EV Charging Infrastructure Requirements for New Developments: Guidelines for Municipalities

Electric Vehicle Infrastructure Development Project **EVID-2005**

Public Report: Project Overview and Results (V 1.0)

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About these Guidelines

These guidelines were prepared by AES Engineering with the BC Institute of Technology, Smart Microgrid Applied Research Team, with support from the Natural Resources Canada Energy Innovation Program. The intent is to provide guidance to municipalities on establishing “EV Ready” requirements for the provision of EV Charging in new construction.

The Guidelines represent the views of the authors, and does not necessarily represent the views, opinions, recommendations or policies of the funders. The publication is not an endorsement of any particular product or proprietary building system.

This resource document does not constitute legal advice. Local governments are expected to seek input from their legal counsel when developing any bylaw or policy amendments.

Introduction

Electric vehicle (EV) adoption is growing rapidly, and near total replacement of passenger vehicles with EVs will be required to achieve local and Federal government climate targets. Providing access to "at home" EV charging is a critical factor to ensure that households will choose EVs. Accordingly, local governments are increasingly requiring 100% "EV Ready" residential parking in new developments.

EV Ready parking is defined as a parking stall that has an adjacent energized outlet (i.e. an electrical junction box or a receptacle) at which an EV supply equipment (EVSE – i.e. an EV charger) can be installed in the future.

Future-proofing buildings with this EV charging infrastructure will realize significant value for drivers, enabling them to adopt EVs and benefit from their associated savings in total cost of vehicle ownership. EV charging infrastructure retrofits will typically be much more costly and complicated than futureproofing new construction with 100% EV Ready parking.

It is recommended that municipal governments implement 100% EV Ready requirements for residential parking in new developments.

Definitions

The following terms relating to EV charging infrastructure are used throughout this Guideline document.

- **Electric Vehicle Energy Management System (EVEMS)**: A system to control electric vehicle supply equipment electrical loads comprised of monitor(s), communications equipment, controller(s), timer(s) and other applicable devices.
- **Electric Vehicle Supply Equipment (EVSE):** "A complete assembly consisting of cables, connectors, devices, apparatus, and fittings installed for the purpose of power transfer and information exchange between the branch circuit and the electric vehicle"[1]. Commonly referred to as an EV charging station or EV charger.
- **EV Ready Parking Stall:** A parking stall that has an adjacent electrical outlet (i.e. a junction box with a cover plate, or a receptacle) at which an EVSE can be installed in the future. Drivers will install EVSE at EV Ready parking stalls over time, as they adopt EVs.

Multi-Unit Residential Building (MURB): Residential developments with multiple units on a single land parcel. For the purposes of this guideline, MURBs include both apartment-style dwellings and townhomes with either shared onsite parking garages and/or private garages associated with individual units.

[1] Canadian Standards Association, "Canadian Electrical Code, Part 1," Canadian Standards Association, Toronto, 2018, p. Section 8, Section 26.

Background

Benefits of Electric Vehicles

Enabling the adoption of electric vehicles (EVs) is critical to fostering more sustainable transportation systems in Canadian municipalities. While municipalities are increasingly focusing on improving active transportation, transit, car-sharing, ride-pooling, and other sustainable transportation modes, it is also expected that private automobiles will remain a significant part of our transportation systems. The benefits of transitioning private vehicles to EVs include:

- **Reduced GHG emissions**. On a life cycle basis, accounting for vehicles' manufacturing, operation, and disposal, EVs emit 50% - 90% less GHG emissions than fossil fuel vehicles.[2] The reduction in GHG emissions depend on which electrical grid across Canada the vehicle is charging on. As carbon intensive electric grids decarbonize into the future, EVs will realize greater life cycle emissions reductions.

- **Better air quality and improved health**. EVs eliminate tailpipe emissions. Tailpipe emissions are estimated to cause 900 deaths and $7.8 billion in health damages (0.5% of Canada's gross national income) every year;[3] the transition to EVs will eliminate these impacts.

- **Economic vitality**. Assuming a Canadian average residential electric utility retail cost of electricity of $0.18 per kWh, the fuel cost of EVs is equivalent to about $0.40 per litre gasoline. General service utility rates can often realize substantially lower costs to charge vehicles, especially when EVEMS systems are leveraged to avoid demand charges. Maintenance costs of EVs are half that of gasoline vehicles.[4]

  Reduced spending on fuel and maintenance costs saves residents and businesses money. These savings have a greater likelihood of recirculating in the local economy than spending on fuel (e.g. gasoline spending tends to leave the local economy); in aggregate, these savings amount to thousands of dollars per household, and can contribute significantly to community economic development.

[2] See e.g. https://www.carboncounter.com/

[3] International Council on Clean Transportation and Climate & Clean Air Coalition. 2019. *A Global Snapshot of the Air Pollution-Related Health Impacts of Transportation Sector Emissions in 2010 and 2015.* https://theicct.org/sites/default/files/publications/Global_health_impacts_transport_emissions_2010-2015_20190226.pdf

[4] Consumer Reports. 2020. *Electric Vehicle Ownership Costs*. https://advocacy.consumerreports.org/wp-content/uploads/2020/09/Maintenance-Cost-White-Paper-9.24.20-1.pdf

Electric Vehicle Adoption Trends

EVs have historically been more expensive than similar models of gasoline vehicles. However, battery costs have declined by an order of magnitude over the past decade and are projected to continue to decline. By the mid-2020s, it is expected that the cost to produce EVs will be the same as fossil fuel vehicles, and subsequently less as visualized in Figure 1.[5] At that point, EVs' market share is expected to accelerate dramatically.

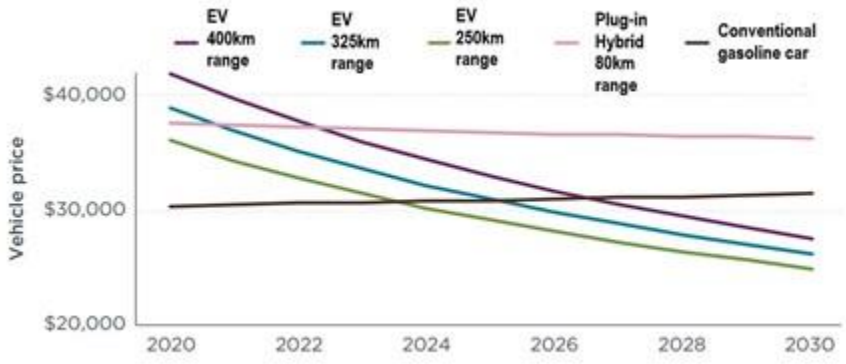

Figure 1: Projected cost comparison of EVs and gasoline vehicles 2020-2030 (Source: ICCT)

Government policy is also driving the transition to EVs. The Government of Canada has announced that 100% of new private vehicles sold will be zero-emission by 2035. Other jurisdictions, including the Provinces of British Columbia and Quebec, have legislated zero emissions vehicle sales requirements that guarantee all new vehicles sold will be zero emissions vehicles by 2035.[6]

To support EV adoption, if parking is provided in new developments[7] it is critical that this parking be adequately futureproofed for EV charging. Accordingly, this Guide supports municipalities in making "EV Ready" requirements for parking in new residential, non-residential, and mixed-use developments.

[5] International Council on Clean Transportation. 2019. *Update on electric vehicle costs in the United States through 2030*. https://theicct.org/publications/update-US-2030-electric-vehicle-cost

[6] See e.g. https://www.environnement.gouv.qc.ca/changementsclimatiques/vze/rapport-mise-oeuvre-2018-2020-en.pdf

[7] Requiring parking in new developments effectively subsidizes private automobile travel – parking requirements induce vehicle ownership and driving; make communities less affordable; and can negatively impact urban design (See, e.g., Donald Shoupe. 2018. *Parking and the City*). Many local governments are therefore rightly considering reducing minimum parking requirements and establishing parking maximums. Nevertheless, when parking *is* implemented in new construction, it is important this parking be appropriately futureproofed for EV charging, so that drivers can choose an EV.

The Need for Access to Home Charging

The US Department of Energy's "charging pyramid" (see Figure 2) provides a conceptual summary of where passenger vehicle EV charging occurs. Parking occurs in the following contexts:

- **At home.** The large majority (currently 72% in Canada[8]) of passenger EV charging occurs at drivers' home. Access to home charging is a critical factor determining whether households will adopt an EV.
- **At work.** Approximately 15% of charging occurs at work.
- **Fleet charging.** For passenger vehicles that are part of corporate fleets, almost all charging usually occurs at fleets' "home-base" or depot.

Figure 2: Charging Pyramid Source: US Department of Energy

- **Public charging.** A relatively small proportion of private vehicles' charging occurs at public charging stations. Nevertheless, public charging is important for households without access to home or work charging; to provide "opportunity charging" (i.e. convenient top-up charging when drivers are parked for shopping, recreating, etc.); and to provide for very fast charging on longer trips.

As the upfront costs of EVs continue to decline, access to convenient forms of charging will increasingly become the most important factor determining EV adoption. As home charging is widely recognized as the most convenient form of EV charging, improving access to home charging is particularly important to enabling EV adoption. However, access to workplace charging and public charging is also important. New construction can be future-proofed to be "EV Ready"

8 Fleetcarma, "Charge the North: Results from the world's largest EV charging study," 2020.

Making New Construction "EV Ready"

Driven predominantly by progressive municipal regulations (discussed below), though also influenced by increasing market demand for access to "at home" EV charging, a growing amount of parking in new developments across Canada is being future-proofed to be "EV Ready".

EV Ready parking features an adjacent electrical outlet (i.e. a junction box with a cover plate, or a receptacle) at which an EVSE can be installed in the future. Drivers will install EVSE at EV Ready parking stalls over time, as they adopt EVs.

The Importance of EV Energy Management Systems to Enable EV Ready Parking

EV Energy Management Systems (EVEMS) are a critical technology that can enable large proportions (e.g. 100%) of parking in new and existing buildings to be EV Ready, and ultimately feature EV charging. EVEMS monitor and control loads, so that the total demand for electricity does not exceed the capacity of a circuit. EVEMS are enabled in the 2018 and 2021 versions of the Canadian Electrical Code.

Load sharing across a branch circuit is a common configuration for EV Ready parking – in this case, multiple outlets (and subsequently EVSE) share a branch circuit. A variety of other electrical configurations are possible using EVEMS – e.g. panel sharing, service monitoring, etc., outlined in figure 3 below.[9]

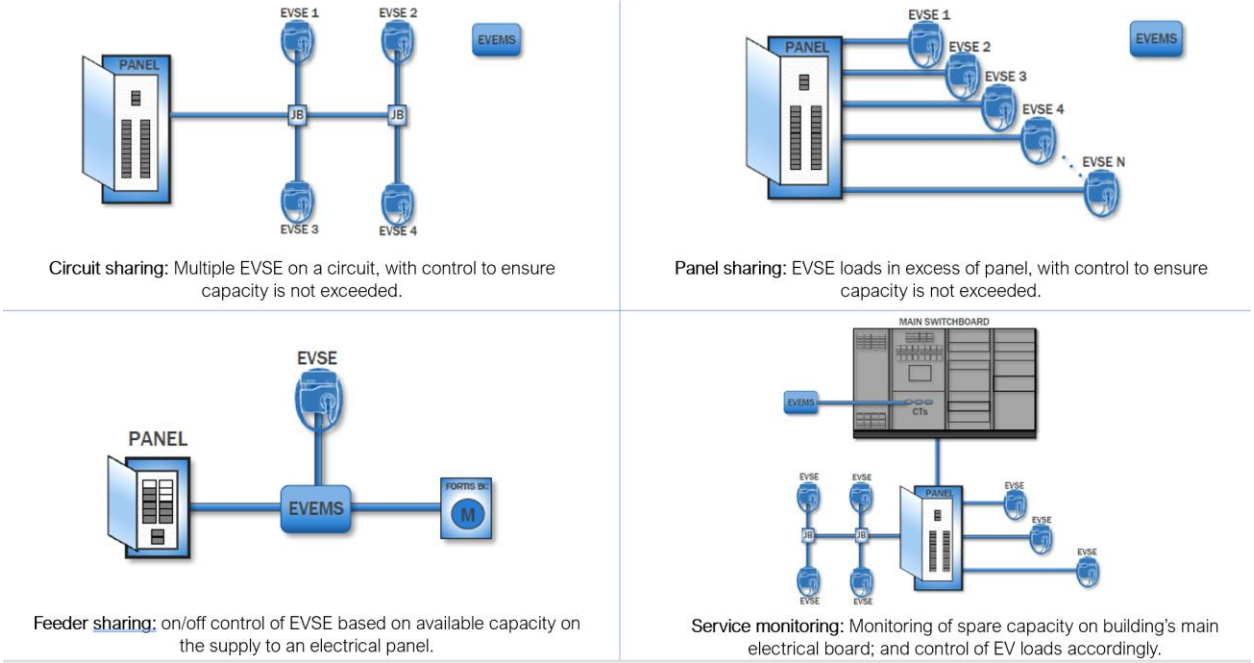

Figure 3: Electric configurations enabled by EVEMS. Source: AES Engineering.

[9] BCIT has prepared a detailed overview of different EVEMS control schemes for CSA Group. https://www.csagroup.org/article/research/electric-vehicle-energy-management-systems/

Compared to providing a similar number of EV Ready parking spaces on unmanaged dedicated electrical circuits, designing for use of EVEMS considerably reduces the cost of providing EV Ready infrastructure. Design that leverages EVEMS reduces developments':

- Utility service capacities, and associated utility service connection fees;
- Capacity of buildings' electrical infrastructure (e.g. transformers, switchgear, feeders, branch panels, etc.); and/or
- Number of branch circuits in a parkade.

Figure andFigure 55 demonstrate the reduced costs from designs that leverage EVEMS in new 100% EV Ready buildings.

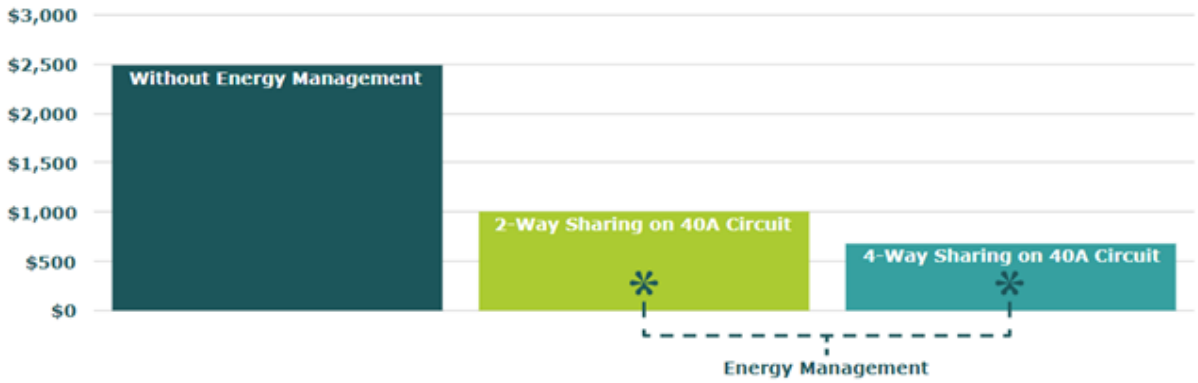

Figure 4: Comparison of cost per energized parking stall of EV charging infrastructure in new construction with various energy management strategies – City of Kelowna. Source: AES Engineering 2019

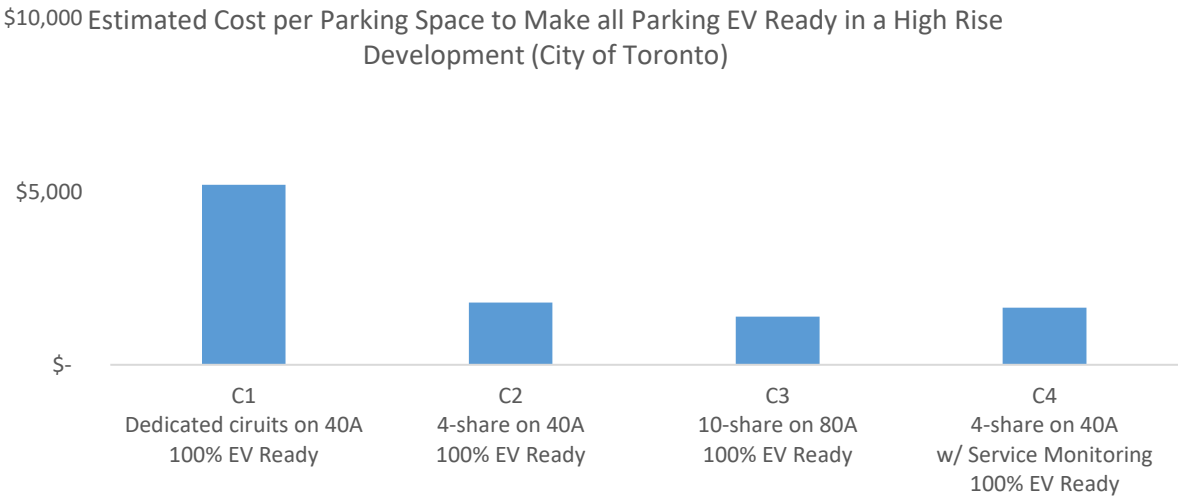

Figure 5: Comparison of cost per energized parking stall of EV charging infrastructure for new and existing developments. Source: AES Engineering October 2021

Controlling the rate and timing of charging with EVEMS has many additional advantages, e.g.:

- **Lower peak demand**. By monitoring building electrical usage and capacity, EVEMS can reduce charging when demand is high. This can reduce demand charges and costs under dynamic utility rates (e.g. "time of use" rates).
- **Extend battery life**. Some EVEMS can monitor battery capacity and slow the charging rate as it fills to preserve battery health.
- **Opportunity for smart features**. Mobile monitoring of charging progress and accurate consumption-based billing are examples of the potential perks of smart charging.

It is critical that designs for EVEMS ensure that EVSE compatible with the EVEMS system are installed.

The Importance of Future-Proofing New Construction to be EV Ready

It is possible to undertake comprehensive retrofits to existing buildings to make large proportions of parking (e.g. all residential parking) EV Ready; pilots of such approaches are profiled in a companion report to this guide "EV Charging Demonstrations in MURBs, and Guidelines for MURB Owners and Developers". However, there are considerable challenges associated with such retrofits. This is particularly true in multifamily condominiums, which have limited technical, managerial and financial resources to successfully implement EV charging in their facilities. Likewise, rental buildings can feature split-incentives between residents and owners/managers.

In general, it will be much more cost-effective to implement 100% EV Ready new residential buildings, compared to retrofits after the fact. AES Engineering has conducted costing studies for the City of Richmond, City of Vancouver, City of North Vancouver, City of Kamloops, City of Abbotsford and Ontario municipalities (for the Clean Air Partnership, with financial support from the Atmospheric fund). Depending on building archetypes and the local market, AES has estimated that 100% EV Ready new multifamily developments can be achieved for costs ranging from approximately $600 to $1500 per parking space. In AES's experience, 100% EV Ready comprehensive multifamily building retrofits can be achieved for a cost premium of approximately 20%-200% compared to what new construction would have cost – However, achieving these relatively positive outcomes requires expert design and multifamily building owners willing to invest in such comprehensive upgrades. Most multifamily buildings instead implement a few EVSE at a time – Costs for such work typically ranges from $6000 to $15,000+ per EVSE. Unfortunately, these incremental upgrades can result in stranded assets.

Local Government EV Ready Requirements

Cities and other jurisdictions are increasingly focused on ensuring that their residents have access to convenient forms of EV charging. Table 1 summarizes EV Ready requirements adopted by a selection of Canadian cities. Other Canadian cities are understood to be considering similar requirements.

Table 1: Collection of Canadian cities with EV Ready requirements.

Jurisdiction	EV Ready Parking Requirements	
	Residential	Commercial
City of Toronto, ON	100%	25%
City of Vancouver, BC	100%	45%
City of Port Moody, BC	100%	20%
City of Surrey, BC	100%	20%
City of Victoria, BC	100%	~5% (varies by land use)
District of Saanich, BC	100%	~5% (varies by land use)
City of Richmond, BC	100%	
City of Burnaby, BC	100%	
City of New Westminster, BC	100%	
City of North Vancouver, BC	100%	45%
District of West Vancouver, BC	100%	
District of North Vancouver. BC	100%	
Town of View Royal, BC	100%	
City of Nanaimo, BC	100%	
Township of Langley. BC	1 per dwelling unit	
City of Nelson. BC	1 per dwelling unit	10%
City of Coquitlam, BC	1 per dwelling unit	
City of Laval, QC	50% in multifamily buildings	
Province of Quebec	All single family dwelling parking	

Local governments with 100% EV Ready requirements have allowed new developments to design for use of EVEMS, reducing the cost of implementing 100% EV Ready parking.

To date, Canadian local governments have implemented these EV Ready requirements as part of parking requirements in their zoning or parking bylaws, under local governments' authority to regulate parking design.

Recommended Municipal EV Ready Requirements

It is recommended local governments require that:

- **All residential parking in new developments be "EV Ready".**
- **A proportion of non—residential in new developments be "EV Ready", with different requirements for parking intended for "workplace charging" versus "opportunity charging"**:
    - Workplace charging - Approximately 20-40% of parking intended for employee parking is recommended to be EV Ready. Like residential uses, workplace charging requirements should allow for significant amounts of load sharing using EVEMS, reflecting that relatively slow rates of EV charging are appropriate for the typically long dwell times of the workplace parking spaces.
    - Opportunity charging - Approximately 15-20% of parking intended for non-residential visitor (e.g. retail customers, etc.) is recommended to be EV for "Opportunity Charging". This Opportunity Charging should provide a relatively fast rate of Level 2 charging (e.g. minimum 6.6kW), given that the dwell times on this parking is shorter.

For these requirements, it is recommended that cities specify that when EVEMS is designed for, minimum performance standards will apply.

The subsections below provide the rationale for structuring EV Ready requirements in this way. Appendix 1 includes model bylaw language for local governments' consideration. Appendix 2 includes model language that can be included in local governments' technical bulletins, explaining requirements to applicants and providing the minimum performance requirements for a given jurisdiction.

Rationale for EV Ready Residential Parking Requirements

Requiring all residential parking to be EV Ready is appropriate because:

- The large majority of EV charging occurs at home.
- Access to home charging is likely the most important factor determining whether a household will choose an EV as its next vehicle.
- It is extremely difficult or impossible to legally trade parking spaces between residents under most forms of parking tenure in condominiums; having legal access to the parking space is likely to be desired by anyone installing an EVSE. Likewise, it can be challenging to trade parking spaces in rental buildings. 100% EV Ready parking ensures access to EV charging.
- To achieve local, provincial and federal emissions reductions targets, all passenger vehicles will need to transition to zero emissions vehicles in the next few decades. EVs represent the most cost-effective, efficient, and technologically viable zero emissions vehicle opportunity[10].

[10] See, e.g. Volkswagen. 2020. "Battery or fuel cell, that is the question" https://www.volkswagen-newsroom.com/en/stories/battery-or-fuel-cell-that-is-the-question-5868; carboncounter.com; Transportation and Environment. 2020. *How clean are electric cars?* https://www.transportenvironment.org/sites/te/files/T%26E%E2%80%99s%20EV%20life%20cycle%20analysis%20LCA.pdf

- Use of EVEMS can make 100% EV Ready parking relatively affordable. Costing studies consistently find costs in the range of $750 - $1500 per parking space for 100% EV Ready multifamily buildings.[11] Costs in single family homes will typically be significantly less.

Rationale for EV Ready Non-Residential Parking Requirements

EV Ready non-residential parking can be implemented relatively cost effectively.[12]

EV Ready non-residential parking can support either workplace charging or opportunity charging.

Workplace charging

Workplace charging refers to EV charging in employee parking spaces, where vehicles will tend to be parked for longer periods of time. Given the typically long dwell times of this parking, significant load sharing using EVEMS is appropriate. Providing workplace charging:

- **Supports drivers without home charging** – Workplace charging provides charging for drivers without access to home charging or other reliable forms of charging (e.g. existing MURB residents; "garage orphans"; etc.). While data sources are limited, AES Engineering roughly estimates that perhaps 63% percent of residents of Metro Vancouver currently do not have access to home charging. Based on projections of EV adoption and access to home charging, AES estimates approximately 40% of workplace parking in new developments would optimally be EV Ready (see Figure 6).

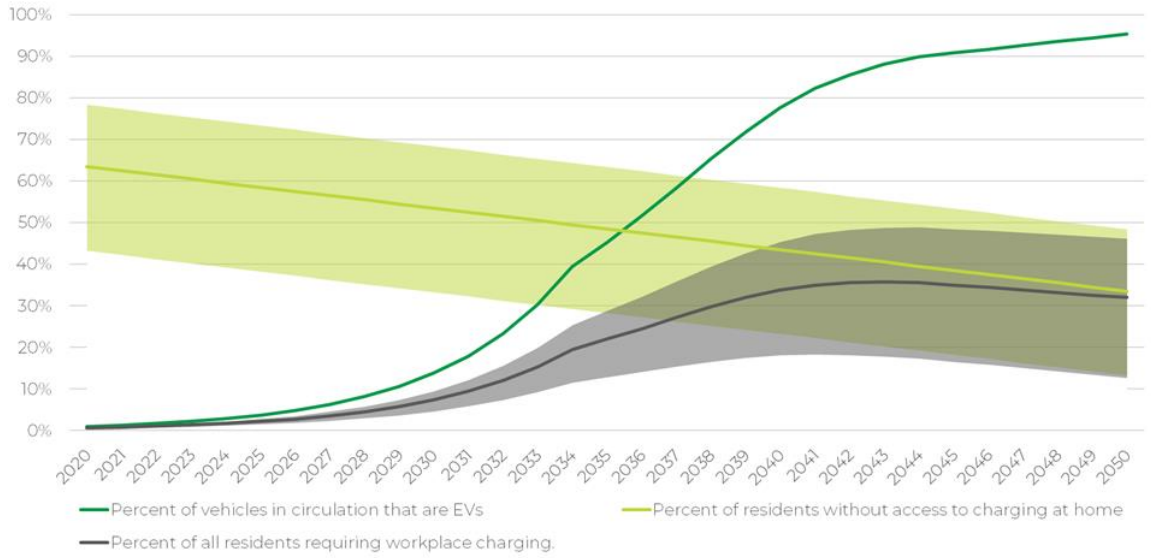

Figure 6: Percent of all residents requiring access to workplace charging in Metro Vancouver

[11] See, e.g. AES Engineering. 2017. *Electric Vehicle Charging Infrastructure in New Multifamily Developments: Requirement Options and Costing Analysis.* Prepared for the City of Richmond; AES Engineering. 2020. *Electric Vehicle Ready Residential Parking: Costing Analysis.* Prepared for the City of Abbotsford; Prism Engineering. 2018. *Electric Vehicle Charging Costing Study Update.* Prepared for City of North Vancouver.

[12] See, e.g.: AES Engineering. 2020. *Electric Vehicle Charging Infrastructure Requirements for Non-Residential Buildings*. Prepared for City of North Vancouver.

- **Provides for long-distance commuters and limited range EVs** - Workplace charging also provides charging for long-distance commuters or vehicles with limited electric range, for whom home charging may not suffice.
- **Uses clean, low-cost daytime power** – Workplace charging provides an opportunity to maximize daytime charging, anticipating future potential for significant amounts of low-cost energy due to growing solar energy supply. Spreading charging opportunities over 24 hours, rather than relying on only overnight charging will reduce electrical grid impacts, and can support future "load shifting" and flexibility to respond to variable renewable energy.

Opportunity charging

Opportunity charging refers to EV charging at establishments where vehicles tend to be parked for shorter periods of time (e.g. retail uses; assembly uses; visitors to offices; etc.). Given the typically shorter dwell times, faster rates of charging are appropriate. Providing some EV Ready parking for opportunity charging:

- Enables households without good access to home or workplace charging to adopt EVs.
- Supports longer trips and limited range EVs.

Complementary Actions

In addition to adopting EV Ready building requirements, local governments are recommended to:

- Advocate to Provinces, Territories and the Federal Government to adopt EV Ready requirements (e.g. either via legislation or codes). This can ensure greater consistency across jurisdictions.
- Engage with Provinces, utilities and utility commissions to identify any barriers to condominiums or building owners charging user fees for electricity used by drivers (e.g. utility law pertaining to whether reselling electricity would require regulation as a public utility; condominium and rental housing law relating to differential fees; etc.), and advocate for any appropriate changes.
- Engage with electrical authorities having jurisdiction to ensure that their compliance regimes vis-à-vis electrical codes fully enables EVEMS.

Appendix 1 – Model EV Ready Bylaw

NOTE: The following language is provided for local government consideration as they integrate EV Ready requirements into their parking requirements. Some explanatory notes are provided in the text in *[bracketed red italics]*, and are not intended for use in the bylaw.

This model language does not constitute legal advice and is intended for illustrative purposes only, without any express or implied warranty of any kind, including warranties of accuracy, completeness, or fitness for any particular purpose. Use of this model language is without any recourse whatsoever to AES Engineering, BCIT, NRCAN or any other parties. Local governments should seek the advice of their legal counsel to develop their own bylaw amendments.

Definitions

"DC Fast Charging" means DC Fast Charging for an Electric Vehicle as defined by SAE International's J1772 standard. *[NOTE: Optional text. See below.]*

"Electric vehicle" means a vehicle that uses electricity for propulsion, and that can use an external source of electricity to charge the vehicle's batteries.

"Electric vehicle energy management system" means a system to control electric vehicle supply equipment electrical loads comprised of monitor(s), communications equipment, controller(s), timer(s) and other applicable devices.

"Electric vehicle supply equipment" means a complete assembly consisting of conductors, connectors, devices, apparatus, and fittings installed specifically for the purpose of power transfer and information exchange between a branch electric circuit and an electric vehicle.

"Energized outlet" means a connected point in an electrical wiring installation at which current is taken to supply utilization equipment.

"Level 2 charging" means a Level 2 electric vehicle charging level as defined by SAE International's J1772 standard and includes variable rate charging that is controlled by an electric vehicle energy management system.

"Opportunity Charging" means Level 2 Charging for an Electric Vehicle supported by a dedicated electrical circuit rated to at least 40A to each Parking Space.

"Shared Vehicle" means an automobile owned and operated by an organization which provides car-sharing services to its members.

"Shared Vehicle Parking Space" means a parking space reserved for the exclusive use of a Shared Vehicle.

EV Ready Requirements

Residential uses

For major renovations and new single family homes, duplexes, and townhomes with private onsite residential Parking Spaces, an energized outlet capable of providing Level 2 charging shall be provided for each dwelling unit. *[NOTE: The intention is to provide at least one energized outlet for each*

households' onsite parking, if onsite parking is provided for that household. If a household's onsite parking area contains two or more parking spaces, the vehicles could all make use of the same outlet – e.g. in a two-car garage, a doubled headed EVSE could be installed, or a single headed EVSE shared between two vehicles.]

For major renovations and new multifamily buildings, each residential parking space, excluding visitor parking, shall feature an adjacent energized outlet capable of providing Level 2 charging or higher to the parking space.

Non-residential uses

For Retail and Assembly uses *[NOTE: local governments may specify the uses as defined in local government bylaws, e.g. "store", "restaurant", "movie theatre", etc.]* in new developments and major renovations:

- A minimum of 15% *[NOTE: local governments could consider other values]* of Parking Spaces or one Parking Space, whichever is greater, shall include an Energized Outlet capable of supporting Opportunity Charging.

For all other non-residential uses in new developments and major renovations:

- A minimum 30% *[NOTE: local governments could consider other values; 20%-40% recommended]* of Parking Spaces shall include an Energized Outlet capable of providing Level 2 Charging or a higher charging level for an Electric Vehicle; and *[NOTE: It is anticipated these parking spaces may support workplace charging. Use of electric vehicle energy management systems to provide significant levels of electrical load sharing is appropriate in these contexts, given the long dwell times of parking in these parking spaces. It is recommended the same charging performance requirements as apply to residential uses also apply to parking that may support workplace charging.]*
- A minimum of 10% *[NOTE: local governments could consider other values]* of Parking Spaces or one Parking Space, whichever is greater, shall include an Energized Outlet capable of supporting Opportunity Charging.

[NOTE: Optional text to allow for implementation of fewer DC Fast Charging stations instead of Level 2 EV Ready parking in non-residential parking.] For all non-residential uses, a development may comply by providing DC Fast Charging Electric Vehicle Supply Equipment capable of providing an equivalent amount of power as can be delivered by the above requirements for Energized Outlets.

Disability Parking

All Disability Parking Spaces required for Residential Uses shall include an Energized Outlet capable of providing Level 2 Charging or a higher for Electric Vehicle charging.

A minimum of 50% of Disability Parking Spaces required for non-residential uses or a minimum of one Disability Parking Space, whichever is greater, shall include an Energized Outlet capable of supporting Opportunity Charging.

Shared Vehicles

All Shared Vehicle Parking Spaces shall include an Energized Outlet capable of supporting Opportunity Charging.

Fractional Number of EV Ready Parking Spaces

When the calculation of Parking Spaces requiring Electric Vehicle charging infrastructure results in a fraction of 0.5 or more of a space, one Parking Space shall be equipped with Electric Vehicle charging infrastructure to meet this fractional requirement.

Labeling

Energized outlets shall be labelled for the intended use for electric vehicle charging.

Charging Performance Requirements

The Director of _____ *[NOTE: Designate appropriate official, e.g. Director of Planning; Director of Transportation; etc.]* may specify minimum charging performance requirements and management guidelines for designs using an Electric Vehicle Energy Management System.

For designs where an Electric Vehicle Energy Management System is intended, the electrical infrastructure shall include all communications equipment, control systems installation, licensing, and permitting required to operate.

Metering

The electrical infrastructure shall include metering that provides for apportioning of energy costs to persons when electric vehicle supply equipment is installed.

Appendix 2 - Model Bulletin – EV Ready Requirements

Summary of Requirements

On *[date]* the *[name of local government]* adopted requirements in *[bylaw citation]* for residential and non-residential parking in new developments and major renovations to be EV Ready. Requirements are summarized below. Definitions for key terms are included at the end of this document.

It is required that:

- For **single family homes, duplexes, and townhomes with private onsite residential Parking Spaces,** an energized outlet capable of providing Level 2 charging shall be provided for each dwelling unit.
- For **multifamily buildings**, each residential parking space, excluding visitor parking, shall feature an adjacent energized outlet capable of providing Level 2 charging or higher to the parking space.
- For **non-residential Retail and Assembly** uses *[NOTE: specify the uses as defined in local government bylaws, e.g. "store", "restaurant", "movie theatre", etc.]*:
    - A minimum of 15% *[NOTE: local governments could consider other values]* of Parking Spaces or one Parking Space, whichever is greater, shall include an Energized Outlet capable of supporting Opportunity Charging.
- For **all other non-residential uses**:
    - A minimum 30% *[NOTE: local governments could consider other values]* of Parking Spaces shall include an Energized Outlet capable of providing Level 2 Charging or a higher charging level for an Electric Vehicle.
    - A minimum of 10% *[NOTE: local governments could consider other values]* of Parking Spaces or one Parking Space, whichever is greater, shall include an Energized Outlet capable of supporting Opportunity Charging.
- **All Disability Parking Spaces required for residential uses** shall include an Energized Outlet capable of providing Level 2 Charging or a higher for Electric Vehicle charging.
- A minimum of 50% of **Disability Parking Spaces required for non-residential uses** or a minimum of one Disability Parking Space, whichever is greater, shall include an Energized Outlet capable of supporting Opportunity Charging.
- All Parking Spaces for **Shared Vehicles** shall include an Energized Outlet capable of supporting Opportunity Charging.

Compliance procedures for Part 9 developments

- At time of Development Permit application, applicants shall indicate EV Ready parking spaces on plans and in a schedule. For developments with a non-residential component, the schedule shall summarize which parking spaces are for Opportunity Charging (i.e. dedicated electrical circuits of 40A or greater).

- At time of Building Permit Applications, applicants shall indicate EV Ready parking spaces on plans and in a schedule. For developments with a non-residential component, the schedule shall summarize which parking spaces are for Opportunity Charging (i.e. dedicated electrical circuits of 40A or greater). If electric vehicle energy management systems are used, a letter

signed and sealed by an electrical engineer shall be submitted with the Building Permit application, confirming the design of the EV charging infrastructure meets Zoning Bylaw requirements and design standards outlined in the Bulletin.

- When construction is complete, inspectors shall inspect for the presence of Energized Outlets for EV charging. If electric vehicle energy management systems are used, a letter signed and sealed by an electrical engineer shall be provided, confirming EV charging infrastructure was installed and meets Zoning Bylaw requirements and associated design and performance standards.

Compliance procedures for Part 3 developments

- At time of Development Permit application, applicants shall indicate EV Ready parking spaces on plans and in a schedule. For developments with a non-residential component, the schedule shall summarize which parking spaces are for Opportunity Charging (i.e. dedicated electrical circuits of 40A or greater).

- At the time of Building Permit Application, applicants shall indicate EV Ready parking spaces on plans and in a schedule. For developments with a non-residential component, the schedule shall summarize which parking spaces are for Opportunity Charging (i.e. dedicated electrical circuits of 40A or greater). A letter signed and sealed by an electrical engineer shall be submitted with the Building Permit application, confirming the design of the EV charging infrastructure meets Zoning Bylaw requirements and design standards outlined in the Bulletin.

- When construction is complete, a letter signed and sealed by an electrical engineer shall be provided, confirming EV charging infrastructure was installed and meets Zoning Bylaw requirements and associated design and performance standards.

Charging performance requirement

- The table below summarizes minimum charging performance requirements. These charging performance requirements are intended to ensure full charging daily for residential (i.e. all night) or workplace (day time) charging applications.

{NOTE: The tables below are representative of center City and inner-ring suburban requirements, and outer-ring suburb or rural requirements, respectively. They are provided for illustrative purpose only. Local governments could consider conducting their own charging performance analysis, considering average vehicle kilometers traveled, vehicle types and efficiency, temperature, and other variables applicable to their community, to determine appropriate charging performance requirements. Please note establishing appropriate minimum performance requirements for future EV charging patterns is subject to sources of considerable uncertainty; the values below were derived for the Cities of Victoria and Abbotsford using available data and a model developed by AES Engineering.]

Charging performance for City and Inner-Ring Suburb (Source: City of Victoria.)

Circuit Breaker Amperage	Maximum Number of Electric Vehicles
20A	1
30A	2
40A	4
50A	5
60A	6
70A	7
80A	9
90A	10
100A	11
125A	14

Charging performance for Outer-Ring Suburb & Rural (Source: City of Abbotsford)

Circuit Breaker Amperage	Maximum Number of Electric Vehicles
20A	N/A
30A	1
40A	3
50A	4
60A	5
70A	7
80A	9
90A	10
100A	11
125A	14

Management guidelines

- Where an electric vehicle energy management system is implemented, provisions for management and maintenance are to be provided to the strata or dwelling unit owner.
- The following are recommended to be included in the strata rules or bylaws, as a minimum:
  - The party (Strata or dwelling unit owner) responsible for electric vehicle supply equipment purchase and installation is clearly delineated, and appropriate permissions and procedures outlined to ensure accessibility to energized outlets for the purposes of EV charging;
  - Electric vehicle supply equipment ownership is established as a fixture, chattel or lease;
  - Billing rules and procedures are established;
  - Designation that where an electric vehicle energy management system is implemented, the electric vehicle supply equipment must be compatible with that electric vehicle energy management system.

Definitions

“Electric vehicle” means a vehicle that uses electricity for propulsion, and that can use an external source of electricity to charge the vehicle's batteries.

“Electric vehicle energy management system” means a system to control electric vehicle supply equipment electrical loads comprised of monitor(s), communications equipment, controller(s), timer(s) and other applicable devices.

“Electric vehicle supply equipment” means a complete assembly consisting of conductors, connectors, devices, apparatus, and fittings installed specifically for the purpose of power transfer and information exchange between a branch electric circuit and an electric vehicle.

“Energized outlet” means a connected point in an electrical wiring installation at which current is taken to supply utilization equipment.

“Level 2 charging” means a Level 2 electric vehicle charging level as defined by SAE International's J1772 standard and includes variable rate charging that is controlled by an electric vehicle energy management system.

“Opportunity Charging” means Level 2 Charging for an Electric Vehicle supported by a dedicated electrical circuit rated to at least 40A to each Parking Space.