost will depend on any required alterations to the electrical system and/or parking areas. A case study on BC Parks’ installation costs found that the price per dual-headed station was often less than \$15,000, but also occasionally higher, due to complex sites that required major renovations or upgrades. Government typically amortizes the EVSE capital costs over 7 years.

For more extensive projects, such as those that require civil works or electrical upgrades, it is also important to consider short-term and future costs. For example, if trenching across a parking lot is required, extra conduit or raceways could potentially be included to avoid re-trenching in the future. Similarly, the sizing of new electrical panels should consider the need for additional capacity for more stations (or other electrification projects) down the line.

Organization-Level EVSE Policy Considerations

The organizational policies on EVSE use will need to be determined by the PSO with input from fleet and facility managers. This document is meant to provide guidance, but PSOs will need to make decisions that best meet their own unique needs. In some instances, it might *not* be possible to install an EVSE. PSOs can develop relationships with local governments and BC Hydro about the use of publicly accessible chargers. Additional considerations for fleet and facility managers include the following:

Accessibility of an EVSE: Fleet vs. Employee or Visitor

In some government locations, the same EVSEs are made accessible to the private vehicles of government employees, the general public (i.e. visitors), and public-sector fleet vehicles. At

other government locations, charging stations for employees or visitors are separated from the dedicated charging stations for fleet vehicles. The separation can be in the form of signage, secure-access parking or charging station sign-in access.

If PSOs wish to charge for employee and visitor EVSE usage, it is recommended that they reach out to approved CSA installers for options and ideas.

Signage

Recommendations include the following:

- Signage is visible and compliant with the specifications of the Ministry of Transportation and Infrastructure¹⁰
- The level of charger (e.g. level 2)
- Maximum parking times
- Fees (if any)
- Troubleshooting recommendations

Etiquette at EVSEs

In situations where the number of EVs exceeds the number of charging plugs (or EV parking stalls), competition for plugs inevitably ensues. This issue often creates tense and frustrating situations at public charging stations. Some encounters involved:

- Non-EVs parked in parking stalls dedicated to EV charging,
- EVs are parked in EV parking stalls, but are not plugged in, and
- EVs are left plugged in at the EV-only parking stalls for longer than the maximum allowable or long after the vehicle has finished charging.

Similar situations can occur at EV parking stalls that are restricted to public-sector fleet vehicles.

For both employee or visitor and fleet-only EV parking stalls, the Ministry of Transportation and Infrastructure requires specific signage, which helps foster good etiquette around using these dedicated stalls.

Charging User Fees

There are a variety of cashless payment technologies for unattended automated EVSE machines. PSOs can charge fees for electricity consumption or for time in the parking stall. The

¹⁰ See https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/traffic-engineering-and-safety/traffic-engineering/traffic-signs-and-pavement-markings/standard-traffic-signs/standard-traffic-signs/information_signs.pdf for signage specifications. See the Ministry's website for more information on sign specifications: <https://www2.gov.bc.ca/gov/content/transportation/transportation-infrastructure/engineering-standards-guidelines/traffic-engineering-safety/traffic-signs-markings?keyword=parking&keyword=signs#catalogue>.

machines generally accept credit cards and/or utilize pre-paid debit systems. Fees can help offset the costs of the infrastructure deployment and limits the length of stay of EVSE users. In order to charge fees for electricity consumption, the EVSEs must be networked with the agency's wireless systems.

The following practices are recommended for parking management:

For employee or visitor EVSEs:

- Either 2-hr or 4-hr maximum charging time in EV parking stalls
- Charge *parking* fees at employee and visitor EV parking stalls, even if PSOs cannot charge electricity fees to employees and visitors

Note that free access to charging for employees could be considered a taxable benefit. Interested parties can check with their employer or CRA.¹¹

For fleet-only EVSE

- Do not charge fees for electricity used by fleet vehicles

Additional rules for both fleet-only and employee and visitor EVSE:

- Restrict EV charging stalls to vehicles that require electrical charging; once the vehicle is fully charged, it should be moved to a non-EV charging stall (as clearly stated on signage)
- Prevent non-EVs from parking in EV charging stalls at any time

Management and Enforcement of EVSEs: Basic Information

In core government buildings, the EVSEs are managed by the ministries. In most locations, there is no “policing” of employee and visitor EVSEs, unless third-party security services are given direction on the matter.

In the broader public sector, the management of fleet-only EVSEs is left up to the individual PSO and the on-site facility managers. Any “policing” of employee or visitor EVSEs is done by third-party parking or security services, who can ticket for issues related to length of use or presence of non-EVs in EVSE stalls.

Some offices book charging stations through the shared office calendar, such as MS Office.

¹¹ See the CRA's website on parking: <https://www.canada.ca/en/revenue-agency/services/tax/businesses/topics/payroll/benefits-allowances/automobile/parking.html>.

Warranties and Asset Management

EVSEs are covered under manufacturer warranty, generally for only a couple of years. Mechanical issues can occur in the first two years of operation. Given the newness of the technology, there is a lack of data about the life-span of the technology, but eventually the assets will need to be replaced. After the end of the warranty, agencies will need professional input on whether repairs or replacement makes sense. The installers approved under the CSA can be consulted about technical issues with EVSE materials.

Summary of Installation Steps for Fleet EVSEs¹²

1. Determine the number and location of chargers required, using a recommended EV to EVSE ratio, to support fleet, staff and/or public use
2. Coordinate planning between fleet managers, parking managers, and finance to determine the best EVSE installation pathway
3. Engage utility provider (Fortis or BC Hydro) to convey intentions early on in the process, solicit input, and inquire about potential incentives
4. Engage with installers participating in the CSA
5. Conduct necessary site, lighting, and electrical assessments with approved professionals
6. Install Level 2 EVSE
7. Train staff on EVSE etiquette, use and relevant policies
8. Ensure proper signage and instructions are posted in accordance with the Ministry of Transportation and Infrastructure [Manual of Standard Traffic Signs and Pavement Markings](#)

Additional Links, Resources, and Information

Plug-in BC: <https://pluginbc.ca/>

NRCan document, “Greening Government Fleets” (2018):

https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/transportation/NRCan_GreeningGovFleets_e.pdf

CSA for EVSE installers: <https://www2.gov.bc.ca/gov/content/governments/services-for-government/bc-bid-resources/goods-and-services-catalogue/ev-charging-stations>

¹² Installing EVSE for employee/visitor parking requires other considerations, including different kinds of signage and considerations around charging fees.

Publicly accessible EVSE located at government locations:

<https://intranet.gov.bc.ca/thehub/real-property/electric-vehicle-charging-stations/frequently-asked-questions>.

Canadian Transportation Agency guidelines: <https://otc-cta.gc.ca/eng/standards-and-guidelines-accessibility-additional-references>.