

"EV Readiness" Requirements Framework

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Authored by:

Brendan McEwen
McEwen Climate and Energy
brendan@mcewenclimate.com

With:



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Of course, the opinions expressed in this report and responsibility for its content are the authors', and not the individuals nor organizations noted above.

Glossary

Electric vehicle (EV): A vehicle that uses electricity for propulsion and that can use an external source of electricity to charge the vehicle's batteries.

EV energy management system (EVEMS): A means used to control EVSE loads through the process of connecting, disconnecting, increasing, or reducing electric power to the loads and consisting of any of the following: a monitor(s), communications equipment, a controller(s), a timer(s), and other applicable device(s). By controlling EVSE loads, EVEMSs can ensure that the electrical capacity of a circuit is not exceeded. EVEMSs can thereby reduce the electrical capacity and associated infrastructure costs necessary to provide EV charging in a building. EVEMSs are sometimes referred to as "load sharing," "power sharing" or "smart charging". A report prepared for the City of Richmond and BC Hydro outlines a variety of different configurations for EVEMS systems.¹

EV supply equipment (EVSE): 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. Also referred to as a "charging station".

"Part 3" buildings: All buildings over three storeys in height or over 600m² in foot print, and some buildings three storeys or less in height or under 600m² in area that are of a specific use. This includes larger buildings intended for residential, commercial or medium-to-low hazard industrial activities, as well as buildings intended for public gatherings, residential care, detention, or high-hazard industrial activities.

"Part 9" buildings: Most buildings three storeys and under in height and with a footprint of 600m² or less. This includes small buildings intended for residential, commercial or residential, commercial or medium-to-low hazard industrial activities (e.g. houses and duplexes, small apartment buildings, small commercial buildings with stores or offices, small industrial shops).

Zero emissions vehicles (ZEVs): Vehicles which produce no emissions from the on-board source of power (e.g. electric vehicle, hydrogen fuel cell vehicle).

¹ AES Engineering, Fraser Basin Council, C2MP, Hamilton & Company. 2018. *Electric Vehicle Charging Infrastructure in Shared Parking Areas*.

https://www.richmond.ca/shared/assets/EV_Charging_in_Shared_Parking_Areas_Report51731.pdf

Executive Summary

The Government of Canada has signed the Paris agreement on climate change, committing to a reduction of greenhouse gas (GHG) emissions of 30% from 2005 levels by 2030, and has also adopted a target that 10% of new passenger vehicle sales be zero emissions vehicles (ZEVs) by 2025, 30% by 2030, and 100% by 2040. In order to achieve Canada's GHG and ZEV goals, it will be necessary to ensure ready access to electric vehicle (EV) charging, particularly "at home" charging.

This report outlines considerations pertaining to establishing minimum requirements for EV charging infrastructure in buildings, and suggests strategies that Natural Resources Canada can take to advance provinces' and local governments' adoption of minimum requirements for EV charging infrastructure for buildings.

Review of EV Charging Infrastructure Requirements

This report compares EV charging infrastructure requirements across a range of jurisdictions, identifying four categories of EV charging infrastructure configurations used in such policies:

- **Partial Infrastructure – Low:** Such requirements specify installation of electrical conduit from an electrical room to a parking space. They do not require electrical capacity be allocated to serve EV loads. They may require physical space in an electrical room to ensure electrical equipment can be retrofitted to serve EV loads at a later date.
- **Partial Infrastructure – High (also referred to as "EV Capable"):** Such requirements specify that sufficient electrical capacity be available for EV charging, typically requiring space on electrical panels for EV loads, calculated as a function of the number of parking spaces. "EV Capable" requirements also typically require electrical conduit be installed, at least in difficult to retrofit areas, such as where conduit penetrates walls or floors.
- **Energized electrical outlets (also referred to as "EV Ready"):** Such requirements specify that parking spaces feature a complete electrical circuit terminating in an electrical outlet for the purpose of EV charging. Implementation of EVSE is not required.
- **EV Supply Equipment (EVSE) Installed:** Such requirements include all electrical infrastructure and EVSE to accommodate charging.

100% "EV Ready" Residential and 20% Non-Residential Parking – Recommended Approach

It is recommended that NRCan support provinces and local governments in adopting requirements that all (100%) residential parking spaces be "EV Ready" and feature an energized electrical outlet capable of providing Level 2 charging. This configuration:

- Is consistent with Canada's GHG and EV sales targets.

- Can have construction cost impacts comparable to other options, if multifamily buildings are designed for EVEMS. The extent of cost savings associated with designing for EVEMS is dependent on the performance requirements for charging systems, as discussed below.
- Supports equity between residents, avoiding challenges with trading parking spaces or renovating for EV access.
- Avoids future retrofit costs to accommodate significant penetration of EV charging.
- Avoids challenges with specifying a fixed electrical panel size.
- Will be easier to enforce as part of building code or zoning/parking mechanisms than “EV Capable” capacity requirements.

It is further recommended that NRCan support provinces and local governments in adopting requirements that some proportion of non-residential parking spaces feature an energized electrical outlet capable of EV charging. 20% of non-residential parking is a reasonable value for inclusion in model codes. Local zoning/parking requirements present the opportunity to more finely tailor EV charging requirements to particular building uses.

EVEMS Performance Requirement Enabling 100% “EV Ready” Requirements

A key element of 100% “EV Ready” requirements is performance requirements for the use of EVEMS systems. Performance requirements ensure adequate power is provided to residential parking spaces to improve likelihood that vehicles will be fully re-charged overnight. Without such performance requirements, buildings may be designed for excessive load sharing, thereby resulting in an insufficient rate of charging. Performance requirements should be developed and referenced in codes and/or zoning/parking requirement mechanisms.

Mechanisms to Require EV Charging Infrastructure

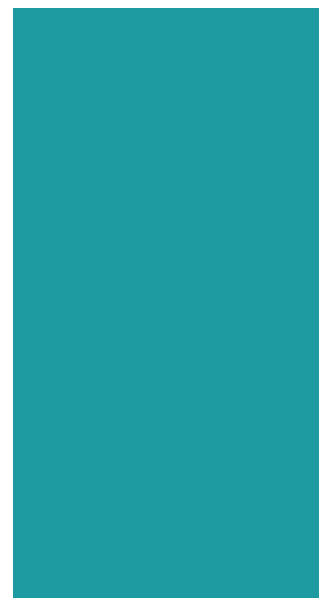
This report compares a variety of mechanisms to implement EV charging infrastructure for new and existing buildings. These include:

- National Building Code of Canada (NBC).
- National Energy Code for Buildings (NECB).
- Canadian Electrical Code (CE Code).
- Local zoning/parking requirements.
- Provincial legislation mandating zoning/parking to require EV charging infrastructure.

Recommendations

Based on the review and comparison of mechanisms, an appropriate strategy is to:

- Pursue code change requests to the NBC (for “Part 9” buildings) and NECB (for “Part 3” buildings) to support “EV Ready” requirements for 100% of residential parking, and 20% of non-residential parking.
- Support local governments and provinces to establish local or provincial zoning/parking requirements in advance of building code requirements coming into effect. Recommendations include:
 - Clarifying local government powers to establish zoning/parking requirements.
 - Encouraging provinces to explicitly enable local governments’ EV charging infrastructure requirements, and to require local governments to adopt such requirements for residential buildings.
 - Disseminating a model bylaw for residential EV charging.
- Commission a study of potential performance requirements for residential developments using EVEMS, and an associated standard. The performance requirement can be referenced in codes and/or zoning/parking mechanisms.
- Support market transformation for EV charging in MURBs, including use of EVEMS & related services.
- Support compliance and enforcement, as requirements are adopted.
- Support development of good practices for EV charging infrastructure requirements for commercial parking.



1. Introduction

1.1 Background

The Government of Canada has signed the Paris agreement on climate change, committing to a reduction of greenhouse gas (GHG) emissions of 30% from 2005 levels by 2030. Nearly one quarter of Canada's GHG emissions are produced by the transportation sector. A key opportunity to reduce lifecycle transportation GHG emissions is adoption of zero emissions vehicles (ZEVs), including plug-in electric vehicles (EVs). As such, the Government of Canada has adopted a target that 10% of new passenger vehicle sales be ZEVs by 2025, 30% by 2030, and 100% by 2040.

In order to achieve Canada's GHG and EV sales goals, it will be necessary to ensure prospective EV drivers have ready access to EV charging. Lack of access to "at home" charging, particularly in multi-unit residential buildings (MURBs), has been identified as a key barrier to the adoption of EVs. Similarly, ensuring access to EV charging in other types of residential and commercial parking contexts can support EV adoption.

Under the Pan-Canadian Framework for Clean Growth and Climate Change, the Government of Canada committed to working with Provinces, Territories and the private sector to develop a Zero Emission Vehicle Strategy for Canada. To inform the development of the strategy, five expert groups were convened during the summer of 2017. One recommendation stemming from these expert groups was to explore the potential for codes and other mechanisms to ensure minimum requirements for EV charging infrastructure at parking spaces across Canada.

1.2 Scope

The purpose of this report is to outline considerations pertaining to establishing minimum requirements for EV charging infrastructure in buildings, and to suggest strategies that Natural Resources Canada can implement to advance provinces' and local governments' adoption of such minimum requirements.

The report is structured as follows:

- Section 2 and Appendix 1 compare different EV charging infrastructure requirement options identified through a policy review of such requirements established in jurisdictions across Canada and internationally. Section 2 then recommends advancing requirements that all (100%) residential parking spaces feature an energized electrical outlet capable of providing "Level 2" charging (a configuration termed "EV Ready"), with associated rationale. It also recommends advancing requirements that 20% of parking spaces for non-residential uses feature an energized outlet capable of providing EV charging ("Level" not specified). Finally, it notes considerations for establishing performance requirements for developments that use EV Energy Management Systems (EVEMS) to comply with 100% residential "EV readiness" requirements; such performance requirements are critical components of 100% "EV Ready" requirements.

- Section 3 and Appendix 2 compare different mechanisms that might be used to establish EV charging infrastructure requirements, including: The National Building Code of Canada (NBC); National Energy Code for Buildings (NECB); Canadian Electrical Code (CE Code); local zoning/parking requirements; and provincial legislation mandating zoning/parking requirement amendments to include EV charging infrastructure. Section 3 suggests NRCan should advance both code changes to the NBC, NECB and perhaps CE Code, as well as action at the provincial and local level to establish zoning/parking requirements for EV charging infrastructure.
- Section 4 includes recommendations. It references Appendixes 4 and 5 which include language appropriate for code change requests, and model zoning/parking bylaw language developed by AES Engineering, respectively.



2. Options for EV Charging Infrastructure Requirements

2.1 Categories of EV Charging Infrastructure Requirements

This project included a review of mechanisms requiring EV charging infrastructure in new developments that have been adopted in jurisdictions across Canada and internationally. Appendix 1 summarizes the requirements and, where possible, includes reference hyperlinks to their code, bylaw, or legislation language. The review is not intended to be comprehensive of all such requirements globally; it provides a sample of jurisdictions and the range of approaches used to require EV charging infrastructure. Requirements are grouped into four different categories of definitions for EV charging infrastructure:

- Partial – Low.
- Partial – High / “EV Capable”.
- Energized electrical outlets / “EV Ready”.
- EV Supply Equipment (EVSE) Installed.

The categories of EV charging infrastructure requirements are described below.

Partial Infrastructure - Low

Such requirements specify installation of electrical conduit from an electrical room to a parking space. They do not require electrical capacity be allocated to serve EV loads. They may require physical space in an electrical room so that electrical equipment can be retrofitted into the building to serve EV loads at a later date.

Jurisdictions with such requirements include New York City, which since 2013 has required electrical raceway (conduit) be provided from an electrical room to 20% of parking spaces, and that the electrical room supplying the garage have physical space for electrical panel(s) sufficient to provide 3.1 kW of electrical capacity to 20% of parking spaces. Likewise, in 2018, the European Union legislated changes in its *Energy Performance in Buildings Directive* that by 2020 Member States must at minimum require electrical conduit to serve all parking spaces in MURBs with greater than 10 parking spaces (additional provisions apply to non-residential parking areas).

Partial Infrastructure – High / “EV Capable”²

Such requirements specify a minimum electrical capacity to be available for EV charging, typically requiring space on electrical panels for EV loads, calculated as a function of the number of parking spaces. “EV Capable” requirements also typically require electrical conduit be installed, at least in difficult to retrofit areas, such as where conduit would penetrate walls or floors.

² Pike et al (2018) define Partial Completion – High as “EV Capable” and Energized or complete electrical circuits as “EV Ready”. See: Pike, Ed; Michael McGaraghan; Kelly Cunningham; Dana Papke Waters. 2018. “Driving Plug-in Electric Vehicle Adoption with Green Building Codes”. 2018 Summer Study on Energy Efficiency in Buildings.

Jurisdictions in the USA, and particularly California, have led in the adoption of requirements that include such “EV Capable” stalls, with additional provisions for some stalls to be “EV Ready”/“Energized”.

- The statewide California Green Building Standard Code (CalGreen) was recently amended to require that 40A per parking space be provided for 10% of residential parking spaces. The requirement also applies to approximately 6% of non-residential parking (precise number of spaces determined by a lookup table). Requirements for residential parking note that where multiple EV spaces are required, “construction documents will indicate the raceway termination point and proposed locations for future EV chargers ... [and that] raceways and related components that are planned to be installed underground, enclosed, inaccessible or in concealed areas shall be installed at the original construction.”³
- The City and County of San Francisco requires that for MURB, Assembly, Business, Institutional and Mercantile occupancies, a minimum of 10% of parking spaces install a full 40A circuit (“EV Ready” level of completion – see below), and that branch circuit panelboard(s) be installed at each parking level with service capacity to deliver a minimum of 40A per parking space for 20% of parking spaces. For all remaining stalls that are not “EV Ready”, developments must at minimum install raceway where penetrations to walls, floors, or other partitions will be necessary to complete circuits for EV charging.
- Likewise, the City of Oakland requires that MURBs with greater than 20 parking spaces feature 10% of parking spaces with a full 40A 208/240V circuit (“EV Ready” level of completion – see below), and in addition that 40A of panel capacity be provide for each space for 10% of parking spaces. Inaccessible conduit must be provided to all parking stalls.

It is important to note that San Francisco and Oakland’s requirements may frequently provide for sufficient electrical capacity for all or most parking spaces to ultimately be served by EV charging, provided that EVEMSs are ultimately adopted to manage loads. Likewise, Calgreen’s capacity requirements could enable higher percentages of parking spaces to feature EV charging through the use of EVEMS. However, these requirements do not necessitate designing buildings to enable greater proportions of EV charging through the use of EVEMS.

Energized Outlet / “EV Ready”

Such requirements specify that parking spaces feature a complete electrical circuit terminating in an electrical outlet for the purpose of EV charging. Implementation of EVSE is not required.

As noted above, a number of American cities require a percentage of parking spaces in new developments to be “EV Ready” in addition to “EV Capable” requirements.

³ California Green Building Standards Code, Part 11. 4.106.4.2.4 <https://codes.iccsafe.org/content/chapter/2057/>

Local governments in British Columbia have adopted parking requirements that all (100%) of residential parking spaces feature an energized outlet capable of providing Level 2 EV charging – as of the time of writing, this list included the Cities of Vancouver, Richmond, Burnaby, North Vancouver, New Westminster, Port Moody, and Surrey. Other cities are considering such requirements. Some of these local governments also include requirements for commercial parking, typically 10-20% Level 2. The City of Coquitlam, BC, has an “EV Ready” requirement that requires that an equivalent number of parking stalls as dwelling units feature an outlet for EV charging. Likewise, the City of Palo Alto, California, requires at least one “EV Ready” or “EVSE Installed” parking space for each residential unit, in addition to requirements for other parking uses.

BC local governments have established these parking requirements in their zoning bylaws’ parking sections, or separate parking bylaws. These bylaws typically include provisions for the cities to establish minimum charging performance requirements for projects that use EVEMS, to ensure designs provide an adequate rate of charging (see section 2.3 below).

EVSE Installed

Such requirements specify EVSE be installed. The Ontario Building Code requires 20% of parking spaces in “Part 3” non-residential buildings feature EVSE; provisions may be AC Level 1 or Level 2. Likewise, the City of Toronto’s Green Standard specifies that for Part 3 MURBs and institutional, commercial, and industrial buildings, 20% of parking spaces feature EVSE. It is understood that London requires 20% of new parking spaces feature EVSE; Oslo has proposed requirements for 50% of residential, office, industry and education parking spaces to have EVSE; Beijing requires 100% for residential and hospitals, 25% for offices and schools, and 15% for stadiums; and likewise other Chinese cities have high “EVSE Installed” requirements.

2.2 Recommended Approach

It is recommended that NRCan support provinces and local governments in adopting requirements that:

- All (100%) residential parking spaces feature an energized electrical outlet capable of providing Level 2 charging.
- Some proportion of non-residential parking spaces feature an energized electrical outlet capable of EV charging.

Further rationale for such requirements are provided below.

2.2.1 Support Requirements that All Residential Parking Spaces be Energized/ “EV Ready”

EV charging infrastructure requirements for residential parking should be considered a major priority. Analysis for Canada’s Zero Emission Vehicle Strategy suggest that 80% of all EV charging occurs at home; indeed, access to “at home” charging is critical to household’s decisions to adopt EVs and may be the most important factor influencing future EV market share.

Requirements for 100% “EV Ready” residential parking are recommended for the following reasons.

Consistency with Canada’s GHG and EV sales targets

Canada targets 30% GHG emissions reductions by 2030, and 80% by 2050, below 2005 levels. Canada also recently announced a target of 100% EV sales by 2040. Both the GHG reduction and EV sales targets are well within the lifetime of new MURBs that would be subject to such requirements.

MURB construction cost impacts that are comparable to other options, if designed for EVEMS

Appendix 3 summarizes findings of two studies of the costs of providing 100% “EV Ready” parking stalls, one prepared for the City of Richmond by AES Engineering and the other prepared for the City of North Vancouver by Prism Engineering. The studies suggest that 100% “EV Ready” MURBs can be achieved at a modest cost premium above other potential EV charging infrastructure requirements:

- Both studies suggest a 100% requirement can be achieved at only a modest cost premium above a requirement for 20% of parking stalls to feature 40A dedicated circuits, when designed for EVEMS.
- Likewise, The AES study also demonstrates the costs can be reasonable compared with the cost of “Partial – High” infrastructure configurations that provide the same level of electrical capacity, but omit wiring and conduit for later completion.

It is important to note that the costs of 100% “EV Ready” requirements depend on performance requirements for use of EVEMS. This consideration is expanded on in section 2.3 below.

Equity between residents, and avoiding challenges with trading parking spaces or renovating for EV access

Requirements for 100% “EV Ready” parking stalls provide all residences with equitable access to an outlet that provides adequate electrical capacity for EV charging.

If all residential parking spaces are not “EV Ready”, households without access to such an “EV Ready” space will either need to trade parking spaces or renovate electrical systems to provide access to EV charging. Trading parking spaces is typically challenging or not possible in condominiums – Different forms of possible parking tenure in condominiums have different implications for trading parking stalls; however, all present major difficulties for residents of condominiums to trade parking stalls.⁴ This has been reported as a major impediment to households adopting EVs in buildings subject to previous requirements in the greater Vancouver area that 20% of parking stalls be “EV Ready”. Likewise, it was noted by developers during

⁴ See Condominium Homeowner Association. 2014. *Installation of Electric Vehicle Charging Stations on Strata Properties in British Columbia*. <http://www.westcoastelectricfleets.com/wp-content/uploads/CHOA-report.pdf>

engagements for Ontario MURB EV charging requirements as a reason not to adopt a 20% requirement.

Instead of trading parking spaces, retrofits can be made to supply electrical power to the parking space. In condominiums, this involves changes to common property, which frequently presents barriers to implementation especially in provinces that have not adopted “Right to Charge” legislation. In rental MURBs, drivers and landlords face principle-agent problems, whereby both landlords and tenants may be hesitant to make these upgrades when tenants may move.

In practice, the challenges associated with either trading or renovating stalls typically prevent EV uptake in MURBs even in buildings with sufficient electrical capacity.

Avoids future retrofit costs to accommodate significant penetration of EV charging

Achieving high penetration of EVs in MURBs may ultimately require EVEMS to be implemented, to avoid exceeding building available electrical capacity, or avoid costs associated with peak EV electrical demand. Implementing EVEMS once a significant portion of parking stalls are already served by EVSE may result in prematurely needing to replace installed EVSE to implement EVSE compatible with the EVEMS, as well as redesigning electrical systems; this results in stranded assets. The barriers to such retrofits can be significant, which again will likely result in MURBs not pursuing such retrofits in an expedient manner.

Avoids challenges with specifying a fixed electrical panel size

Ontario’s requirement for “Part 9” residences⁵ that a 200A panel be provided to support EV charging has in some cases triggered electrical upgrades for buildings that would otherwise feature smaller electrical panels and utility services. Requiring an energized outlet capable of providing Level 2 charging allows for “Part 9” buildings to either implement a dedicated circuit, or implement EVEMS that can control loads so as not to exceed the capacity of an electrical panel.

Will be easier to enforce as part of building code or zoning/parking mechanisms than “EV Capable” capacity requirements

Building officials, and local governments transportation or development approvals staff, who may play a role in enforcing building code or zoning/parking requirement mechanisms, respectively, typically do not inspect electrical plans or calculations. As noted in section 4 of this report, use of either of these mechanisms for EV charging infrastructure requirements necessitate investments to ensure effective enforcement and compliance.

It is anticipated that requirements for “EV Ready” parking will entail simpler compliance processes (but by no means without challenges) than requirements for electrical capacity to be provided via a “Partial – High / EV Capable” requirement. Reviewing provisions for “EV Ready”

⁵ Ontario Regulation 139/17. Building Code. 3.1.21.1(3). <https://www.ontario.ca/laws/regulation/r17139>

is a single process, as opposed to partial installation which necessitates review of both current and future provisions.

Summary

The table below, derived from the AES Engineering, Fraser Basin Council, and C2MP report *Residential Electric Vehicle Charging: A Guide for Local Governments* prepared for the City of Richmond⁶, is a useful summary of the implications of different EV charging infrastructure requirements for MURBs and the relative merits of making all residential parking “EV Ready”.

Infrastructure Option	Minimize upfront costs	Minimize retrofit costs	Simple for condo assn. / owner	Equitable for residents	Simple to enforce	Future-proof
Percentage-based (e.g. 20%)						
Partial-Low (all stalls)						
Partial-High / “EV Capable” (all stalls)						
Energized / “EV Ready” (all stalls)						
EVSE Installed (all stalls)						

2.2.2 Support Requirements that Some Proportion of Non-Residential Parking Spaces be Energized/ “EV Ready”

In addition to residential charging, EV charging in non-residential parking spaces is important to enabling EV adoption, providing opportunities for “at work” and “on the go” charging. Workplace charging can augment, or in some instances replace, at home charging. Indeed, increasing workplace charging is important to encouraging EV adoption - The US Department of Energy estimates that employees with access to workplace charging are six times more likely to adopt an EV than those without access to charging at work.⁷ Likewise, EV charging infrastructure

⁶ Source: AES Engineering, Fraser Basin Council, C2MP. 2018. *Residential Electric Vehicle Charging: A Guide for Local Governments*. Prepared for City of Richmond and BC Hydro. https://www.richmond.ca/_shared/assets/Residential_EV_Charging_Local_Government_Guide51732.pdf

⁷ US DOE. January 2017. *Workplace Charging Challenge Progress Update 2016: A New Sustainable Commute*. https://afdc.energy.gov/files/u/publication/wpc_2016_progress_report.pdf

available to customers, visitors, and/or the public at non-residential parking spaces can: Complement other forms of EV charging; mitigate “range anxiety”; provide for longer vehicle trips; and serve emerging shared mobility services (e.g. ride-hailing, ride-sharing, etc.).

The appropriate level of EV charging in non-residential applications differs according to the use of parking. For example:

- Workplace and other forms of long-duration parking can be well served by AC Level 1 charging.
- Short-term parking may be best served by dedicated AC Level 2 or even higher capacity charging.

As noted in Appendix 2, local governments could use zoning/parking requirements to granularly tailor different EV charging requirements for parking associated with specific land uses. The level of charging, provisions for minimum performance requirements for use of charging, what percentage of spaces must feature infrastructure, and state of infrastructure completion, can vary based on particular land uses.⁸

Appendix 2 also notes that given the structure of the NBC, NECB and CE Code, it would be more difficult to make granular requirements tailored to different land uses via these model codes. EV charging infrastructure requirements included in these mechanisms could specify a percentage of non-residential parking spaces that must feature energized outlets for the purpose of EV charging. It is recommended that this not require a specific level of EV charging, leaving developments the flexibility to decide the most appropriate form of charging for the particular parking uses at developments. It is recommended that a requirement for 20% of parking stalls serving non-residential uses feature an energized outlet for EV charging is appropriate, based on precedents from Ontario, BC municipalities, Californian cities, and other jurisdictions.

2.3 Performance Requirements for Developments Using EVEMS

BC local government bylaws that establish requirements for 100% “EV Ready” residential parking stalls typically include provisions for charging performance requirements to ensure adequate electrical capacity for typical driving requirements, once all EV spaces are in use. Similarly, the City of Palo Alto’s Ordinance No. 5393 includes provisions for the Chief Building Official to determine a sufficient level of circuit capacity that must be available to EV parking spaces⁹.

⁸ Jim Hindson has developed example zoning bylaw provisions that would tailor EV charging requirements based on a wide range of specific land uses. See: Jim Hindson. P. Eng. March 2019. *A Methodology to Revise a Municipal Zoning Bylaw for EV Infrastructure*. <https://www.scribd.com/document/400263586/Methodology-for-EV-Infrastructure-Regulation-0319>

⁹ City of Palo Alto. Ordinance No. 5393. Section A4.106.8.3.(d). <https://www.cityofpaloalto.org/civicax/filebank/documents/54976>.

For example, the City of Richmond's performance requirement specifies:

"The system must be capable of supplying a minimum performance level of 12 kWh per parking space over an eight (8) hour overnight period, assuming that all parking spaces are in use by a charging EV."

The performance requirement allows for 4-way load-sharing on a 208V 40A branch circuit, while not precluding other designs. Such a configuration was deemed to provide sufficient energy for the vast majority of charging needs in Richmond, given typical vehicle kilometers traveled (VKT) by vehicles, climate, etc. To date, other BC local governments have tended to replicate this requirement.

Performance requirements ensure adequate power is delivered to residential parking spaces to ensure a high likelihood that vehicles will be fully re-charged overnight. Without such performance requirements, electrical designs may include excessive load sharing, resulting in insufficient power to provide an adequate rate of charging.

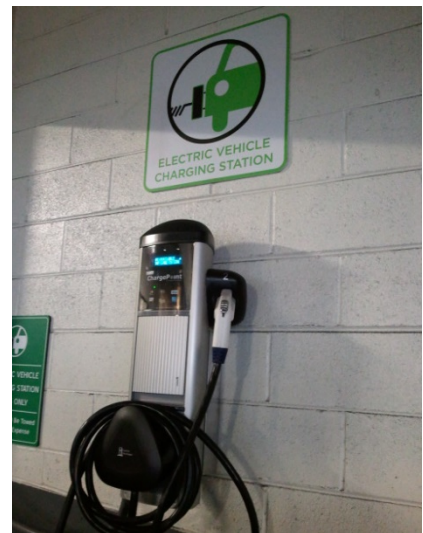
Areas with greater VKT, colder climates, propensity for larger vehicles, and hillier topography, will need significantly greater power delivered to vehicles to achieve the same quality of experience from the charging infrastructure (e.g. the same likelihood of being fully re-charged each morning, and to avoid the need to regularly augment "at home" charging with public "on the go" or "at work" charging). Preliminary estimates conducted by project team members suggest the power required for vehicles in outer suburbs in a cold region may be three or more times that of regional city centers in more temperate climates. It is also important to note that due to the statistical "law of large numbers", less electrical capacity per vehicle is needed per parking space when increased sharing is implemented.

For this reason, some stakeholders argue that minimum performance requirements applicable to residential charging will need to vary for developments based on these variables. Likewise, performance requirements applicable to charging in non-residential areas could be considered. All else being equal, differing performance requirements for different locations would mean less load-sharing, greater electrical capacity requirements, and greater costs for developments in locations where energy needs are greater. Alternately, a consistent performance requirement could be established; this would potentially overbuild electrical infrastructure in city centres, while under-building in suburban and exurban MURBs.

Conversations with NRC staff suggest that a performance requirement(s) for use in model codes could be:

- Developed via a third party standard, which would then be referenced in code.
- Established directly in code, perhaps as an interim measure before being established in a standard that can be referenced in code.

Likewise, zoning/parking requirements could include EVEMS performance requirements, reference a third party standard, or make provisions for a performance requirement to be established by jurisdiction.



3. Comparison of Mechanisms to Require EV Charging Infrastructure in New Developments

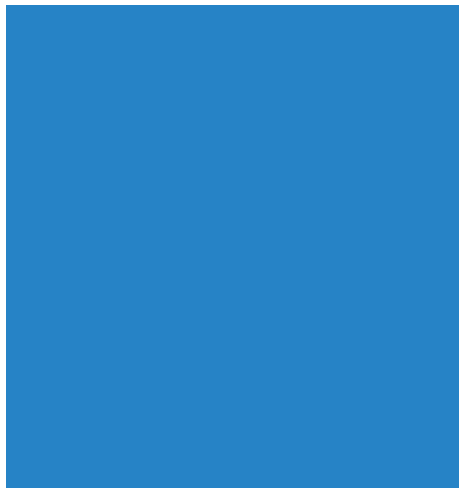
Appendix 2 includes a comparison of a variety of mechanisms that might be used to advance requirements for EV charging infrastructure in new and existing buildings. These include:

- National Building Code of Canada (NBC).
- National Energy Code for Buildings (NECB).
- Canadian Electrical Code (CE Code).
- Local zoning/parking requirements.
- Provincial legislation mandating zoning/parking to require EV charging infrastructure.

Based on review and comparison of these mechanisms, an appropriate strategy is to:

- Pursue code change requests to the NBC (for “Part 9” buildings) and NECB (for “Part 3” buildings) to support “EV Ready” requirements for 100% of residential parking and 20% of non-residential parking. A code change request for the CE Code to require the same provisions could also be considered, although based on the review conducted for this project, would be unlikely to be successful as the scope of the CE Code is safety of electrical installations, and not design/policy issues.¹⁰
- Support local governments and provinces to establish local or provincial zoning/parking requirements in advance of adoptions of building code requirements.

The recommendations in Section 4 below expand on these broad strategies.



¹⁰ The 2018 CE Code does include language pertaining to the safe implementation of EVSE and EVEMSs. However, it does not make requirements for EV charging infrastructure to be implemented in all new construction.

4. Recommendations

4.1 Pursue Code Change Requests for 100% “EV Ready” Residential Parking and 20% “EV Ready” Non-Residential Parking

Code Change Request for NBC and NECB

Review of model codes conducted as part of this project suggests requirements for “Part 3” buildings would best reside within the current structure and scope of the NECB, while requirements for “Part 9” buildings would be included in Part 9 of the NBC. Appendix 4 contains language appropriate for a code change request.

It is important to note that code change requests to the NBC and NECB may trigger policy discussions at the Provincial and Territorial Policy Advisory Committee on Codes (PTPACC) relating to objectives and functional statements, as well as whether the scope of the NBC and NECB would extend beyond the building line to encompass surface parking on premises. It is understood such policy discussions can take years; additionally, there is historically lag time from release of model codes and their adoption by provinces. Given these factors, there may be significant delay in adoption of “EV Ready” requirements in provincial codes. Given the anticipated delay and other considerations, it is recommended that NRCan also support zoning/parking requirements for “EV Readiness”, and potentially changes to the CE Code, as noted below.

Consider a Code Change Request to the CE Code

As noted in Appendix 2, there are a variety of potential benefits were EV charging infrastructure requirements to be made in the CE Code. However, such requirements were determined to be likely outside the scope of the CE Code – The scope of CE Code is safety of electrical installations, and not design/policy issues. Indeed, a code change request to the CE Code to include a requirement for an energized outlet provided at all residential parking stalls was rejected in 2016 on this basis.

Nevertheless, NRCan could consider submission of a code change request for the CE Code. CE Code Section 0 regarding the object of the CE Code notes that:

“Wiring installations that do not make provision for the increasing use of electricity may be overloaded in the future, resulting in a hazardous condition. It is recommended that the initial installation have sufficient wiring capacity and that there be some provision made for wiring changes that might be required as a result of future load growth.”

A case for a code change request could be made on the basis that EV charging will be demanded in the future, necessitating wiring capacity to serve this load.

4.2 Support Local Governments and Provinces in Making Consistent Zoning/Parking Requirements

Clarify local government powers to establish zoning/parking requirements

In BC, local governments have amended parking design requirements in parking or zoning bylaws to require “EV Ready” parking. Likewise, other provinces’ local government legislation may allow local governments to make requirements for EV charging infrastructure as a parking requirement under existing authority to establish zoning and/or parking requirements. However, provinces’ local government enabling legislation does not explicitly note that EV charging infrastructure is in the scope of local governments’ authority. Clarification and/or amended provincial legislation to explicitly allow for use of zoning/parking requirements would empower local governments to pursue these strategies.

NRCan could fund legal opinions to determine whether making requirements for EV charging infrastructure is within the authority of local governments.

Encourage provinces to enable or require EV charging infrastructure requirements

NRCan could engage with the provinces to encourage amendments to legislation to explicitly enable local governments to make EV charging infrastructure requirements as a parking design requirement.

Furthermore, it is the author’s understanding that provinces could require local governments to make specific zoning/parking requirements for “EV Readiness”. For example, provinces could amend local government legislation to compel local governments to amend zoning/parking to require 100% of residential parking to feature an energized outlet, while also enabling local governments to adopt requirements for other parking uses. Provinces might also make similar requirements through other legislation. Legal advice should be sought to identify the most appropriate means of establishing province-wide zoning/parking requirements for EV charging in each province.

Disseminate a model bylaw for residential EV charging

Appendix 5 contains a model bylaw prepared by AES Engineering, for consideration.

4.3 Commission a Study of Potential Performance Requirements for Developments Using EVEMS and an Associated Standard

NRCan could support a study of potential performance requirements that specify minimum adequate provision of power for EV charging. The objective of the analysis would be to quantify the implications of different variables (VKT, climate, topography, number of parking spaces shared on a branch circuit, etc.) on the energy needs of vehicles in different regions. The analysis would subsequently identify appropriate charging performance requirements across Canada, and an appropriate method for managing regional variances. The intent of the assessment would be to establish appropriate minimum charging levels whilst minimizing complexity of implementation. The analysis could also include a costing study to provide insight on the cost

implications of performance requirements for MURB developments in different regions. Performance requirements for residential charging should be prioritized; however, such requirements could also encompass non-residential parking applications.

NRCAN could support such performance requirements adoption as a standard by a suitable standards development body. Such a standard could be referenced in codes and/or zoning/parking requirements. Alternately, performance requirements could be referenced directly in code changes or zoning/parking requirements.

Assessment and development of appropriate charging performance requirements is a short-term priority, to support code change requests for the 2020 NECB and NBC. It is recommended that NRCAN consider initiation of development of charging performance requirement options, as a matter of urgency. It is worth noting that AES Engineering are in the process of preparing a model to inform development of charging performance requirements. NRCAN could consider supporting peer review and validation for this work and funding an associated costing study to evaluate the implications for charging performance requirements.

4.4 Support Market Transformation for EV Charging in MURBs, Including Use of EVEMS and Related Services

A variety of factors influence adoption of EV charging infrastructure in MURBs. The factors are expected to be summarized in a separate “ZEV Charging in MURBs and Garage Orphans” report being prepared for NRCAN. Removing barriers to EVEMS enabled EV charging services in MURBs will enable provinces and local governments to adopt EV Ready requirements for MURBs. Likewise, incentives for EVEMS enabled EV charging in new and existing MURBs will support market transformation in this sector, which will improve the prospects for adoption of “EV Ready” requirements.

4.5 Support Compliance

Significant investments in training and capacity-building will be necessary to ensure the industry is prepared to comply with EV charging infrastructure requirements, and that electrical inspectors, building officials and other local government staff are prepared to enforce either building code and/or zoning/parking requirements. Importantly, training should be included for electrical engineers and electrical contractors, which are ultimately responsible for the design and construction of the electrical infrastructure for EV charging.

Building officials and other local government staff do not typically inspect electrical systems. Many interviewees for the project noted that building officials and electrical inspectors experienced challenges in interpreting and enforcing EV charging infrastructure requirements. There will be a need to identify appropriate responsibilities for electrical inspectors, building officials and/or other disciplines, depending on mechanisms which are adopted, and supporting training and information sharing to support compliance and enforcement.

4.6 Support Development of Good Practices for EV Charging Infrastructure Requirements in Commercial Parking Areas

Given the importance of “at home” charging to enabling adoption of EVs, “EV Ready” requirements for residential parking areas are a major priority. EV charging infrastructure requirements for non-residential parking are also important to supporting EV adoption and avoiding future retrofit costs. Considerations of how best to support EV charging in non-residential parking contexts are more complex than residential – such an application should consider:

- Optimal EV charging service (Level 2, DCFC, extent of load-management, etc.) for different types of parking uses (such as short-term commercial visitor parking; longer-term commercial parking; employee parking; various different land uses; medium and heavy-duty vehicle parking and loading zones; etc.).
- How parking uses could be defined in codes that were not structured to differentiate between types of parking. Customizing requirements to different commercial land uses is anticipated to be easiest using zoning mechanisms. Review conducted for this project suggests that different parking uses could be defined in the NBC and NECB at a less granular level, perhaps based on occupancy types recognized in codes.
- Cost-benefit considerations of providing the infrastructure.
- Business models for building owners and occupants to use the infrastructure, and likelihood it will be used.

NRCan could support research and industry engagement into what constitutes recommended EV charging infrastructure requirements in commercial parking areas. This may support local and provincial governments in considering requirements tailored to different parking uses, and future model code change requests. Results of such a study would also assist designers and developers in implementing appropriate EV charging infrastructure in new developments, including any developments subject to requirements for EV charging infrastructure in non-residential parking areas.

Appendix 1: Summary of EV Charging Infrastructure Requirements of Various Jurisdictions

Note: The list below is not intended to represent a comprehensive summary of requirements in all jurisdictions.

Jurisdiction & Mechanism	EVSE Installed	Energized Outlet / "EV Ready"	Partial Infrastructure – High / "EV Capable" <ul style="list-style-type: none">Electrical capacityConduit installed (at least in hard to retrofit areas)	Partial Infrastructure – Low <ul style="list-style-type: none">No provisions for electrical capacityConduit installed (at least in hard to retrofit areas)	Notes
British Columbia					
Vancouver - Parking Bylaw Section 4.14, VBBL Section 10.4 (current) ¹¹		<ul style="list-style-type: none">Ground-oriented residential garage - 100%MURB (excl. visitors) – 100% Level 2Commercial – 10% Level 2		<ul style="list-style-type: none">Ground-oriented – Raceway, if panel would exceed 200A	EVEMS performance standard applies.
Vancouver – Vancouver Building By-Law Section 10.4 (Prior to Jan 2019) ¹²		<ul style="list-style-type: none">Ground-oriented residential – 100%MURB – 20% (1 40A, 208V/240V per 5 stalls)Commercial – 10%		<ul style="list-style-type: none">Ground-oriented – Raceway, if panel would exceed 200AMURB - sufficient space in electrical room for 100%.	
City of Richmond - Zoning Bylaw Section 7.15 ¹³		<ul style="list-style-type: none">Residential (excl. visitors) – 100% Level 2			EVEMS performance standard applies.
Burnaby – Zoning Bylaw 800.8 ¹⁴		<ul style="list-style-type: none">Residential (excl. visitors, secondary suites) – 100% Level 2			EVEMS performance standard applies.
City of Coquitlam – Zoning Bylaw Part 7 714 ¹⁵		<ul style="list-style-type: none">Residential (excl. visitors) – each dwelling unit Level 2			EVEMS performance standard applies.
City of New Westminster – Zoning Bylaw Section 150 ¹⁶		<ul style="list-style-type: none">Residential & co-op (excl. visitors) – 100% Level 2			EVEMS performance standard applies.
City of North Vancouver – Section 909 ¹⁷		<ul style="list-style-type: none">Residential (excl. visitors, secondary suites) – 100% Level 2			EVEMS performance standard applies.
City of Port Moody - Zoning Bylaw, No. 2937 Section 6.11 ¹⁸		<ul style="list-style-type: none">Residential & co-op (excl. visitors) – 100% Level 2Commercial – 20%			EVEMS performance standard applies.
City of Surrey		<ul style="list-style-type: none">Residential – 100% Level 2Visitor – 50% Level 2Commercial 20% Level 2			EVEMS performance standard applies.
City of Port Coquitlam ¹⁹			<ul style="list-style-type: none">Residential – each dwelling unit: Level 2		
Note: The author is aware of multiple other BC local governments in the process of developing EV charging infrastructure requirements.					

¹¹ City of Vancouver. BY-LAW NO. 12156 Parking By-law No. 6059 regarding electric vehicle charging stations and bicycle end of trip facilities. <https://bylaws.vancouver.ca/consolidated/12156.PDF>; City of Vancouver. BY-LAW NO. 12154. A By-law to amend Building By-law No. 10908 Regarding electric vehicle charging stations and bicycle end-of trip facilities. <https://bylaws.vancouver.ca/consolidated/12154.PDF>

¹² City of Vancouver. Building By-law #11996 & 12013: Book I - Insert Pages Set 3. Accessed January 29, 2019. <https://vancouver.ca/files/cov/vbbl-book-1-set-3.pdf>

¹³ City of Richmond. Consolidated Richmond Zoning Bylaw 8500. Section 7. https://www.richmond.ca/_shared/assets/ParkingLoading24226.pdf

¹⁴ City of Burnaby. Zoning Bylaw – Schedule No. VIII Off-Street Parking. <https://www.burnaby.ca/Assets/Zoning+Bylaw/Off+Street+Parking.pdf>

¹⁵ City of Coquitlam. Zoning Amendment Bylaw No. 4905, 2018. <http://publicdocs.coquitlam.ca/cyberdocs/getdoc.asp?doc=3147617>

¹⁶ City of New Westminster. Zoning Amendment Bylaw (Electric Vehicle Charging Infrastructure in Residential Buildings) NO. 8040, 2018. [https://www.newwestcity.ca/database/files/library/100_Introduction\(14\).pdf](https://www.newwestcity.ca/database/files/library/100_Introduction(14).pdf)

¹⁷ City of North Vancouver. Zoning Bylaw, 1995, No. 6700, Amendment Bylaw, 2018, No. 8693" (Electric Vehicle Charging Infrastructure).

¹⁸ See: <http://www.portmoody.ca/modules/showdocument.aspx?documentid=18431>

¹⁹ See: <https://www.portcoquitlam.ca/business-development/develop-a-property/electric-vehicles/>

Jurisdiction & Mechanism	EVSE Installed	Energized Outlet / “EV Ready”	Partial Infra – High / “EV Capable”	Partial Infrastructure – Low	Notes
Ontario					
Ontario Building Code Section 3.1.21 ²⁰	<ul style="list-style-type: none"> Buildings, other than apartments – 20% (any EVSE – i.e. Level 1, Level 2, DCFC) 		<ul style="list-style-type: none"> Ground-oriented garage, carport or driveway - 200A panelboard; raceway. 	<ul style="list-style-type: none"> Buildings, other than apartments – remainder (OBC requires the remaining parking spaces be designed to permit future installation of EVSE, but does not specify how. Technical Support document provides further direction, but notes dependence on design of building). 	
City of Toronto – Toronto Green Standard Version 3 ²¹	<ul style="list-style-type: none"> Tier 1 (mandatory) - Residential apartment buildings 4 storeys and higher; all Industrial, Commercial and Institutional – 20% (any EVSE – L1 or L2) Tier 2 (voluntary) – 25% 			<ul style="list-style-type: none"> Residential apartment buildings 4 storeys and higher; all Industrial, Commercial and Institutional – remainder (conduit from electrical room to parking lot). 	
California					
California Green Building Standard Code – CalGreen – Section 4.106 (approved Jan 16 2019) ²²			<ul style="list-style-type: none"> MURB – 40A panel capacity for 10% of parking spaces & inaccessible raceway. Non-residential – 40A panel capacity for ~6% of parking spaces & inaccessible raceway 		Exceptions may be made, if no commercial power supply or if utility costs for homeowner or developer would increase by >\$400 per dwelling unit.
City of Palo Alto – Ord. 5393 ²³	<ul style="list-style-type: none"> Non-residential (other than hotels) – 5% Hotels – 10% 	<ul style="list-style-type: none"> Multifamily – 1 per dwelling unit 	<ul style="list-style-type: none"> Single family Multifamily guest parking – 25% Multifamily with individual attached parking – 1 per dwelling unit Non-residential – 20% 		
City & County San Francisco – Ord. 92-17 - Green Building and Environment Codes ²⁴		<ul style="list-style-type: none"> Ground-oriented residential – 100% MURB, Assembly, Business, Institutional & Mercantile occupancies - 10% (40A, 208V/240V), no less than 2 parking spaces. 	<ul style="list-style-type: none"> MURB, Assembly, Business, Institutional & Mercantile occupancies – 40A panel capacity for 10% of parking spaces 	<ul style="list-style-type: none"> MURB, Assembly, Business, Institutional & Mercantile occupancies – inaccessible raceway for remainder of parking spaces; sufficient space in electrical room for 100%. 	<ul style="list-style-type: none"> Exceptions may be made, if no commercial power supply or if utility costs for homeowner or developer would increase by >\$400 per dwelling unit. Installation of one Fast Charger (min 30kW) may reduce up to five “EV Ready” spaces.

²⁰ Ontario Regulation 139/17. Building Code. Filed May 17, 2017. <https://www.ontario.ca/laws/regulation/r17139> ; see also Ontario Electrical Safety Authority. “Electrical Vehicle Charging Systems - Ontario Building Code Change – Electrical Vehicle Charging Systems”. Accessed January 29, 2019 <https://www.esasafe.com/contractors/resources/electrical-vehicles>

²¹ City of Toronto. Toronto Green Standard Version 3 – Air Quality for Mid to High-Rise Residential & all Non-Residential Development. Accessed February 5, 2019 <https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/toronto-green-standard-version-3/mid-to-high-rise-residential-all-non-residential-version-3/air-quality-for-mid-to-high-rise-residential-all-non-residential-development/>

²² Requirements derived from: California Department of Housing and Community Development. Final Express Terms for the Proposed Building Standards of the Department of Housing and Community Development Regarding the Adoption of the 2019 California Green Building Standards Code (CalGreen) – California Code of Regulation, Title 24, Part 11 (HCD 06/18); *Personal communication* that these requirements were adopted at the California Building Standards Commission (CBSC) January 16 2019 meeting. The CBSC has not yet published Approved Meeting Minutes have not yet been published at <http://www.bsc.ca.gov/calendar/bscmtgs.aspx> as of January 29, 2019. And California Green Building Standards Code, Part 11 – 2016. Chapter 4 – Residential Mandatory Measures. (4.106.4) <https://codes.iccsafe.org/content/chapter/2057/>

²³ City of Palo Alto. Ordinance No. 5393. Ordinance of the Council of the City of Palo Alto Amending and Restating Chapter 16.14 of the Palo Alto Municipal Code, California Green Building Standards Code 2016 Edition, and Local Amendments and Related Findings. <https://www.cityofpaloalto.org/civicax/filebank/documents/54976>

²⁴ City and County of San Francisco. Ordinance 92-17. Green Building and Environment Codes – Requirements for Installation of Electric Vehicle Chargers. <https://sfbos.org/sites/default/files/o0092-17.pdf>

Jurisdiction & Mechanism	EVSE Installed	Energized Outlet / "EV Ready"	Partial Infra – High / "EV Capable"	Partial Infrastructure – Low	Notes
City of Oakland – Ord. 13419 - Plug In Electrical Vehicle Readiness Code Update ²⁵		<ul style="list-style-type: none">MURB - 10% (40A, 208V/240V); higher % for less than 20 parking spaces.	<ul style="list-style-type: none">MURB – 40A panel capacity for additional 10% of stalls; higher % for less than 20 parking spaces.	<ul style="list-style-type: none">MURB – inaccessible raceway for remainder.	
Note: Information on other California cities' EV charging infrastructure requirements is available in Appendixes C & D of CARB 2018. <i>Electric Vehicle (EV) Charging Infrastructure: Multifamily Building Standards.</i> ²⁶					
New York					
New York City Law 2013/130 ²⁷				<ul style="list-style-type: none">Parkades & open parking lots (except Mercantile uses) – 20% (conduit & room in electrical room).	
Europe					
European Union – Energy Performance of Buildings Directive 2010/31/EU ²⁸	Non-residential - By 2025, Member States shall require 20% for non-residential buildings with more than 10 parking spaces.			MURB - By 2020, Member States shall require electrical conduit for all MURBs with greater than 10 parking spaces.	<ul style="list-style-type: none">Member States will transpose EPBD in their own Codes and/or legislation.Member States may forgo non-residential requirements for small & medium enterprises, which could exempt most sites.²⁹Applies to new construction & major renovations.Applies to parking within and adjacent to buildings.
Austria ³⁰			<ul style="list-style-type: none">Residential – 50% (3kW capacity & ducting).Non-residential – 10% "normal power" or 4% "high power".		<ul style="list-style-type: none">Some exceptions for high cost.Expected to be updated to align with EPBD.
France ³¹				<ul style="list-style-type: none"><=40 Spaces – 50% residential; 10% Tertiare, Industriel, Service Public; 5% commercial/cinemas.>40 Spaces – 75% residential; 20% Tertiare, Industriel, Service Public; 10% commercial/cinemas.	<ul style="list-style-type: none">Expected to be updated to align with EPBD.

²⁵ City of Oakland. Ordinance No. 13419. "Ordinance Adopting Local Amendments to Sections 4.106.4 and 5.106.5.3 of the 2016 Edition of the California Green Building Standards Code and Amending Oakland Muncpal Code Chapter 15.04 to Include New Requirements for Plug-in Electric Vehicle Infrastructure to Comply with Changes to State Law and Adopting CEQA Exemption Findings." <https://oakland.legistar.com/LegislationDetail.aspx?ID=2867571&GUID=9B9DF1D2-EF8D-470F-85F8-26BDCD2D4914>

²⁶ California Air Resources Board. April 2018. Electric Vehicle (EV) Charging Infrastructure: Multifamily Building Standards. <https://arb.ca.gov/cc/greenbuildings/pdf/tcac2018.pdf>

²⁷ New York City. Law Number 2013/130. "A Local Law to amend the administrative code of the city of New York and the New York city building code, in relation to electric vehicle charging stations in open parking lots and parking garages." <https://legistar.council.nyc.gov/LegislationDetail.aspx?ID=1501659&GUID=65344E17-4C65-4751-81E7-7A0D4DD9F7CD>

²⁸ Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency. – Article 8 <https://eur-lex.europa.eu/legal-content/EN/TXT/?toc=OJ%3AL%3A2018%3A156%3ATOC&uri=uriserv%3AQJ.L.2018.156.01.0075.01.ENG>

²⁹ Bellona. January 11, 2018. "Newly agreed EU buildings law to require buildings' "readiness" for electric vehicles".

³⁰ Values in table derived from personal communication from European Commission staff. See: <http://ec.europa.eu/growth/tools-databases/tris/de/index.cfm/search/?trisaction=search.detail&year=2016&num=624&mLang=EN>

³¹ Values in table derived from personal communication. See: http://www.avere-france.org/Site/Article/?article_id=6675

Jurisdiction & Mechanism	EVSE Installed	Energized Outlet / “EV Ready”	Partial Infra. – High / “EV Capable”	Partial Infrastructure – Low	Notes
Italy ³²				<ul style="list-style-type: none">Residential – 20%	<ul style="list-style-type: none">Expected to be updated to align with EPBD.
Spain ³³				<ul style="list-style-type: none">Residential – 20%Non-residential – 2.5%	<ul style="list-style-type: none">Expected to be updated to align with EPBD.
London – The London Plan Policy 6.13 - Parking ³⁴	All parking - 20% - “Developments in all parts of London must... ensure that 1 in 5 spaces (20%) provide an electrical charging point to encourage the uptake of electric vehicles.”				
Oslo – Proposed Revision of Parking Standards (under consideration; not adopted) ³⁵	Residential – 50% Office, industry, educational – employee parking – 50% Other – 20%		Residential – remainder.		
China					
Qingdao ³⁶		<ul style="list-style-type: none">Residential – 100%Public parking spaces – 20%			
Beijing ³⁷	<ul style="list-style-type: none">Residential – 100%Office buildings – 25%Other public buildings (hospital, school, stadium) are 100%, 25%, and 15%				

³² Values in table derived from personal communication. See: https://www.edilportale.com/news/2017/01/risparmio-energetico/dal-2018-obbligo-di-colonnine-di-ricarica-elettrica-nei-nuovi-edifici_55898_27.html

³³ Values in table derived from personal communication. See: <http://normativa.infocentre.es/sites/normativa.infocentre.es/files/noticies/20204606e.pdf>

³⁴ Greater London Authority. The London Plan - Policy 6.13 – Parking. Accessed January 29 2019, <https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan/london-plan-chapter-six-londons-transport/pol-27>

³⁵ Values in table derived from personal communication with City of Oslo staff and International Council on Clean Transportation staff. Oslo staff shared proposed standard.

³⁶ Values in table derived from personal communication with International Council on Clean Transportation staff. See: <https://www.d1ev.com/news/shichang/67040>

³⁷ Values in table derived from personal communication with International Council on Clean Transportation staff. See also: ICCT. October 2018. Electric vehicle capitals: Accelerating the global transition to electric drive. https://www.theicct.org/sites/default/files/publications/EV_Capitals_2018_final_20181029.pdf

Appendix 2: Comparison of EV Charging Infrastructure Requirements

	NBC	NECB	ECEB	CE Code	Local Zoning / Parking Requirements	Provincially Legislated Zoning / Parking Requirements
Implementation Notes	Model national code. Provinces and some cities have authority to adopt, and may make modifications and additions. ³⁸	Model national code. Provinces and some cities have authority to adopt, and may make modifications and additions.	Model national code in early stages of development.	Provinces and some cities have authority to adopt, and may make modifications and additions.	Local governments adopt zoning or parking requirements for EV charging infrastructure.	Provinces require, or compel local governments to require, EV charging infrastructure.
Are EV Charging Infrastructure Requirements within Scope of the Mechanism?	<p>Potentially. Objectives and Functional Statements will likely need to be amended. This requires CCBFC to consult with provinces and territories at PTPACC³⁹ – may take years.</p> <p>NECB is likely the more appropriate Code mechanism for “Part 3” buildings, given the current Objectives and the structure of the NBC.</p> <p>NBC 9.34 or 9.36 could include requirements for EV charging infrastructure.</p>	<p>Potentially. Objectives and Functional Statements will likely need to be amended. Initial communications with the Codes Centre suggests the Objective would be to reduce GHG emissions, which is not currently an Objective of NBC or NECB. Current Functional Statements regarding Objective “OE 1.1 – excessive use of energy” do not encompass transportation systems, only buildings.</p> <p>Changes to Objectives and Functional Statements requires CCBFC to consult with provinces and territories at PTPACC – may take years.</p>	<p>Scope not yet defined. Objectives and Functional Statements may align with NBC & NECB.</p>	<p>Unlikely. Scope of CE Code is safety of electrical installations, and not design/policy issues.</p> <p>A request to amend the CE Code to require an outlet for EV charging for each parking space serving residential occupancies was rejected in 2016.</p> <p>One expert noted that some provincial electrical codes may have requirements for block heaters, a design/policy consideration; however, may not provide a precedent for CE Code</p> <p>Section 0 of CE Code notes: “It is recommended that the initial installation have sufficient wiring capacity and that there be some provision made for wiring changes that might be required as a result of future load growth.” Given that probability of future EV load growth is high, the potential for EV charging infrastructure requirements in the CE Code to accommodate this growth could be explored.</p>	<p>Potentially. Some provinces’ local government legislation may allow local governments to make requirements for EV charging infrastructure. In BC, local governments have established changes to parking design requirements in parking or zoning bylaws. Legal advice should be sought regarding local governments’ authority to make such requirements in different provinces. Clarification and/or amended provincial legislation to explicitly allow for use of zoning/parking requirements could empower local governments to pursue these strategies.</p>	<p>Likely. It the author’s understanding that provinces could require local governments to make specific zoning/parking requirements by amending local government legislation; likewise, other legislation might be used. Legal advice should be sought.</p>
Extent of property covered	<p>Very likely within the building line. Application of the NBC applies to buildings. No requirements exist outside the building line. Nevertheless, team not aware of any language specifically excluding the site.</p> <p>Interviews with NRC staff noted that an NRCan CCR for EV charging infrastructure might trigger a policy discussion regarding scope of NBC to encompass site.</p>	<p>Very likely within the building line. Application of the NEBC applies to buildings. No requirements exist outside the building line. However, there is an active code change request pertaining to site lighting; based on that precedent, there might be an opportunity for EV charging requirements to apply to parking outside the building line (if desired).</p> <p>Interviews with NRC staff noted that a NRCan CCR for EV charging infrastructure might trigger a policy discussion regarding scope of NECB to encompass premises.</p>		Building or property coverage possible.	Building or property coverage possible.	Building or property coverage possible.

³⁸ For adoption of NBC and NECB, see https://www.nrc-cnrc.gc.ca/eng/solutions/advisory/codes_centre/code_adoption.html

³⁹ National Research Council of Canada. 2016. Policies and Procedures: Canadian Commission on Building and Fire Codes. https://www.nrc-cnrc.gc.ca/eng/solutions/advisory/codes_centre/code_change_guidelines.html See Appendix L.

	NBC	NECB	ECEB	CE Code	Local Zoning / Parking Requirements	Provincially Legislated Zoning / Parking Requirements
Allows for different parking requirements for different land uses	Possible. Likely less granular application to different types of parking practical compared to zoning/parking mechanism.	Possible. Likely less granular application to different types of parking practical compared to zoning/parking mechanism.		Possible. Likely less granular application to different types of parking practical compared to zoning/parking mechanism.	Yes. EV charging infrastructure requirements readily tailored to different land uses.	Yes. EV charging infrastructure requirements readily tailored to different land uses. For example, province could establish minimum requirements for residential parking, and enable local governments to make requirements for other parking types of parking.
Efficacy/Simplicity of Compliance & Enforcement	Potentially challenging. Experience from other jurisdictions suggests that significant challenges exist for building officials support compliance with an electrical requirement. Electrical designers and inspectors reference CE Code. The 2018 CE Code notes in section 26.720(n): “where required by the <i>National Building Code of Canada</i> , receptacles for use with electric vehicle supply equipment as specified in Rule 86-306 shall be provided for car spaces in a garage or carport.” Appendix B of the CE Code which is informative (non-mandatory) notes: “It is intended by this requirement to recognize a need for additional electric vehicle charging infrastructure in residential occupancies only in those cases where such electric vehicle charging infrastructure is mandated by the provincial/territorial building codes or local building or zoning regulations. Users of this Code should consult local building or zoning bylaws for electric vehicle charging infrastructure requirements and for the number of dedicated receptacles for electric vehicle charging equipment required as a percentage of the total parking spaces for cars in a residential occupancy.” Greater compliance & enforcement challenges may exist for NECB, as 2018 CE Code 26.720(n) only notes NBC. Interpretation may vary across different jurisdictions. The CE Code could be amended.			Simplest. Electrical designers and inspectors reference CE Code.	Potentially challenging. See NBC/NECB note at left.	
Performance Requirement⁴⁰	Could be established in NBC, or external standard referenced by NBC.	Could be established in NECB, or external standard referenced by NECB.		Anticipated that could be established in CE Code, or external standard referenced by CE Code. Further exploration required.	Local govts could establish. Opportunity for provincial or national standard.	Local govts or province could establish. Opportunity for provincial or national standard.
Potential for Variances / Exemptions⁴¹	Alternative solutions processes exist. More challenging process than for zoning/parking mechanism.				Established process for parking / zoning variances at local governments.	Established process for parking / zoning variances at local governments.
Speed of Adoption	Anticipated to take years from code change request to adoption by provinces.	Anticipated to take years from code change request to adoption by provinces.		Anticipated to take years from code change request to adoption by provinces. Could be faster than NBCC, NECB given code cycles length.	Possibly relatively expedient (months).	Possibly relatively expedient (months).
Scale of Impact	National, with adoption by provinces.	National, with adoption by provinces.		National, with adoption by provinces.	Local.	Provincial.

⁴⁰ Performance requirement intended to ensure adequate electrical capacity to provide for typical driving requirements, once all/most EV spaces in use.

⁴¹ The ability to provide variances or exemptions to requirements may be desired, as in some instances electrical service costs may be significantly greater even when a project has taken advantage of EVEMS to minimize load. Conversely, recourse to variances/exemptions may reduce the impact of EV charging infrastructure requirements.

Appendix 3: Summary of Studies Evaluating Costs of Providing 100% Energized Outlets for Residential Parking in MURBS

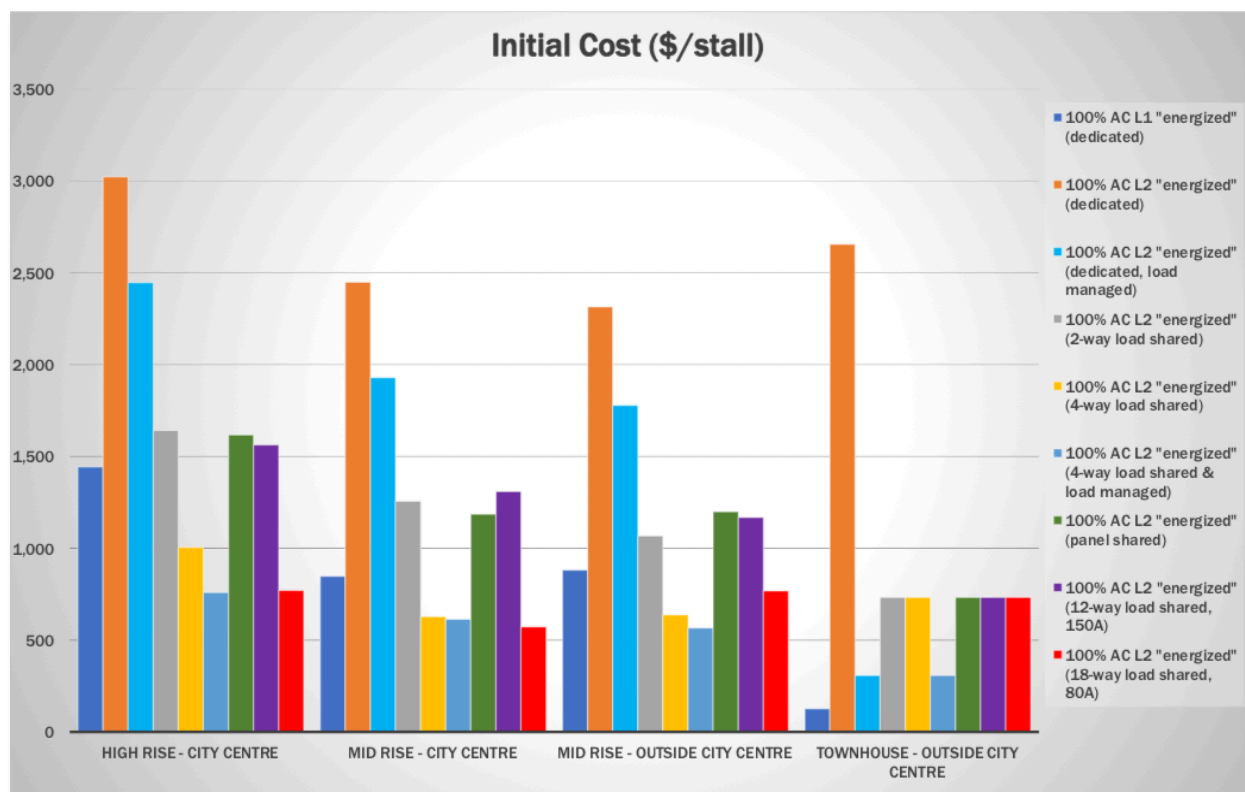
The following studies have evaluated the costs of providing all residential parking spaces in MURBs with energized outlets:

- “Electric Vehicle Charging Infrastructure in New Multifamily Developments - Requirement Options and Costing Analysis” prepared for the City of Richmond, BC, by AES Engineering.
- “Electric Vehicle Charging Costing Study Update” prepared for the City of North Vancouver by Prism Engineering.

Key findings from these reports are briefly summarized below.

AES Study

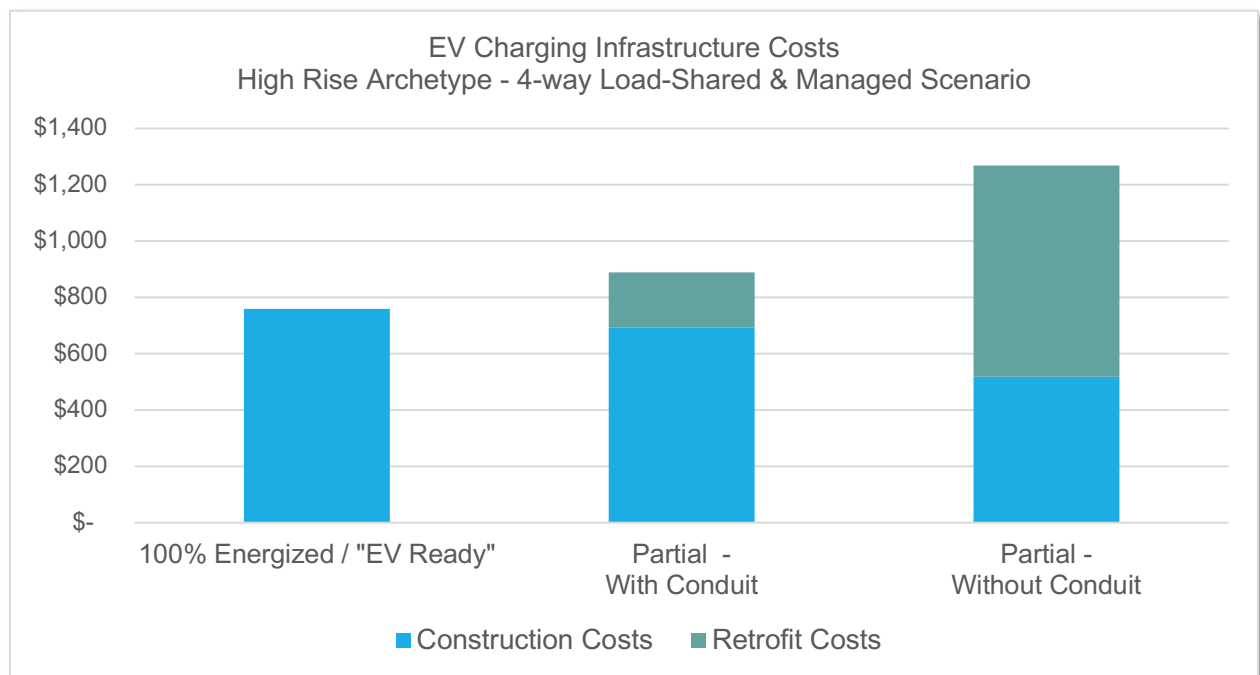
The AES Engineering study estimates the costs to serve each residential parking space with an energized outlet capable of providing Level 2 charging, for four residential building archetypes, each with nine EV charging infrastructure configuration scenarios. The chart below summarizes this costing information.



Source: AES Engineering. 2017. Prepared for the City of Richmond.

The study demonstrates that designs using EVEMS can achieve substantial cost reductions compared to providing a dedicated 208V 40A circuit to each parking space. As an example amongst the scenarios, the study estimates that 4-way load shared across a branch circuit can be delivered for an average cost of \$751 per parking space across the building archetypes; this 4-way load shared EV charging infrastructure design represents a cost-effective solution for more temperate regions with relatively low average daily driving distance requirements.

The study also demonstrates the costs can be reasonable compared with the cost of “Partial – High” infrastructure configurations that provide the same level of electrical capacity, but require end users to install wiring or both wiring and conduit (see below).



EV charging infrastructure costs derived from AES Engineering 2017.⁴² This estimate suggests that construction costs for a “Partial – High” level of completion capable of providing charging to all vehicles will be comparable to 100% Energized, while necessitating higher renovation costs (which were estimated to typically be greater than completing circuits at time of construction).

⁴² AES Engineering. April 2017. *Electric Vehicle Charging Infrastructure in New Multifamily Developments - Requirement Options and Costing Analysis Electrical Engineering Services*. Prepared for the City of Richmond.

Prism Study

The Prism Engineering study compares the cost of providing all residential parking spaces with a Level 2 outlet for EV charging for three building archetypes, across three scenarios:

1. Dedicated circuits.
2. EVEMS-enabled 4-way load sharing across branch circuits.
3. EVEMS-enabled 4-way loading sharing across branch circuits, with additional management that monitors the total building demand (kW) and automatically disconnects EVCS circuits if the building demand increases past a pre-defined threshold.

It finds significantly lower costs for all archetypes when EVEMS is used. The chart below, from a City of North Vancouver staff report, summarizes information from the Prism study, noting the average cost per stall for projects using EVEMS systems. It notes the modest incremental cost compared with the CNV's current policy that 20% of all stall feature dedicated circuits capable of Level 2.

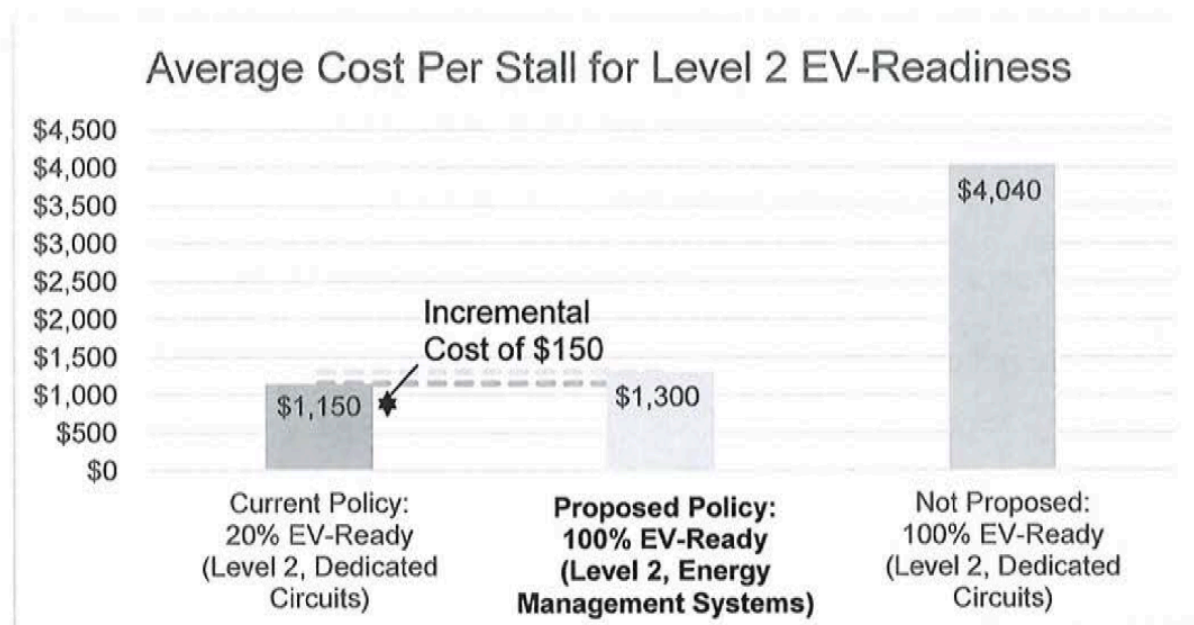


Figure 1. Source: *Electric Vehicle Charging Costing Study Update*, report by Prism Engineering Ltd., prepared for the City of North Vancouver November 13, 2018.

Source: City of North Vancouver "Electric Vehicle Charging Infrastructure Requirements for New Development staff report."⁴³

⁴³ Item 8 in December 10 2018 City of North Vancouver Council Meeting. Available at: <https://www.cnv.org/your-government/council-meetings>

Impacts of Electric Utility Service Costs

The studies highlighted do not include utility service connection costs. However, EVEMS can significantly reduce the necessary service size increase; indeed, in some instances, building demand load management systems could allow for no greater building demand than a building without EV charging infrastructure. Nevertheless, it is anticipated that the electrical load increase due to EV charging will result in changes to utility service costs for some new developments.⁴⁴

⁴⁴ The City of Richmond Council report for its zoning EV charging infrastructure requirements notes that “variances in EV parking requirements may be considered in rare cases when a development implements EV Energy Management Systems, and yet can document significantly greater costs due to infrastructure upgrades or BC Hydro extension fees.” It is understood that other municipalities would also consider such variances. The ability to make such variances more readily for zoning mechanisms compared to codes is a consideration in the merits of these different mechanisms.

Similarly, the Calgreen section 4.106.4 notes that exceptions to EV charging infrastructure requirements may be made “on a case-by-case basis, where the local enforcing agency has determined EV charging and infrastructure are not feasible based upon one of more of the following conditions:

1. Where there is no commercial power supply.
2. Where there is evidence substantiating that meeting the requirements will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the homeowner or the developer by more than \$400.00 per dwelling unit.”

Similar provisions could be established as part of zoning/parking requirements, and policies to interpret them. Such provisions could also be considered for inclusion in model codes, though it is unclear what are the most appropriate provisions for the Canadian context.

Appendix 4: NBC and NECB Code Change Request Language

Language suitable for a Code Change Request submission is included below. It includes both language for the NECB, and for the NBC applicable to “Part 9” buildings.

NECB

The following is recommended for inclusion in a new section of Part 7: Electrical Power Systems and Motors.

For all new residential buildings (Group C occupancies), all parking spaces provided for residential use, including car-share spaces, with the exception of visitor parking stalls, shall be provided with an energized outlet installed adjacent to the space, for the purpose of EV charging. The energized outlet shall be capable of supporting connection of Level 2 charging.

[For consideration: 20% of residential visitor parking stalls shall be provided with an energized outlet for the purpose of EV charging.]

For all new non-residential buildings (Group A, B, D, E and F occupancies), 20% of parking spaces provided for non-residential use shall be provided with an energized outlet adjacent to the parking space, for the purpose of EV charging.

Where an EVEMS is implemented, a minimum charging performance requirement to ensure sufficient rate of charging, shall apply. **[NOTE:** *Such a charging performance requirement would need to be developed by a qualified entity and referenced in this code change. EVEMS represent a compromise between electrical infrastructure costs and charging performance. Development of charging performance requirements is necessary to ensure a reasonable compromise is achieved. Charging performance requirements may vary from region to region. Major factors include daily driving distance, topography, temperature, and vehicle types/efficiency. Performance requirements will dictate the minimum amount of electrical load to serve EVs, and thus the size of electrical systems and associated costs.*]

Definitions:

Electric vehicle (EV) 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 supply equipment (EVSE) 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 EV.

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

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.

NBC

The following is for inclusion in either 9.34 or 9.36 of the NBC.⁴⁵

For each:

- one-family dwelling, two-family dwelling, one-family or two-family dwelling with a secondary suite or lock-off unit, rowhouse, and laneway house, each storage garage, carport or driveway parking area shall be provided with an energized outlet for the purpose of EV charging. The energized outlet shall be capable of supporting connection of Level 2 charging.
- multiple dwelling, multiple dwelling component of a multiple-use development, or rowhouse, all parking spaces provided for residential use, excluding visitor parking spaces, shall be provided with an energized outlet installed adjacent to the space, for the purpose of EV charging. The energized outlet shall be capable of supporting connection of Level 2 charging.

For all new non-residential buildings (Group A, B, D, E and F occupancies), 20% of parking spaces provided for non-residential use shall be provided with an energized outlet adjacent to the parking space, for the purpose of EV charging.

Where an EVEMS is implemented, a minimum charging performance requirement to ensure sufficient rate of charging, shall apply. [**NOTE:** *Such a charging performance requirement would need to be developed by a qualified entity and referenced in this code change. EVEMS represent a compromise between electrical infrastructure costs and charging performance. Development of charging performance requirements is necessary to ensure a reasonable compromise is achieved. Charging performance requirements may vary from region to region. Major factors include daily driving distance, topography, temperature, and vehicle types/efficiency. Performance requirements will dictate the minimum amount of electrical load to serve EVs, and thus the size of electrical systems and associated costs.*]

Definitions:

Electric vehicle (EV) 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 supply equipment (EVSE) 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 EV.

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

⁴⁵ This language is derived from the City of Vancouver's Parking Bylaw provisions, with some changes made to include driveway parking areas, and EVEMS.

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.

Appendix 5: Model Bylaw

See below for model bylaw and commentary published by AES Engineering.



AES

Designing A Better Tomorrow

REPORT FOR EV Charging Model Bylaw

AUTHORED BY:

Don Chandler, B.Sc.

PEER REVIEWED BY:

Royce Bernard, P.Eng., P.E., RCDD, LEED AP

SUBMITTED BY:

AES Engineering Ltd.
1330 Granville Street
Vancouver, BC V6Z 1M7
P 604.569.6500 F 604.569.6501
www.AESEngr.com

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1. GENERAL

The following document provides model bylaw and supporting bulletin examples, based on adopted bylaws of municipalities in Metro Vancouver requiring 100% EV Ready infrastructure.

2. MODEL BYLAW

DEFINITIONS:

Electric vehicle (EV) 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 supply equipment (EVSE) 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.

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

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 EVEMS.

REQUIREMENTS:

All new buildings, uses, structures, major renovations, and parking spaces for use by residential occupancies including car-share spaces, (excluding visitor parking spaces), shall have an energized outlet installed adjacent to the space for the purpose of electric vehicle charging.

Ten (10) percent of all new parking spaces serving commercial, industrial, and institutional occupancies shall have an energized outlet installed adjacent to the space for the purpose of electric vehicle charging.

The electrical infrastructure shall include cold jaw revenue metering that provides for apportioning of energy costs to persons when EVSEs are installed.

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

Commented [Don Chand1]: Level 2 is defined as 208/240 volts and 20 amp to 100 amp rating.

Commented [Don Chand2]: Applies to all building types, including single family houses (SFH), MURBs, etc. All residents should be treated equal. There is necessity for separate rules for SFH and MURBs. Change of use, and renovations should also trigger this bylaw. All residential buildings should be included, for development, building, and electrical trade, permits.

Commented [Don Chand3]: BC Utilities Commission Act designates that sale is for use by owners only (not visitors). This is proposed to be changed as a result of the BCUC investigation into EVs. Consideration of who pays and how to bill visitors is an issue for stratas.

Commented [Don Chand4]: Strata Act Regulations define the boundary between the unit owned space and the common wall. The EVSE may be mounted on that line or in the neighbours space. Adjacent is vague enough, but also restrictive as to location.

Commented [Don Chand5]: Or an appropriate percentage for any other land use. A table could be utilized. Staff spaces may be undefined, so some way to provide for staff, not visitors such as a retail mall vs office. Where solar energy is prevalent, more commercial charging should be considered. Dwell time or duration of stay is relevant to performance.

Commented [Don Chand6]: One revenue meter for EV charging loads, per building, is intended, and supported by BC Hydro. A strata is a person as are the members. EVSE meters are not revenue grade but apportioning based on any estimate is allowed by Strata Property Act and BC Hydro, though Measurement Canada is not conclusive on this issue. Cold jaw indicates a disconnect switch before the meter for improved maintenance safety.



The municipality may specify utility and billing communication protocols, minimum charging performance, and/or management guidelines. |

Commented [Don Chand7]: Defer to a bulletin to enable efficient changes and variances by the municipality.

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. 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. |

Commented [Don Chand8]: Recent information reveals that some buildings in Vancouver have not installed the required number and EV owners are now disadvantaged. Plan checkers are not always familiar with electrical requirements, increasing the challenge associated with enforcement. The intent of the statements is to assist in ensuring the requirements are implemented.

3. BULLETIN

REQUIREMENTS:

The energized outlet shall be capable of providing Level 2 charging. Where an EVEMS is employed, charging performance shall comply with the following performance requirements.

Commented [Don Chand9]: Level 2 is typically necessary as a minimum, with some isolated exceptions, even at home. 20A-50A is typically sufficient. >(20+ km overnight average) Level 1 is typically insufficient.

EVSEs are to support OCPP protocols for utility signals and transmission of billing data.

PERFORMANCE:

The electrical installation is to provide adequate charging performance to ensure full charging daily, over the average times available for charging at the residence or workplace. The requirement represents the ability to fully charge 90 per cent of the time, based on daily driving distance statistical distribution, elevation variation, temperature, available charging time, average driving speeds, vehicle mix and efficiencies, and charging efficiencies.

Commented [Don Chand10]: Europe has generally implemented OCPP, as has the US, and NRCAN and the Ministry of Transportation is supportive of adoption. The protocol addresses billing as well as load control signals from the utility. Load signals are necessary for SFHs, and billing for MURBs.

The following table outlines minimum charging performance but does not preclude implementation of alternate configurations to meet the intent of the requirements.

Commented [Don Chand11]: Based on SFU study for arrival time home distribution.

Commented [Don Chand12]: 90th percentile is three days a month, which is sufficient for the next day commute. Probability of requiring more on 2 consecutive days is $0.1 * 0.1 = 1\%$.

Commented [Don Chand13]: 233 Watt hrs / km is average.

Commented [RB14]: Charging performance requirements for the specific municipality should replace the example table included.



MINIMUM CIRCUIT BREAKER RATING (AMPS)	NUMBER OF EVSE PER CIRCUIT	
	CITY CENTRE (25 VKT)	OUTSIDE CITY CENTRE (39 VKT)
20	1	N/A
30	3	1
40	4	3
50	6	4
60	7	5
70	9	6
80	11	8
90	12	9
100	14	13
125	16	13
150	20	16

Table 1: Minimum charging performance

Refer to the following information for proposed management guidelines.

MANAGEMENT GUIDELINES:

The following management guidelines are recommended, as a minimum:

- § The party responsible for EVSE purchase and installation is clearly delineated, and appropriate permissions procedures outlined;
- § EVSE ownership is established as a fixture or chattel;
- § Means for reconciliation of electricity costs are established, consistent with the Utilities Commission Act of BC and the Strata Property Act of BC;
- § Billing rules are established;
- § Designation that where an EVEMS is implemented, the EVSE must be compatible with that EVEMS;
- § Requirements for labelling of outlets and panels is designated to avoid conflicting use, as per the electrical code and requirements of the AHJ;
- § Where EVEMS is implemented, provisions for management and maintenance are to be provided.

Commented [RB15]: Based on Richmond studies of strata and Utilities Commission rules. Addition of right-to-charge designation would prove beneficial.

Commented [Don Chand16]: Installations will not operate with incompatible management systems controlling the same equipment or circuits.



In order to ensure the issues are managed appropriately, an owner-developer is required to file strata bylaws at the Land Title Office, establishing mechanisms the strata proposes to manage EV charging, assuring billing does not exceed the utility charges for electricity, any common meter is registered to the strata corporation (and its members), and that the management issues are addressed.

For strata bylaw examples refer to Appendix A. For additional information on strata bylaw development, refer to the following guides:

- § *City of Richmond Electric Vehicle Charging Infrastructure in Shared Parking Areas: Resources to Support Implementation & Charging Infrastructure Requirements;*
- § *City of Richmond Residential Electric Vehicle Charging: A Guide for Local Government.*



APPENDIX A: BYLAW EXAMPLES



GENERAL

The following municipalities have either adopted, or in the process of adopting, EV charging bylaws requiring installation of an energized outlet for 100% of parking stalls for new residential construction.

- § City of Burnaby;
- § City of Coquitlam;
- § Township of Langley;
- § City of Maple Ridge;
- § City of New Westminster;
- § City of North Vancouver;
- § District of North Vancouver (preliminary stages);
- § City of Richmond;
- § City of Surrey;
- § City of Vancouver.

The City of Richmond was the first municipality to adopt the requirement to accommodate 100% of parking stalls, with the effective date of April 1, 2018, with the City of Vancouver, City of Coquitlam, and others following.

The bulletin prepared by the City of Richmond designated a minimum charging performance of 12kWh in an eight-hour overnight charging period, which represents a maximum of 4 chargers on a 40A circuit. The City of Surrey, City of Coquitlam, and City of Burnaby have performed charging performance assessments, resulting in different requirements, with the intent of incorporating into subsequent bulletins.

Follow is a copy of the municipality bylaws, and bulletins where developed.



CITY OF RICHMOND

BYLAW:

7.15 Provision of Electric Vehicle Charging Infrastructure [Bylaw 9756, Dec 18/17. Effective April 1/18.

1. 7.15.1 *For new buildings, structures and uses, all residential parking spaces, excluding visitor parking spaces, shall feature an energized outlet capable of providing Level 2 charging or higher to the parking space. [Bylaw 9756, Dec 18/17. Effective Apr 1/18]*
2. 7.15.2 *Energized outlets, provided pursuant to section 7.15.1 above, shall be labeled for their intended use for electric vehicle charging. [Bylaw 9756, Dec 18/17. Effective Apr 1/18]*
3. 7.15.3 *Where an electric vehicle energy management system is implemented, the Director of Engineering may specify a minimum performance standard to ensure a sufficient rate of electric vehicle charging. [Bylaw 9756, Dec 18/17. Effective Apr 1/18]*

BULLETIN:

Applies to new residential buildings, or new residential use.

Adopted Dec 18, 2017, Effective April 1, 2018, in stream developments exempt while permit valid, Pre-adoption permit applications and endorsed within 6 months have until Dec 15, 2019 to receive permit and still be exempt.

NOTES FROM WEBSITE:

- § SFH duplex, townhouses with private parking: Level 2 40A shared up to 4 adjacent.
- § Apartments, townhouses with shared parking: Level 2 dedicated or managed.
- § Managed: 12 kWh per space over 8 hours overnight with all spaces in use. e.g. 4 share on 40A.
- § EVEMS must provide communications.
- § Strata rules for who owns / installs / pays for EVSEs. Compatibility of EVEMS and EVSEs.
- § Electric Vehicle Charging Infrastructure in Shared Parking Areas: Resources to Support Electric Vehicle Charging Infrastructure Implementation & Requirements
- § Billing established. Single separate utility meter.



CITY OF VANCOUVER

PARKING BY-LAW

SECTION 2 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 Supply Equipment means 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;

Energized Outlet means a connected point in an electrical wiring installation at which current is taken and a source of voltage is connected to supply utilization equipment;

Level 2 Charging means a Level 2 electric vehicle charging level as defined by SAE International's J1772 standard;

SECTION 4 OFF STREET PARKING SPACE REGULATIONS

4.14 Required Parking Spaces of Electric Vehicle Charging

4.14.1 For each:

- a) one-family dwelling, two-family dwelling, one family or two family dwelling with a secondary suite or lock off unit, rowhouse and laneway house, each storage garage or carport shall be provided with an energized outlet capable of providing Level 2 charging or higher to the storage garage or carport, except where the provisions of Sentence 10.4.3.(2) of Division B of Building By-law apply;
- b) multiple dwelling, multiple dwelling component of a multiple-use development, or rowhouse, all parking spaces provided for residential use, excluding visitor parking spaces, shall be provided with an energized outlet capable of providing Level 2 charging or higher to the parking space;
- c) commercial building or commercial component of a multiple-use development with ten or more parking spaces, a minimum of one parking space for every ten parking spaces, plus one space for any additional parking spaces that number less than ten, shall be provided with an energized outlet capable of providing Level 2 charging or higher to the parking space; and
- d) commercial building or commercial component of a multiple-use development with less than ten parking spaces, a minimum of one parking space shall be provided with an energized outlet capable of providing Level 2 charging or higher to the parking space.



4.14.2 Energized outlets provided pursuant to section 4.14.1 above shall be labeled for their intended use for electric vehicle charging and installed in conformance with Sentence 10.4.3.1(1) of Division B of the Building By-law.

VANCOUVER BUILDING BY-LAW SECTION 10.4. ELECTRIC VEHICLE CHARGING

10.4.3. Electric Vehicle Charging for Buildings.

10.4.3.1. Electrical Service and Capacity (See Appendix A).

- 1) The electrical installations, including the service capacity of the installation, the number and distribution of circuits and receptacles, shall meet the requirements of the "Electrical Safety Regulation."

Book 1 - Replacement Pages: September 10, 2018. In Book 1, Division B, Part 10, Council strikes out Sentences (2) through (6) of section 10.4.3.1. and substitutes the following:

- 2) Where the requirements of section 4.14.1(a) of the Parking By-Law would cause the dwelling unit calculated load to exceed 200 A in one-family dwellings, two-family dwellings, one-family dwellings with secondary suite or a lock-off unit, two family dwellings with secondary suites or a lock-off unit, row housing, or laneway houses, the installation of an energized outlet for Level 2 charging may be omitted provided that a minimum nominal trade size of 21 raceway supplied with pull string leading from the dwelling unit panelboard to an electrical outlet box is installed in the storage garage or carport and is labelled to identify its intended use with the electric vehicle supply equipment.
- 3) Where an electric vehicle energy management system is implemented, Chief Building Official may specify a minimum performance standard to ensure a sufficient rate of electric vehicle charging.

5. In Book 1, Division B, Part 10, Council strikes out section 10.4.3.2., Electrical Rooms.

CITY OF BURNABY

ZONING BY-LAW 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 used to control electric vehicle supply equipment loads through the process of connecting, disconnecting, increasing, or reducing electric power to the loads and consisting of any of the following: a monitor(s), communications equipment, a controller(s), a timer(s), and other applicable device(s).



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 and a source of voltage is connected to supply utilization equipment.

Level 2 Charging means a Level 2 electric vehicle charging level as defined by SAE International's J1772 standard."

ZONING BY-LAW 800.8 PROVISION OF ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

No. 13903 Page 1

1. (1) All parking spaces required for dwelling units pursuant to Section 800.4 shall include an energized outlet capable of providing Level 2 charging or a higher charging level for an electric vehicle, except:
 - (a) parking spaces for visitor parking;
 - (b) parking spaces for secondary suites;
 - (c) existing or new parking spaces for existing dwelling units; and
 - (d) all parking spaces required for dwelling units included in a development for which, on or before 2018 September 1:
 - (i) the Rezoning Bylaw for the development has received Second Reading;
 - (ii) a building permit application has been submitted for the development in accordance with the City's Building Bylaw; or
 - (iii) a preliminary plan approval application has been submitted for the development in accordance with Section 7.3 of this Bylaw.
- (2) Energized outlets provided pursuant to Section 800.8(1) above shall be labeled for the use of electric vehicle charging.
- (3) The Director Planning and Building may specify requirements for technical matters, including but not limited to metering, and performance standards for electric vehicle energy management systems.



- (4) *The Director Planning and Building may issue a variance for the requirements under this Section 800.8 in exceptional circumstances where compliance with the requirements is demonstrated to not be feasible."*

BULLETIN: ELECTRIC VEHICLE (EV) CHARGING BYLAW

The purpose of this Bulletin is to notify owners, designers and contractors of the new requirement for Electric Vehicle Charging outlets.

Effective 2018 September 01, all required parking spaces for new dwelling units, including single, two and multi-family dwellings, but excluding visitor and secondary suite parking spaces, shall be provided with an energized outlet capable of providing Level 2 charging for an electric vehicle.

This requirement does not apply to developments that have applied for a building permit or preliminary plan approval or have an active rezoning application that has advanced past Second Reading prior to 2018 September 01. It also does not apply to new parking spaces servicing existing dwelling units.

The location of all EV charging outlets shall be indicated on the drawings submitted for building permit. Building permit application, other than single- and two-family dwellings, shall also include electrical drawings of the EV charging system, signed and sealed by a professional engineer. Each energized outlet must be labelled for its intended use.

BULLETIN: BURNABY ELECTRIC VEHICLE (EV) CHARGING INFRASTRUCTURE TECHNICAL BULLETIN REQUIREMENTS AND GUIDELINES FOR EV CHARGING BYLAW

Highlights include:

- § Parking areas that are individually serviced with electrical infrastructure directly from the adjacent private residence.
- § Each required parking space for a new dwelling unit, excluding those for secondary suites and visitor parking, must feature an energized outlet of 208-240V AC and minimum 40A circuit breaker.
- § The 2018 CEC includes new rules that recognize EVEMS; however, it has not yet been adopted by BC. In order to use the EVEMS prior to the adoption of the 2018 CEC, a request for an "alternative solution" submitted by a professional engineer to the Building Department is required.
- § The performance standard is:
 - The system must be capable of supplying a minimum performance level of 12 kWh average per EVSE, over an 8-hour period, assuming that all parking spaces are in use by a charging EV.



§ Communications Technology

- Projects implementing EVEMS must provide for communications technology necessary for the function of the chosen EVEMS (e.g. cellular repeaters, wireless access points, or cabled infrastructure).

§ Metering

- In buildings with shared parking areas, EV electrical infrastructure should be separately metered from the common areas so that stratas, building owners and BC Hydro can distinguish between common area electrical usage and EV charging electrical usage.

CITY OF COQUITLAM

BY-LAW 4905, 2018 TO AMEND ZONING BYLAW NO. 3000, 1996

Electric Vehicle Energy Management System means a system that controls the process of connecting, disconnecting, increasing and reducing electric power to electric vehicle supply equipment loads, and which system may be comprised of one or more monitors, communications equipment, controllers, timers 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.

This Section sets out the minimum number of parking spaces required pursuant to this Part that must also be equipped each with an energized outlet for an electric vehicle.

Each energized outlet required under this Section 714 must provide level 2 charging or higher.

Where an electric vehicle energy management system is implemented, the Director of Development Services may specify a minimum performance standard to ensure a sufficient rate of electric vehicle charging.

(a) Apartment, Townhouse, Street-Oriented Village Home Residential.

The lesser of: (i) the number of dwelling units; and (ii) 100% of the number of spaces required pursuant to this Part, excluding parking spaces designated for visitors.

Additional Requirement: Any energized outlets required under this Section 714 must be provided in parking spaces designated for residents, not visitors.

Electric Vehicle Charging Infrastructure Requirements Guide:



Performance standards are based on ensuring EVs are fully charged 90% of the time from overnight charging, and sufficiently charged for the subsequent day driving, greater than 99% of the time.

NUMBER OF EVSE PER CIRCUIT	MINIMUM CIRCUIT BREAKER RATING (AMPS)
1-3	40
4	50
5	60
6	70
7	80
8	90
9	100
10	110
11-12	125
13-15	150
16-19	175
20	200

Where the feeder ampacity exceeds the rating of the equipment (e.g. 40A EVSE connected to a 100A feeder), a local circuit breaker is required to provide overcurrent protection.

Where an EV energy management system is implemented, communications technology necessary for the function of an EV energy management system, such as cellular, wireless, or cabled infrastructure, must be provided.

ENERGIZED OUTLET LABELS FOR EV CHARGING

All energized outlets must be labeled for their intended use for EV charging.

BC HYDRO METERING

The EV load should be metered separately from the common house or building load. Energized outlets may be connected to a single BC Hydro meter that is separate from other meters. Alternatively, energized outlets may be connected to a dedicated BC Hydro meter socket for each outlet.

FUTURE RETROFITTING

The EV infrastructure shall be designed such that it is scalable for future retrofitting to provide for energized outlets in 100% of resident parking spaces. To meet this design standard, all infrastructure needed in the electrical room shall be provided, but the implementation will be such that one space per dwelling unit features an energized outlet capable of providing Level 2 charging or higher.



To ensure all design standards are met, the parking plan or related plan submitted with the Development Permit shall show the location of all energized outlets and include the following notes:

- § "All energized outlets shall be labeled for their intended use for electric vehicle charging";
- § How the electric vehicle load will be metered and confirmation that the apportioning of energy costs to persons when charging stations are installed is available;
- § Confirmation from an electrical engineer that the EV infrastructure is designed such that it is scalable for future retrofitting to provide for energized outlets in 100% of resident parking spaces;
- § Where an EV energy management system has been implemented;
 - Confirmation from an electrical engineer that the performance standard will be met;
 - Confirmation from an electrical engineer that communications technology necessary for the function of the energy management system has been provided.

In addition, a letter signed and sealed by an electrical engineer shall be submitted with the Building Permit application confirming that the design of the EV charging infrastructure meets Zoning Bylaw requirements and the design standards outlined above. Once construction is complete, a letter signed and sealed by an electrical engineer shall be provided confirming that the EV charging infrastructure was installed and meets Zoning Bylaw requirements and the design standards outlined above.

MANAGEMENT OF EV CHARGING

Following are guidelines for the management of the EV charging infrastructure that must be established by the developer:

- § Clear delineation of the party responsible for paying for the charging station and its installation and the permission procedures to do so;
- § Charging station ownership;
- § A means to reconcile common parking area only electricity costs to individual drivers that is consistent with the Utilities Commission Act of BC;
- § Billing rules; and
- § In cases where an EV energy management system is implemented, charging stations that are compatible with the EV energy management system will be installed and the EV energy management system is installed, managed and maintained. Outlets and the panels are appropriately labelled to avoid conflicting use, as per the electrical code.

For strata developments, the above items must be addressed in the strata bylaws.



CITY OF NEW WESTMINSTER

CORPORATION OF THE CITY OF NEW WESTMINSTER ZONING AMENDMENT BYLAW (Electric Vehicle Charging Infrastructure in Residential Buildings) NO. 8040, 2018

A Bylaw to Amend Zoning Bylaw No. 6680, 2001

WHEREAS the Council has adopted a zoning bylaw under Part 14 of the Local Government Act, and wishes to amend the bylaw,

The CITY COUNCIL of the Corporation of the City of New Westminster, in open meeting assembled, ENACTS AS FOLLOWS:

- 1. This Bylaw may be cited for all purposes as "Zoning Amendment Bylaw (Electric Vehicle Charging Infrastructure in Residential Buildings) No. 8040, 2018.*
- 2. Zoning Bylaw No. 6680, 2001 is amended at Section 120 [Definitions], by adding the following definitions in alphabetical order.*

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 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.

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.

Energized Level 2 Outlet means a connected point in an electrical wiring installation at which Level 2 service is taken to supply utilization equipment (with Level 2 defined by SAE International's 11772 standard).

- 3. Zoning Bylaw No. 6680, 2001 is further amended by adding the following after section 150.77:*

"Provision of Electric Charging Infrastructure

150.78 For new buildings that contain at least one dwelling unit, all residential parking spaces and spaces for co-operative vehicles, shall feature an energized Level2 outlet or higher to the parking space. Energized Level 2 outlets will not be required for visitor parking spaces.

150.79 Energized Level 2 outlets, provided pursuant to section 150.78 above, shall be labeled for their intended use for electric vehicle charging.



150.80 Where an electric vehicle energy management system is implemented, the Director of Engineering may specify a minimum performance standard to ensure a sufficient rate of electric vehicle charging.

150.81 For spaces dedicated to co-operative vehicles, the Director of Engineering may specify a minimum performance standard to ensure a sufficient rate of electric vehicle charging."

7. Zoning Bylaw No.6680, 2001 is further amended by replacing Section 150.74 with the following:

"Parking for Co-operative Vehicles

150.74 If one co-operative vehicle and one co-operative vehicle parking space are provided for any multiple unit dwelling, then the overall number of off-street parking spaces may be reduced by five (net reduction of four spaces) parking spaces for each co-operative vehicle and co-operative vehicle parking space up to a maximum of 10% of the parking required."

8. Zoning Amendment Bylaw (Electric Vehicle Charging Infrastructure in Residential Buildings) No. 8040, 2018 is effective as at April 1, 2019.

Bulletin and Performance Requirement are under development.

CITY OF NORTH VANCOUVER

1. This Bylaw shall be known and cited for all purposes as "Zoning Bylaw, 1995, No. 6700, Amendment Bylaw, 2018, No. 8693" (Electric Vehicle Charging Infrastructure).

2. Zoning Bylaw, 1995, No. 6700" is hereby amended as follows:

a. Division 1: Part 2: Interpretation by adding the following definitions in alphabetical order:

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 used to control electric vehicle supply equipment loads through the process of connecting, disconnecting, increasing, or reducing electric power to the loads and consisting of any of the following: a monitor(s), communications equipment, a controller(s), a timer(s), and other applicable device(s).

Energized Outlet means a connected point in an electrical wiring installation at which current is taken and a source of voltage is connected to supply utilization equipment.

Level 2 Charging means a Level 2 Electric Vehicle charging level as defined by SAE International's J1772 standard.



1. Division IV: Part 9: Parking and Access Regulations by adding the following section after 908:

909 Provision of Electric Vehicle Charging Infrastructure

- (1) All parking spaces required for Residential Uses in accordance with Figure 9-3 – Minimum Parking Provision by Class of Building and parking spaces for Shared Vehicles, shall include an Energized Outlet capable of providing Level 2 charging or a higher charging level for an Electric Vehicle, except:
- (a) parking spaces for Visitor Parking; and
 - (b) parking spaces for Accessory Secondary Suite Use.
- (2) Energized Outlets provided pursuant to Section 909(1) above shall be labeled for the use of Electric Vehicle charging.
- (3) Where an Electric Vehicle Energy Management System is implemented, the Director of Planning may specify a minimum performance standard to ensure a sufficient rate of Electric Vehicle charging.

This Bylaw shall be effective as of the 1st day of June, 2019.

No performance standard or bulletin is apparent as of Jan 6, 2019.

CITY OF MAPLE RIDGE

CITY OF MAPLE RIDGE BYLAW NO. 7489-2018

A Bylaw to amend the text of Maple Ridge Off-Street Parking and Loading Bylaw No. 4350- 1990 as amended.

WHEREAS, it is deemed expedient to amend the Maple Ridge Off-Street Parking and Loading Bylaw No. 4350-1990 as amended:

NOW THEREFORE, the Municipal Council of the City of Maple Ridge, enacts as follows:

1. This Bylaw may be cited as "Maple Ridge Off-Street Parking and Loading Amending Bylaw No. 7489-2018".
2. That Bylaw No. 4350-1990 Part 1 Interpretation, Definitions be amended by inserting the following after "1.2 d)":
 - e) Level 2 charging as defined by the SAE International's J1772 standard;



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

That Bylaw No. 4350-1990 Part II General Requirements be amended by deleting "2.3" and replacing with the following:

2.3 For this bylaw:

- (a) When calculation of the required number of off-street parking spaces results in a fractional parking space, one (1) off-street parking space shall be provided to meet the fractional requirement; and*
- (b) When calculation of the required number of parking spaces to be provided with an energized outlet capable of providing electric vehicle charging results in a fractional parking space, one (1) off-street parking space and the corresponding electric vehicle charging requirement shall be provided to meet the fractional requirement.*

That "Schedule "F"" is inserted following "Schedule "E"":

1.0 Electric Vehicle Charging Infrastructure Requirements:

1.1 For each:

- a) One-family residential, two-family residential, triplex residential, fourplex residential, courtyard residential, Townhouse and Street Townhouse residential use, a minimum of one parking space per dwelling unit shall be provided with an energized outlet capable of providing Level 2 charging;*
- b) Apartment use, not including Townhouse, in all CD zones as well as in the RM-2, RM-3, RM-4, RM-5, RM-6, C-1, C-2, C-3, C-5, CS-1, H-1, H-2, and CRM zones, each parking space provided for residential use, excluding visitor parking spaces, shall be provided with an energized outlet capable of providing Level 2 charging;*

APPENDIX B:

- c) Apartment and Townhouse use in all CD zones as well as in the RM-1, RM-2, RM-3, RM-4, RM-5, RM-6, C-1, C-2, C-3, C-5, CS-1, H-1, H-2, and CRM zones, a minimum of 50% of required visitor parking spaces shall be provided with an energized outlet capable of providing Level 2 charging;*
- d) Commercial and institutional uses with 10 or more required off-street parking spaces, a minimum of 10% of the parking spaces shall each be provided with an energized charging station capable of providing Level 2 charging.*



1.2 Energized outlets and charging stations provided pursuant to Section 1.1 above shall be installed in conformance with the B.C. Electrical Code.

1.3 Visitor and commercial and institutional use parking spaces provided with energized outlets and/or charging stations shall be clearly marked "EV Charging Only" and installed in conformance with the City of Maple Ridge Sign Bylaw No.4653-1992.

Maple Ridge Off-Street Parking and Loading Bylaw No. 4350-1990 as amended is hereby amended accordingly.

CITY OF SURREY

CITY OF SURREY BYLAW NO. 12000

Part 5, Parking and Loading/Unloading

Amend Section A. General Requirements, as follows:

- Insert a new Sub-section 7 as follows:

7. Provision of Electric Vehicle Charging Infrastructure

- (a) Every owner of a new *building* or a *building* containing a new use, must construct and install for every residential *parking space*, 50% of visitor *parking spaces*, and 20% of commercial *parking spaces*, an energized electrical outlet capable of providing Level 2 or a higher level of electric *vehicle* charging, as defined by SAE International's 11772 standard, as amended or replaced from time to time, for each such *parking space*; or
- (b) The owner of a *building* referred to in sub-section 7.(a) must install an electric *vehicle* energy management system that controls electrical loads for the electrical *vehicle* supply equipment with a minimum performance standard approved by the City to ensure a sufficient rate of electric *vehicle* charging; and
- (c) The owner of a *building* referred to in sub-sections 7.(a) and (b) must label each such energized electrical outlet for its intended use for electric *vehicle* charging; and
- (d) The requirements set out in section 7.(a) through (c) apply to the owners in accordance with the transitional provisions set out in Schedule J, Table J.1 of this By-law.