VILLAGE OF RIVER FOREST
SUSTAINABILITY COMMISSION

Tuesday, September 12, 2023 – 7:00 PM
Village Hall – 400 Park Ave., River Forest, IL

You may submit your written public comments via email in advance of the meeting to: sjansen@vrf.us
You may listen to the meeting by participating in a Zoom conference call as follows: dial-in number: 312-626-6799 with meeting ID: 816 4491 8569 or by clicking here. If you would like to speak during public comment, please email sjansen@vrf.us by 4:00 PM on Tuesday, September 12, 2023.

AGENDA

1. Call to Order/Roll Call
2. Public Comment
3. Adoption of Meeting Minutes for August 22nd, 2023
4. Commissioner Updates
5. Working Group Reports
6. Electric Vehicle Charging
    a. EV Infrastructure Network Study
    b. EV Readiness Cohort
7. Communications
8. Other Business
9. Schedule Next Meeting – October 10, 2023
10. Adjournment

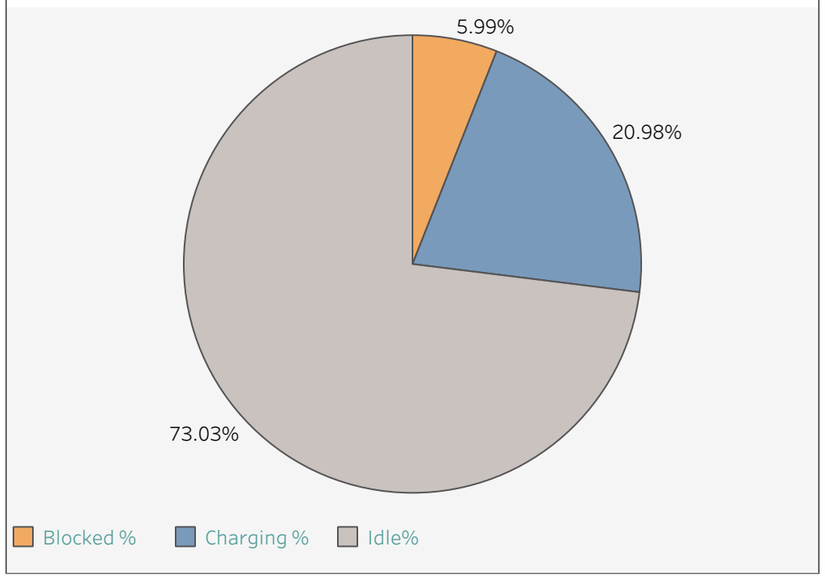
Assure Station Metrics Monthly Reporting

Village of River Forest IL - Monthly Report - July 2023

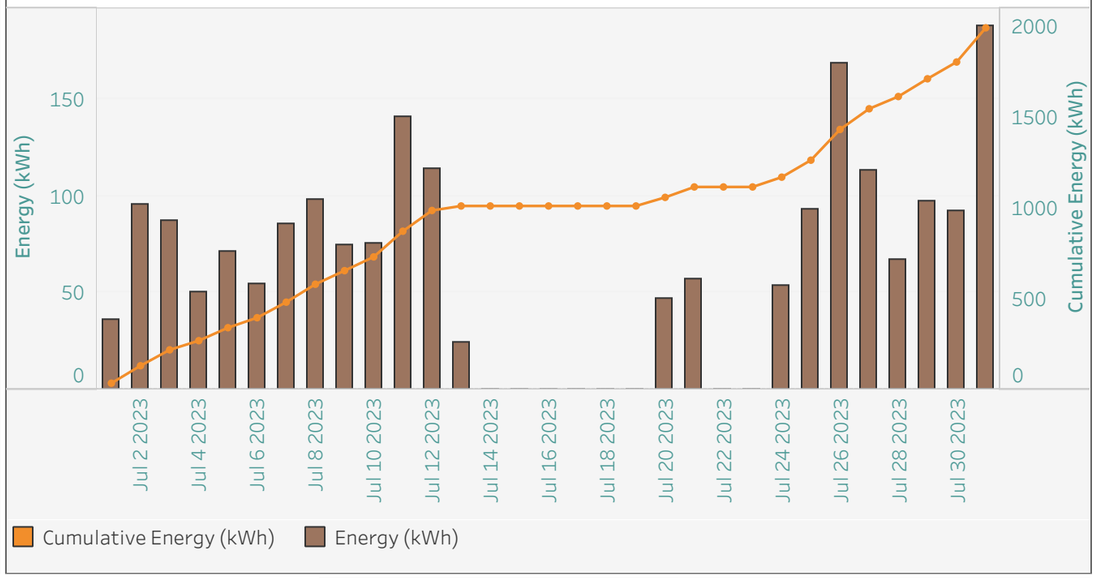
Company Id: 153681
Port Level: All
Organization Name: All
Month End Date: 7/31/2023

Port Count	Station Count	Total Revenue ($)	Energy (kWh)	GHG Savings (kg)	Gasoline Saved (Gal)	Unique Driver	Session Count
2	1	0	1,987	835	249	25	108

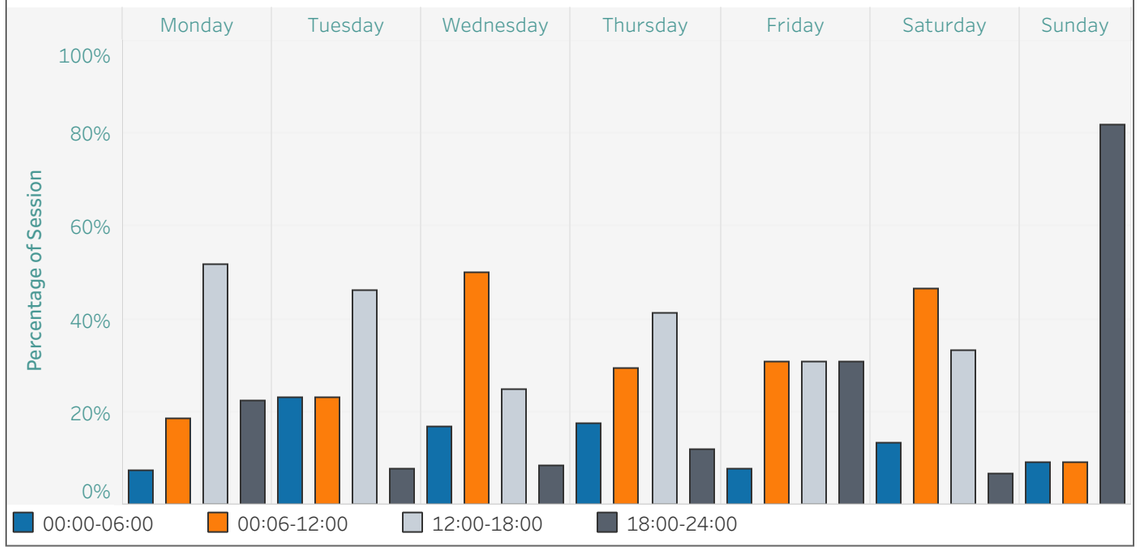
Port Utilization: 24 Hours



Energy Dispensed (kWh) by Day



Session Starts by Time of Day Month



Average Session Duration (Hours)	3.72
Average Session Charge Time (Hours)	2.89
Average Session Energy (kWh)	18.40
Average Session Revenue ($)	0.00
Occupied Hours	401.2
Charging Hours	312.1

Assure Station Metrics Reporting
Appendix

Port Utilization Chart: This is a view of station utilization during common business hours.
You can use this information to determine if updates need to be made to pricing / access policies or if stations should be added.

Session Start Distribution Chart: This is a view (by day) of what times drivers start sessions.
You can use this information to fine tune time of day pricing policy rules.

Station / Port Count: In order to be counted, a station must have the "Assure" entitlement applied.
This is the number of stations / ports that currently have the "Assure" entitlement.

Total Revenue: This is the sum of session fees generated by your "Assure" stations minus the ChargePoint service fee (10%).
This is based on session dates (not transaction date which may differ). Your Flex Billing reports should be used for financial reporting.

Energy (kWh): All energy dispensed through your "Assure" stations.
This data point can be useful in reconciling station energy against energy bills.

GHG Savings (kg): All the green house gasses (95% CO2) that would have been released had the miles provided by your stations come from gasoline.
This data point can be useful in sustainability reporting.

Unique Drivers: The number of unique drivers that used your stations this month (a driver would be counted only once even if they used different RFID cards).
An understanding of the number of unique drivers visiting may be useful in creating station messaging / video ads.

Gasoline (Gal) Saved: All the gasoline that would have been burned had the miles provided by your stations come from gasoline.
This data point can be useful in sustainability reporting.

Uptime: Percentage of time that your ports were capable of dispensing power.
ChargePoint is committed to keeping your ports dispensing power 98% of the time or better.

Sessions: Total session count.
An understanding of the number of times your stations authorize a session can be useful creating station messaging / video ads.

Average Session Duration: Average amount of time drivers occupy your stations.
This data point can be useful in fine tuning length of stay pricing policy rules.

Average Charging Time: Average amount of time per session energy is flowing.
This data point can be useful in fine tuning length of stay pricing policy rules.

Average Session Energy: Average amount of energy dispensed.
This data point can be useful in fine tuning price per kW pricing policy rules.

Average Session Revenue: Average session fee - 10%.
This data point can be useful in fine tuning minimum & maximum values for pricing policy rules.

Total Hours Occupied: Sum of all session durations.
This is used in part to determine utilization.

Total Hours Charging: Sum of all session charging durations.
This is used in part to determine utilization.

VILLAGE OF RIVER FOREST
SUSTAINABILITY COMMISSION
TUESDAY, AUGUST 22, 2023

A regular meeting of the Village of River Forest Sustainability Commission was held on Tuesday, August 22, 2023 at 7:00 p.m. in the Community Room of Village Hall, 400 Park Avenue – River Forest, IL.

1. CALL TO ORDER/ROLL CALL

The meeting was called to order at 7:03 PM. Upon roll call, the following persons were:

Present: Chairperson Simon, Commissioners Charrette, Cheng, Drury, Kopelow, Veazie, and Student Commissioner Stierwalt.
Absent: Commissioner Lennon
Also Present: Management Analyst Seth Jansen

2. PUBLIC COMMENT

None.

3. ADOPTION OF MEETING MINUTES

Commissioner Charrette requested the Commission Reports section of the minutes be divided into shorter paragraphs, but no changes to the text of the minutes were made. Chairperson Charrette made a motion, seconded by Commissioner Veazie to approve the meeting minutes as amended from July 11, 2023.

Roll Call:
Ayes: Chairperson Simon, Commissioners Charrette, Cheng, Drury, Kopelow, Veazie
Absent: Commissioner Lennon
Nays: None
Motion Passes.

4. COMMISSIONER REPORTS

The Commission discussed the monthly LRS report and monthly ChargePoint report included in the meeting packet. Commissioner Kopelow asked if ChargePoint reports could be provided to show the rolling average usage over the course of the year.

Commissioner Drury raised the topic of creating waste reduction posters to shared in public settings and with partnering institutions, specifically sharing such posters at Library coffee talks.

The Commission discussed filling the vacant Student Commissioner seat. Student Commissioner Stierwalt said he would share the application with the Oak Park and River

Forest High School Environmental Club. The Commission also agreed the application should be shared with Fenwick High School and Trinity High School.

Commissioner Charrette discussed attending the Oak Park's 1st anniversary meeting of their Climate Ready Plan.

The Commission discussed the proposed working groups and finalized the topics and assignments: Commissioners Charrette and Kopelow would be the electrification working group, Commissioners Veazie and Lennon would be the renewable energy working group, and Commissioners Drury and Cheng would be the waste working group. Chairperson Simon would serve as the lead for any items assigned to the Commission by the Village Board of Trustees. Commissioner Cheng noted that the working groups could be used to bring in resident volunteers who may have an interest in a particular topic.

Commissioner Veazie noted that he and Commissioner Lennon had already met as the renewal energy and provided a brief overview of that discussion. They agreed the 3 priority projects would be community solar, rooftop solar, and local renewables. The local renewables focus would include finding opportunities to partner with the schools and park district in utilizing renewable energy as well as identifying any opportunities for geothermal.

5. PROPOSED POLYSTYRENE ORDIANCE

Chairperson Simon introduced the draft ordinance, summarized recent activities of the Commission on the topic, and outlined the process moving forward with the Village Board. Commissioner Kopelow noted that the reference to "gross income" should instead state "total income" to remain consistent with the terms used by the IRS.

Chairperson Simon made a motion, seconded by Commissioner Charrette to recommend to the Village Board of Trustees to approve an ordinance prohibiting the use of polystyrene foodware.

Roll Call:
Ayes: Chairperson Simon, Commissioners Charrette, Cheng, Drury, Kopelow, Veazie
Absent: Commissioner Lennon
Nays: None
Motion Passes.

6. COMMUNICATIONS

Mr. Jansen outlined recent newsletter topics and solicited input for upcoming newsletters. Commissioner Charrette volunteered to write the September monthly newsletter article on light pollution. The Commission agreed to include a reminder for electronic waste pickup sign-up as a weekly newsletter item. Commissioner Drury volunteered to write an weekly newsletter article on preventing littering at River Forest Parks. The Commission discussed the Guide to Sustainable Living webpage on the Village website and inquired about getting information on visits to the webpage.

7. OTHER BUSINESS

None.

8. SCHEDULE NEXT MEETING – SEPTEMBER 12, 2023

The Commission reached a consensus to hold its next meeting Tuesday, September 12, 2023.

9. ADJOURNMENT

Commissioner Charrette made a motion, seconded by Commissioner Drury to adjourn the meeting at 8:30 PM.

Roll Call:
Ayes: Chairperson Simon, Commissioners Charrette, Cheng, Drury, Kopelow, Veazie
Absent: Commissioner Lennon
Nays: None
Motion Passes.

_____
Seth Jansen, Secretary

Village of River Forest
Public Works and Development Services
400 Park Avenue
River Forest, IL 60305
Tel: 708-366-8500

MEMORANDUM

Date: September 12, 2023

To: Sustainability Commission

From: Seth Jansen, Management Analyst

Subj: Electric Vehicle Readiness Cohort

In the fall of 2022, the Metropolitan Mayors Caucus invited municipalities to participate in the new Electric Vehicle ("EV") Readiness Program to prepare to meet the growing demand for EVs and EV charging infrastructure. Qualifying local governments applied to join an EV Readiness cohort and receive free technical assistance and training in a variety of critical areas as they work toward the designation of "EV Ready Community." In November of 2022, the Village of River Forest applied for and was accepted into the 2nd cohort. The Village specifically sought the 2nd cohort as its start would coincide with the completion of the Village's EV Infrastructure Network Study.

Similar to the SolSmart program, local government members of the EV Readiness cohorts follow a pathway toward EV Ready Bronze, Silver or Gold by completing a number of actions presented in the EV Readiness Checklist. With guidance and resources assembled by the Caucus' EV Readiness Team, municipal leaders develop clear permitting for EV charging infrastructure, analyze zoning and parking codes to address barriers to EV infrastructure, engage the community, and participate in technical and safety training for staff.

Attached is the complete EV Readiness Checklist Actions Spreadsheet, detailing each action required to earn Bronze, Silver, and Gold designation, along with other actions which can be done to earn additional points. Below are specific action items which coincide strongly with the Sustainability Commission's mission relating to Community Outreach and Communications and are required for a specified designation level:

- **CE-1** Create and host an EV readiness landing page on municipal website. Required for Silver.
- **CE-1A** Communicate EV readiness commitment and actions to constituents. Required for Bronze.
- **A-3A** Provide consumer resources on EVs and EVCSs, to help residents make informed purchasing decisions by providing links on municipal EV readiness webpage or sharing

information, such as purchasing information, to the appropriate audience. Required for Silver.

- **MD-1A** Provide current information on incentives and grants to community by linking to IEPA rebate and info about federal tax credits. Required for Bronze.
- **MD-1D** Promote Property Assessed Clean Energy (PACE) financing to businesses for large-scale EVCS projects. Required for Gold.
- **UE-2A** Encourage all EV owners to register with utility by linking to ComEd's EV registration webpage. Required for Bronze.
- **UE-2B** Educate residents about dynamic rate offerings. Required for Silver by linking to ComEd's EV dynamic rate offerings webpage. Required for Silver.
- **PK-2A** Communicate provisions of Illinois Vehicle Code (ILCS 625 ILCS 5/11-1308) and/or local parking code regarding unauthorized use of EV-only parking by non-EVs at both public and private properties through communication via website, signage, brochure, social media, etc. Required for Bronze.
- **PK-6D** Identify and promote EVCS by sharing digital EVCS locating tools through EV webpage or print communication. Required for Silver.
- **ST-3** Provide EV and EVCS safety information to consumers by linking to such information on EV landing page. Required for Silver.

Given the Commission's recent work on the Guide to Sustainable Living on the Village website, development of an additional resource page specific to Electric Vehicle Readiness would be beneficial to both existing Commission goals and beginning implementation of actions outlined in the EV Readiness Cohort. As templates and resources are provided to staff, such information will be shared with the Commission members in the Electrification and Outreach subgroups to begin formulation of a draft EV Readiness page within the Guide.

Attachments:
EV Readiness Checklist Actions Spreadsheet

EV READINESS CHECKLIST ACTIONS

Action #	Objectives and Actions	Ac	
		Bronze	Silver
CR	COMMIT TO EV READINESS		
CR-1	Make a public statement in support of EV readiness.	5	
CR-2	Report baseline metrics, including power level and quantity of publicly accessible and municipally owned EVCSs; number of municipal EVs; and registered constituent-owned EVs.	5	
CR-3	Establish process for tracking and reporting meaningful EV and EVCS metrics over time.		
	COMMIT TO EV READINESS TOTAL POINTS POSSIBLE	10	0
ZP	ZONING AND PLANNING		
ZP-1	Evaluate zoning code to identify any barriers to safe, expedient EVCS development.	10	
ZP-2	Clearly classify EVCS in zoning regulations.		
ZP-2A	When EV charging is not the primary use of the site, classify the EV charging station as an **accessory use.**	5	
ZP-2B	When EV charging is the **primary use** of the site, establish new classification of retail EV charging facility or articulate suitable existing classification.		
ZP-3	Establish zoning regulations to facilitate EVCS installation and clearly communicate rules.		
ZP-3A	Define transportation electrification technologies (EVs, EVCSs) to be considered.		2
ZP-3B	Establish zoning regulations to facilitate EVCS installation, assuring it no more difficult to site EVCS than any other equipment or use, and clearly communicate rules.		5
ZP-3C	For EV charging stations that are the **primary use** of the site, update zoning code to allow these in most or all districts.		
ZP-3D	Establish new or articulate existing regulations for content and appearance of advertising on EVSEs.		5
ZP-3E	Establish new or articulate existing regulations for whether and under what conditions EV charging stations are allowed in the right of way.		5
ZP-3F	Establish new or articulate existing regulations for the appearance of public EVCSs.		5

ZP-3G	Clearly and concisely communicate EVCS zoning regulations to the public.		**2**
ZP-4	**Where minimum parking requirements exist, flex the number of required parking spaces to accommodate Level 2 and DCFC EVCS. (*Conditional Points*)**	**5**	
ZP-4A	Adapt the number of required parking spaces for parking areas with EV car sharing.		
	PLANNING		
ZP-5	**Plan for community EV readiness.**		
ZP-5A	Define EVCS policy as a public benefit.		
ZP-5B	Integrate EV readiness into relevant local plans, such as strategic plans, energy, climate, and/or comprehensive plans. Include goals, quantifiable metrics and/or specific actions. Communicate plans with the utility.		
ZP-5C	Evaluate EVCS community needs, gaps, and prioritize EVCS for equity and access to charging based on occupancy types (e.g., multi-family dwelling, workplace, residential) and locations in the community.		
ZP-5D	Integrate EVs and EVCSs in public facility planning.		
ZP-6	**Support regional planning and collaboration for a robust and strategic network of EV charging.**		
ZP-6A	Engage with regional organizations and other strategic partners to advance best practices and policies for EV readiness and sustainable transportation overall.		
ZP-6B	Integrate EVCS siting with regional priorities such as mass transit systems, airports, freight, transit-oriented development (TOD), and proximity and accessibility to main thoroughfares and designated alternate fuel corridors.		
ZP-7	**Engage with state, federal, and utility initiatives that support EV readiness.**		
	ZONING AND PLANNING TOTAL POINTS POSSIBLE	**20**	**24**
PI	**PERMITTING AND INSPECTION**		
PI-1	**Develop clear and code-compliant standard permitting and inspection processes for EVCSs, which ensure health and safety, based on occupancy type, zoning classification, charging level, and project complexity.**		
PI-1A	Develop a clear and code-compliant standard permitting and inspection process for **single family residential** EVCSs.	**5**	
PI-1B	Develop a clear and code-compliant standard permitting and inspection process for **multiple family and commercial** EVCSs.	**5**	

PI-1C	Provide clear direction on the utility right-of-way permit process and incorporate into the application process.		
PI-1D	Post standard EVCS checklist, permitting forms, and approval requirements online.	**5**	
PI-1E	Provide list of applicable local, state, and federal codes, laws, regulations, and suggested best practices for EVCSs to assist developers and installers.		**5**
PI-2	**Establish fair and expedient permitting and inspection process.**		
PI-2A	Process EVCS standard permit application approvals in no more than 10 business days.		**5**
PI-2B	Complete EVCS standard inspection in no more than 5 business days after installation completion/contractor request.		**5**
PI-2C	Establish reasonable standard permitting and inspection fee structures.	**5**	
PI- 2D	Exempt or waive fees for residential EVCS permitting applications.		
PI-2E	Create online EVCS permit approval process.		
PI-3	**Establish registration & licensing requirements/process for qualified EVCS installers.**		
PI-3A	Provide online access to lists of Illinois Commerce Commission (ICC) certified EVCS installers and registered contractors.		**5**
PI-3B	Advise multi-family and commercial EVCS permit applicants that they may be required to submit a utility Modification & Relocation Service Application for substantial increase in new load.		**3**
PI-3C	Require EVCS installers applying for permits to be registered with the ICC as part of permitting process.		
PI-3D	Advise constituents that EVCS installation contractors should be registered with the ICC.	**3**	
PI-4	**Train staff on municipal EVCS permitting and inspection procedures.**		**5**
PI-5	**Establish clear rules and enforcement policies for EV charging.**		
PI-5A	Establish new or articulate existing rules, enforcement policies, and fees for non-permitted work or non-compliant EVCS installations.		
PI-5B	Establish new or articulate existing rules, enforcement policies, and fees for non-compliant operation and maintenance.		

PI-5C	Monitor operation of publicly accessible EVCS with periodic inspection and re-certification.		
PI-6	**Make permit data open and accessible to facilitate regional charging networks, partnerships, and information sharing among local government departments.**		
	PERMITTING AND INSPECTION TOTAL POINTS POSSIBLE	**23**	**28**
ST	**SAFETY AND TRAINING**		
ST-1	**Support public safety staff and first responders in safely managing incidents involving EVs and EVCSs.**		
ST-1A	Provide professional awareness training of EVs and EVCSs for first responders and public safety personnel.	**5**	
ST-1B	Provide professional hands-on training of EVs and EVCSs for appropriate first responders and public safety personnel.		
ST-1C	Equip first responders with on-vehicle Emergency Guides for EVs and EVCSs.		
ST-1D	Adopt draft standard operating procedures for emergency incidents involving EVs and EVCSs.		
ST-1E	Advise local tow truck operators/storage facility owners to be trained on safety requirements for loading, hauling, and storage of EVs, post incident.		
ST-2	**Integrate transportation electrification considerations into community safety plans.**		
ST-3	**Provide EV and EVCS safety information to consumers.**		**2**
	SAFETY AND TRAINING TOTAL POINTS POSSIBLE	**5**	**2**
PK	**PARKING AND ACCESS**		
PK-1	**Establish public parking policies to balance constituent needs and support growth in EV readiness.**		
PK-1A	Establish whether and under what conditions public electrical outlets may be used for Level 1 EV charging.		
PK-1B	Integrate ADA requirements to allow both disabled and non-disabled patrons to equitably access EV charging spaces.		
PK-1C	Allow reasonable public access to EV charging on municipally owned and other public properties.		
PK-1D	Conduct a parking study to balance constituent needs and support growth in EV readiness.		
PK-2	**Establish and communicate parking enforcement policies and procedures.**		

PK-2A	Communicate provisions of Illinois Vehicle Code (ILCS 625 ILCS 5/11-1308) and/or local parking code regarding unauthorized use of EV-only parking by non-EVs at both public and private properties.	**3**	
PK-2B	Establish and communicate parking enforcement policies not addressed in Illinois Vehicle Code, such as ticketing and towing of EVs.		
PK-2C	Tailor parking rules to match EVCS power level, such as shorter turnover times for DCFC.		
PK-3	**Establish fair and enforceable fee structure for charging at municipally owned parking areas.**		
PK-4	**Design parking rules to safely and equitably allow access, while matching charging type, physical space, land use, occupancy type, and type of parking.**		
PK-5	**Require EVCS owners to properly maintain equipment, monitor for security, and manage risks.**		
PK-6	**Clearly identify and promote EVCSs with wayfinding and informational signage.**		
PK-6A	Provide wayfinding signage where helpful to direct EV drivers to EVCSs.		
PK-6B	Clearly identify EV parking spaces and post parking rules at EVCS location.		
PK-6C	Recommend registration of public EVCSs on websites such as the Alternative Fuels Data Center to help EV drivers find EVCSs.		
PK-6D	Identify and promote EVCS by sharing digital EVCS locating tools.		**2**
	PARKING AND ACCESS TOTAL POINTS POSSIBLE	**3**	**2**
NC	**NEW CONSTRUCTION**		
NC-1	**Establish targets and timelines for making all new construction EV Capable, EV Ready and/or EVSE Installed, as applicable. Tailor targets for single-family residential, multi-family residential and commercial construction.**		**5**
NC-2	**Communicate/ enforce provisions of the Illinois Electric Vehicle Charging Act (Public Act 103-0053), which requires new construction projects for single-family and multi-family dwellings to be EV Capable and provides a right to charge for residents.**		**5**
NC-3	**Incentivize and/or encourage EV readiness for new construction**		
NC-3A	for **single-family residential** development to be **EV Ready and/or EVSE Installed.**		

NC-3B	for **multi-family residential development.** Target a proportion of parking spaces to be EV Ready and/or EVSE Installed. Establish requirements for maximum electrical amperage for each parking space and power capacity for electrical panels.		
NC-3C	for **commercial development.** Target a proportion of parking spaces to be EV Capable, EV Ready and/or EVSE Installed. Establish requirements for maximum electrical amperage for each parking space and power capacity for electrical panels.		
NC-3D	Encourage **commercial developers** to provide EV charging capacity and support their plans to electrify their own fleets/operations.		
NC-3E	For multi-family or commercial development categories, extra points will be awarded for actions resulting in EVSE Installed parking.		
NC-4	**Codify requirements for new construction to be EV Capable, EV Ready and/or EVSE Installed, as applicable:**		
NC-4A	for **single-family residential** development to be **EV Ready and/or EVSE Installed .**		
NC-4B	for **multi-family residential development.** Target a proportion of parking spaces to be EV Ready and/or EVSE Installed. Establish requirements for maximum electrical amperage for each parking space and power capacity for electrical panels.		
NC-4C	for **commercial development.** Require a proportion of parking spaces to be EV Capable, EV Ready and/or EVSE Installed. Establish requirements for L2 and DCFCs, maximum electrical amperage for each parking space and power capacity for electrical panels.		
NC-4D	Adapt requirements for EV Capable, EV Ready and/or EVSE Installed that considers the extra capacity of DCFCs.		
NC-4E	For each of the above development categories, extra points will be awarded for codes requiring EVSE Installed parking. *Maximum 30 pts*		
NC-5	**Establish requirements or incentives and provide guidance for renovation/retrofit construction to be EV Capable, EV Ready and/or EVSE Installed.**		
NC-6	**Advocate for new construction EV readiness at the state or federal level.**		
NC-7	**Make public properties EV Capable or EV Ready during new construction and renovations.**		
	NEW CONSTRUCTION TOTAL POINTS POSSIBLE	**0**	**10**
A	**ACCESS TO EV CHARGING**		

A-1	**Encourage property owners, managers and employers to support easy and equitable access to EV charging along with promoting all forms of sustainable transportation.**		
A-2	**Partner to provide equitable access to EVs and EVCSs through innovative policies and programs.**		
A-2A	Support access to charging for shared EVs and shared ride programs using EVs.		
A-2B	Partner to offer carbon-free last mile programs using electric shuttles and buses, EV car sharing, EV micro-mobility, as well as active transportation and transit options.		
A-3	**Support consumer protection for EVs and EVCSs.**		
A-3A	Provide consumer resources on EVs and EVCSs, to help residents make informed purchasing decisions.		**2**
A-3B	Establish new or articulate existing regulations for availability (uptime) of public EVCSs.		
	ACCESS TO EV CHARGING TOTAL POINTS	**0**	**2**
MF	**MUNICIPAL FLEETS**		
MF-1	**Evaluate feasibility of integrating EVs into municipal fleets.**		
MF-1A	Assess municipal fleet to understand current operational requirements and usage characteristics, and to identify suitable applications for EVs.		**5**
MF-1B	Identify EVs to suit fleet needs. Compile information on vehicle requirements, operating and capital costs, and warranty and maintenance information. Investigate upcoming EV models.		**5**
MF-1C	Assess fleet charging needs, including physical and operational requirements, projected daily energy requirements, EVCS, and associated investment. Engage the utility early in the process.		**5**
MF-1D	Forecast return on investment.		**5**
MF-1E	Estimate and report environmental and community benefits from the electric fleet, including greenhouse gas and pollution reduction.		**5**
MF-2	**Develop a fleet transition plan for EVs and EVCSs.**		
MF-2A	Create multi-year purchasing plans that include right-sizing vehicles, current and future EV availability, vehicle retirement, and budgetary constraints.		
MF-2B	In concert with the utility, evaluate potential locations for EVCSs based on operational suitability, access, short- and long-term power capacities, and retrofits or new construction required.		

MF-2C	Train appropriate in-house staff to operate EVs and EVCSs.		
MF-2D	Train in-house staff to maintain EVs.		
MF-2E	Evaluate sharing municipal EVCSs with the public.		
MF-3	**Procure EVs and EVCS.**		
MF-3A	Procure and operate electric vehicles in the municipal fleet. **Points Conditional* per Tab MF-3A		
MF-3B	Participate in cooperative EV and EVCS purchasing programs.		
MF-3C	Track fleet EV metrics over time, such as hours in use; vehicle miles traveled; number of charging events; comparative fuel and maintenance costs; and greenhouse gas and other pollution avoided.		
MF-3D	Install EVCS for public use on municipal land.		
	MUNICIPAL FLEETS TOTAL POINTS	**0**	**25**
UE	**UTILITY ENGAGEMENT**		
UE-1	**Collaborate to promote transportation electrification.**		
UE-1A	Communicate large-scale **private and public** EVCS project plans in the community to the utility.		
UE-1B	Collaborate with the utility to install public EVCS.		
UE-1C	Participate in beneficial electrification programs, such as solar PV, energy storage, EV charging, managed charging and Vehicle-to-Grid (V2G) integration.		
UE-2	**Educate EV users about utility programs.**		
UE-2A	Encourage all EV owners to register with utility.	**2**	
UE-2B	Educate residents about dynamic rate offerings.		**2**
	UTILITY ENGAGEMENT TOTAL POINTS	**2**	**2**
CE	**COMMUNITY ENGAGEMENT**		
CE-1	**Create and host an EV readiness landing page on municipal website.**		**5**
CE-1A	Communicate EV readiness commitment and actions to constituents.	**2**	
CE-1B	Promote access to EVs and EVCSs to residents and visitors though apps, online resources, publications, and other community marketing.		
CE-2	**Educate the public to support EV readiness and encourage EV adoption.**		

CE-2A	Leverage nonprofit groups, local volunteer groups, and citizen commissions to educate the community about EVs and EVCSs through demonstrations, presentations or other community events. Invite the utility.		
CE-2B	Introduce the municipal EV fleet at community events, or support other events that engage and educate residents on EVs.		
CE-2C	Host or support an educational event open to businesses, institutions, and other local governments presenting EVs, EVCSs, opportunities, and policies. Invite the utility.		
CE-2D	Communicate public health, equity, climate, and energy outcomes and benefits from EV readiness to the community.		
CE-3	**Promote community partnerships.**		
CE-3A	Engage and educate local EV dealers in EV readiness planning and programs.		
CE-3B	Collaborate with businesses, organizations, and institutions to advance EV readiness and access to charging.		
CE-3C	Collaborate with the park district, library and other local governments to advance EV readiness and access to charging.		
CE-3D	Support development of EVCS at nonprofit or community facilities through fee waivers, technical assistance or connections to other forms of support.		
CE-4	**Cultivate community leadership by convening a citizens advisory group to support EV readiness, or add EV responsibilities to current commission or committee.**		
	COMMUNITY ENGAGEMENT TOTAL POINTS	**2**	**5**
MD	**MARKET DEVELOPMENT AND FINANCE**		
MD-1	**Facilitate use of incentive programs for EVs and EVCS.**		
MD-1A	Provide current information on incentives and grants to community.	**3**	

MD-1B	Provide local financial incentives and/or development incentives for EVCS, to support workplace charging, multi-family dwellings, and other priority locations.		
MD-1C	Provide financial incentives to residents to purchase EVs and/or EVCS.		
MD-1D	Promote Property Assessed Clean Energy (PACE) financing to businesses for large-scale EVCS projects. **Conditional*		
MD-1E	Monitor existing and pending grants and incentive programs to be ready to deploy plans when funds become available.	**2**	
MD-2	**Assist in developing EV and EVCS markets.**		
MD-2A	Leverage procurement expertise and other benefits by purchasing EVs and EVCS through cooperative procurement.		
MD-2B	Engage local banks, credit unions, foundations and/or community funds to support favorable lending for EVs and EVCSs.		
MD-2C	Provide information to consumers about EV and EVCS financing options.		
MD-2D	Specify the use of clean fuel vehicles and equipment in requests for proposals (RFPs) and contracts for vendors supplying services to the municipality (e.g., waste haulers).		
MD-3	**Evaluate financial impacts of municipally owned, publicly accessible EVCS.**		
MD-3A	Evaluate investment cases for public charging services considering costs and revenue sources like revenue sharing, advertising revenues, local tax, license fees, and other costs and revenues.		
MD-3B	Establish fee structure for municipally owned EVCS installations based on time of day, energy consumption (kWh) and/or demand charges.		
MD-4	**Evaluate financial impacts of EVs and EV charging in the community.**		
MD-4A	Consider impacts of lost motor fuel tax and advocate for sustainable, favorable solutions.		
MD-4B	Consider gasoline stations being augmented or displaced with EVCSs and estimate potential associated revenue impacts.		
MD-4C	Forecast needs, resources, and/or costs to make EVCS ready for safe and adequate power for EV charging for future needs, in concert with the utility.		
MD-5	**Demonstrate that financial plans consider social and environmental costs and benefits.**		
	MARKET DEVELOPMENT AND FINANCE TOTAL POINTS	**5**	**0**

* *Conditional requirement* . Points will depend on municipality and/or extent

SUMMARY OF POINTS POSSIBLE BY CATEGOR			
CATEGORY		AWA	
ABBR.	DESCRIPTION	Bronze	Silver
CR	COMMIT TO EV READINESS TOTAL POINTS	10	0
ZP	ZONING AND PLANNING TOTAL POINTS	20	24
PI	PERMITTING AND INSPECTION TOTAL POINTS	23	28
ST	SAFETY AND TRAINING TOTAL POINTS	5	2
PK	PARKING AND ACCESS TOTAL POINTS	3	2
NC	NEW CONSTRUCTION TOTAL POINTS	0	10
OR	ACCESS TO EV CHARGING TOTAL POINTS	0	2
MF	MUNICIPAL FLEETS TOTAL POINTS	0	25
UT	UTILITY ENGAGEMENT TOTAL POINTS	2	2
CE	COMMUNITY ENGAGEMENT TOTAL POINTS	2	5
MD	MARKET DEVELOPMENT AND FINANCE TOTAL POINTS	5	0
	TOTAL POINTS	70	100
			24

ACTION TASK TOTAL POSSIBLE BY AWARD		
Award Level	Bronze	Silver
Bronze totals	70	
Silver totals	70	100
Gold totals	70	100

				Action Verifi
Gold	Extra Points	Extra Points Only		EVRC Documentation to be submitted by EVRCC
				letter of commitment, adopt GRC
				spreadsheet
5	5			memo describing municipal process
5	5	0		
				zoning evaluation worksheet and memo describing barriers or omissions with recommendations for code changes
				evidence of such classification
	5	5		evidence of such classification
	2			Evidence terms are defined
	5			Zoning code
	5	5		Zoning code
	5			Zoning code
	5			Zoning code
	5			Zoning code

	2			Zoning code
				Zoning code
	5	5		Zoning code
	5	5		evidence of definition posting
	15	15		section of relevant plan, evidence that plan communicated to the utility
10	10			memo or report, possibly map
	10	10		evidence of such planning
	5	5		participation on EVRAC, with CMAP, others
	5	5		evidence of such collaboration
	5	5		participation and/or comment to IDOT, Illinois Commerce Commission (ICC), IEPA, FHWA, Illinois Energy Code Advisory Council (regarding EV readiness in the stretch code)
10	94	60		
				Permit process is so identified
				applicant's checklist, permit application, inspector's checklist
				applicant's checklist, permit application, inspector's checklist

	5	**5**		Evidence that this direction is provided and incorporated into the application process
				provide list or link to list online
	5			provide list or link to list online
	5			evidence of this policy on checklist/website, or completed time-stamped permit
	5			evidence of this policy on checklist/website, or completed time-stamped permit
				Will accept self-defined reasonable and will flag "unreasonable" that's out of line with others
	5	**5**		Create ordinance to waive or exempt fees for residential EVCS
	10	**10**		link
	5			link on municipal webpage
	3			statement indicating this on the permit application and checkbox indicating applicant complies
5	**5**			statement indicating this is a required on the permit application and blank for ICC registration #
				Statement on EV landing page and/or on residential permits
	5			summary of in-house training content, date, (ppt) and attendance. If IBEW, proof of attendance
5	**5**			evidence of such rules on municipal EV landing page or other
5	**5**			evidence of such rules on municipal EV landing page or other

	5	5		evidence this is done/planned
	5	5		evidence this is done
15	73	30		
				curriculum, dates and time, summary of content or agenda, attendance
5	5			curriculum, dates and time, summary of content or agenda, attendance
5	5			Evidence these have been procured and distributed (letter)
5	5			SOP submission
	5	5		Evidence that such information has been distributed
	5	5		evidence of such planning
	2			link to such information on EV landing page
15	27	10		
	5	5		evidence this is done
	5	5		code or policy
	10	10		evidence this is done
	10	10		parking study

				Evidence this is communicated (e.g., website, signage, brochure, social media, etc.)
	10	**10**		text of code
	5	**5**		text of code
	5	**5**		fee structure and rules
5	**5**			rules
	10	**10**		evidence this is done
	10	**10**		photos, inventory of markers
	5	**5**		photos, inventory of signs
	5	**5**		link to text on municipal EV webpage and/or in other materials
	2			link to text on EV webpage or print communication
5	**87**	**80**		
	5			table of planned targets for all three levels and all relevant development types with target dates
	5			evidence this was done
	10	**10**		Evidence of such incentives and standards for SF residential

	15	**15**		Evidence of such incentives and standards for multi-family development
	10	**10**		Evidence of such incentives and standards for commercial development
	10	**10**		evidence this was done
	10	**10**		photos, report, other evidence EVSE is installed resulting from municipal intervention
	10	**10**		Evidence of such incentives and standards for SF residential
	15	**15**		Evidence of such incentives and standards for MF residential
10	**10**			Evidence of such incentives and standards for commercial development
	5	**5**		Municipal code demonstrating how DCFC can fulfill requirements
	10	**10**		photos, report, other evidence EVSE is installed resulting from municipal intervention
	20	**20**		Evidence that this was done
	5	**5**		Evidence of testimony, letter, or public comment submitted
10	**10**			Evidence of completion
20	**150**	**120**		

	5	5		Demonstrate encouragement was done - proof of employer/landlord meeting, information shared in communication to employees/tenants, presentation to target groups, participation in municipal EV advisory committee
	5	5		Allow innovation, evidence of such a program
	10	10		Evidence of program, could be allowing curbside, could be reduced parking rates, other innovation
	10	10		Allow innovation, evidence of such a program
	2			Links provided on municipal EV readiness webpage, or other evidence of sharing information to the appropriate audience, such as purchasing information
	2	2		Evidence of new or existing regulations
0	34	32		
	5			Consultant report, or in house fleet inventory and assessment
	5			fleet inventory with conversion evaluation and details
	5			Consultant, vendor, or in house report
	5			Consultant, vendor, or in house report
	5			AFLEET report
10	10			In house or consultant report
5	5			In house or consultant report

4	4			Evidence of training, date, time, content, memo, attendance list
	5	5		Evidence of training, date, time, content, memo, attendance list
4	4			In house or consultant report
10	10			proof of ownership
	10	10		proof of procurement/attempted procurement through regional purchasing cooperative or Sourcewell, proof of membership
5	5			spreadsheet, ComEd report, AFLEET report
	10	10		evidence this was done
38	88	25		
	10	10		evidence that municipality advised ComEd about plans or advised private property owners to work with ComEd
	10	10		evidence this was done
	10	10		evidence this was done
				link to ComEd's EV page on website
	2			link to ComEd's EV page on website
0	32	30		
	5			Link to EV landing page
				evidence of social media post, newsletter article, press release, etc.
	5	5		links and evidence of promoting EV charging & vehicles

	10	**10**		evidence of event including purpose, event details and characterization of attendance. Summary of outcomes
	2	**2**		evidence of event and presence of municipal EVs
	5	**5**		evidence of event including purpose, event details and characterization of attendance. Summary of outcomes
	5	**5**		print or digital communication from the community
	5	**5**		evidence of dealers on municipal advisory commission, presence of display vehicle at community event, education presentation or other
	5	**5**		evidence of municipal support or collaboration, such as zoning variance, expedited permitting, supportive wayfinding, complementary investment, technical support, project assistance, and/or education, promotion
	5	**5**		evidence of municipal support or collaboration, such as zoning variance, expedited permitting, supportive wayfinding, complementary investment, technical support, project assistance, and/or education, promotion
	10	**10**		evidence of municipal support or collaboration, such as zoning variance, expedited permitting, supportive wayfinding, complementary investment, technical support, project assistance, and/or education, promotion
	10	**10**		Evidence of board or council action to create commission. Evidence of assignment to existing commission. Meeting agenda/minutes
0	**67**	**62**		
				evidence of posts

	10	10		evidence of program with outcomes
	10	10		evidence of program with outcomes
2	2			evidence information is shared with businesses at appropriate times
				sign up for IACT newsletter and IEPA updates
	5	5		evidence order was placed using SPC specs/ through SPC
	5	5		evidence of meetings or correspondence with lending institutions
	3	3		link on website
	10	10		language in RFP and/or contract. Outcomes are desired
	10	10		spreadsheet, report
	5	5		published fee structure
	5	5		report or memo estimating impacts. Evidence of advocating for solutions/alternatives
	5	5		report or memo documenting community gas stations and estimates of impacts. Evidence of policy or assistance provided
	10	10		report
	5	5		evidence that plans do
2	85	83		

RY

RD GROUP

Gold	Extra points	Extra Points Only
5	5	0
10	94	60
15	73	30
15	27	10
5	87	80
20	150	120
0	34	32
38	88	25
0	32	30
0	67	62
2	85	83
110	742	532

GROUP

Gold	Total Extra Points	Total Minimum
	30	100
	30	200
110	20	300

cation and EVR Team Support

Support Needed (from EVR Team)	EVRCC Date Submitted	EVR Team Date Approved	NOTES - for EVRCC or EVRT
template			
template worksheet in EVRCC Homework share folder			
guide, tools to calculate GHG reductions, etc.			
Zoning evaluation worksheet in EVRCC homework share folder			
template			
template			
standard definitions			
template codes			
template			
template codes			
template ROW permit process			
template codes			

template codes			
template codes. Consider power level.			
template codes			
examples			
examples			
model plan			
examples			
opportunities to collaborate & participate			
opportunities to collaborate & participate			
opportunities to collaborate & participate			
Definitions			
sample checklist from NBI			
sample checklist from NBI			

examples			
Resources and links			
Resources and links			
probably none			
probably none			
provide current range of permit fees			
probably none			
link to examples			
link to ICC certified installers and registered contractors			
link to ComEd application			
explanation of and link to ICC registration			
explanation of and link to ICC registration			
set up trainings with IBEW			

opportunities to collaborate and share			
connection to training opportunities			
connection to training opportunities			
on-vehicle Emergency Guides for EVs and EVCS.			
Provide templates that include scene size-up, EV identification, power isolation, de-energization, vehicle stabilization, passenger extraction, etc.			
connection to training opportunities			
probably none			
links to safety resources			
examples of overnight parking/charging on public property			
template			
examples of overnight parking/charging on public property			
models of parking study			

examples			
examples			
examples			
examples			
suggestions to include protective measures such as bollards, head-in parking safe cord management, access and egress			
standards and suggested parcel size to avoid unnecessary clutter			
standards			
links and guidance			
links and guidance			
template table, add ICC draft possibly for targets			
Illinois Electric Vehicle Charging Act Link			
standards and examples			

standards and examples			
standards and examples			
probably none			
probably none			
standards and examples			
standards and examples that include minimum standards			
standards and examples that include minimum standards			
examples			
none			
examples			
connect to opportunities to advocate			
Including structures, parking lots, etc.			

None, allow flexibility for municipal relationships with these groups. Share utility program info			
resources and examples			
resources and examples			
None, allow for innovation			
links to consumer resources			
resources & examples			
list of consultants, model fleet assessment			
list of consultants, model fleet assessment			
list of consultants, model fleet assessment			
examples			
AFLEET training			
list of consultants, model procurement plans			
list of ICC qualified experts			

connect to training			
connect to training			
model municipal sharing arrangements			
probably none			
promote offerings			
ComEd, AFLEET training			
model RFP			
need plat of survey, load letter, complete meter service application			
information about BE programs when available			
connect to opportunities. Provide examples. education vs deployment			
link to registration info			
link to dynamic rate offerings			
template landing page with EV Ready logo, prompts to include permitting, link to ComEd			
template message			
template message			

case study from Wilmette and others			
case studies from municipalities			
Speakers and resource list			
provide calculators, facts, resources			
examples			
examples			
examples			
examples			
probably none			
link to IEPA rebate and info about federal tax credits. Add ComEd programs when available			

case studies - Batavia, Naperville			
case studies - Batavia, Naperville			
links to CPACE program			
links to IACT and IEPA newsletter sign up			
links to Suburban Purchasing Cooperative & Sourcewell			
none			
link to consumer finance options			
recommended language for RFP or sample contract			
examples			
local case studies			
none			
contact info for ComEd			
examples			

Village of River Forest
Public Works and Development Services
400 Park Avenue
River Forest, IL 60305
Tel: 708-366-8500

MEMORANDUM

Date: September 12, 2023

To: Sustainability Commission

From: Seth Jansen, Management Analyst

Subj: Electric Vehicle Infrastructure Network Study

Analysis: In Summer of 2022, the Village of River Forest issued a Request for Proposals ("RFP") seeking a Professional Engineering Firm to assist the Village in conducting a Village-wide electric vehicle ("EV") infrastructure network study. The purpose of the study is to provide a comprehensive analysis of the Village to identify ideal locations for EV infrastructure for both Village-owned fleet vehicles and to encourage EV usage by the general public. The RFP language was developed with feedback provided by the Sustainability Commission at the June 2022 meeting.

Staff reviewed each submittal, selected the one that best fit the needs of the Village with the submittal from Ciorba Group, Inc., and negotiated the scope and cost of the work to be included in the study in order to get the total project cost closer to the anticipated project budget. The agreement was approved by the Village Board of Trustees at the November 14, 2022 Village Board Meeting and the contract was executed shortly afterward. The Study was completed between January and April of 2023. A draft report was provided to Village Staff for review and feedback in May of 2023 and the final report was issues in June of 2023.

The Report evaluates the electrical and parking improvements required to prepare several parking lots for electric vehicle (EV) charging stations within the Village. The study aligns with the Village's sustainability goals and will prepare the Village to take advantage of national and state-led grants and incentives to improve EV charging infrastructure across the county. Eleven locations were included in the study:

1. Village-owned North Ave. Parking Lot
2. Dominican University
3. Village Pump Station
4. Fenwick High School Priory Campus
5. Concordia University
6. Village-owned Thatcher Ave. Commuter Lots
7. Village Hall

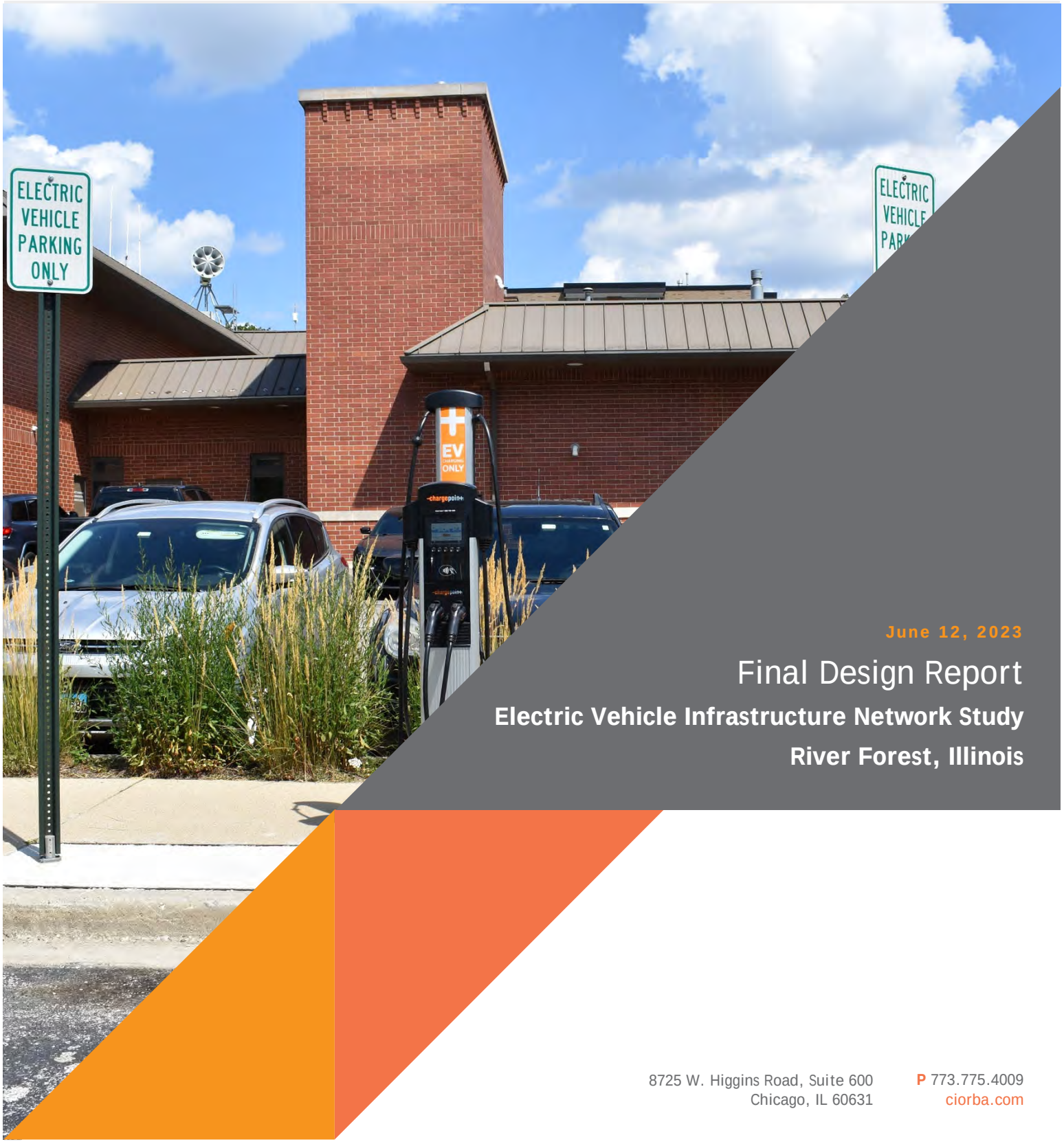
8. Village-owned Lake St. and Franklin Ave. Parking Lots
9. Town Center Parking Lot
10. River Forest Community Center
11. Village Public Works Garage

The Study includes information on EV charging equipment, analysis of parking usage and electrical infrastructure, and estimates on equipment cost and available grant programs. EV equipment information includes charging levels, connector configurations, charging duration times, and analysis of charging equipment from three manufacturers. Location studies analyze parking space counts, layout, and utilization, as well as the existing electrical infrastructure present at each site, or potential ComEd electric service locations, which could be used to power EV charging stations. Site recommendations are also made for each location included in the study and include recommendations for electrical infrastructure improvements and recommendations for equipment/charging levels.

Recommendation: There is no need for a formal motion. Staff intend to utilize the findings of this study when planning and installing any future electric vehicle infrastructure.

Attachment: Final Design Report - Electric Vehicle Infrastructure Network Study

CiorbaGroup
CONSULTING ENGINEERS



June 12, 2023

Final Design Report

Electric Vehicle Infrastructure Network Study

River Forest, Illinois

8725 W. Higgins Road, Suite 600
Chicago, IL 60631

P 773.775.4009
ciorba.com

TABLE OF CONTENTS

CHAPTER 1 : PROJECT OBJECTIVES

1.1 SCOPE OF WORK

Given the increased popularity of electric vehicles, the Village of River Forest retained Ciorba Group to evaluate the electrical and parking improvements required to prepare several parking lots for electric vehicle (EV) charging stations within the Village. The study aligns with the Village's sustainability goals and will prepare the Village to take advantage of national and state-led grants and incentives to improve EV charging infrastructure across the county. Eleven locations were included in the study as shown in Figure 1.1.

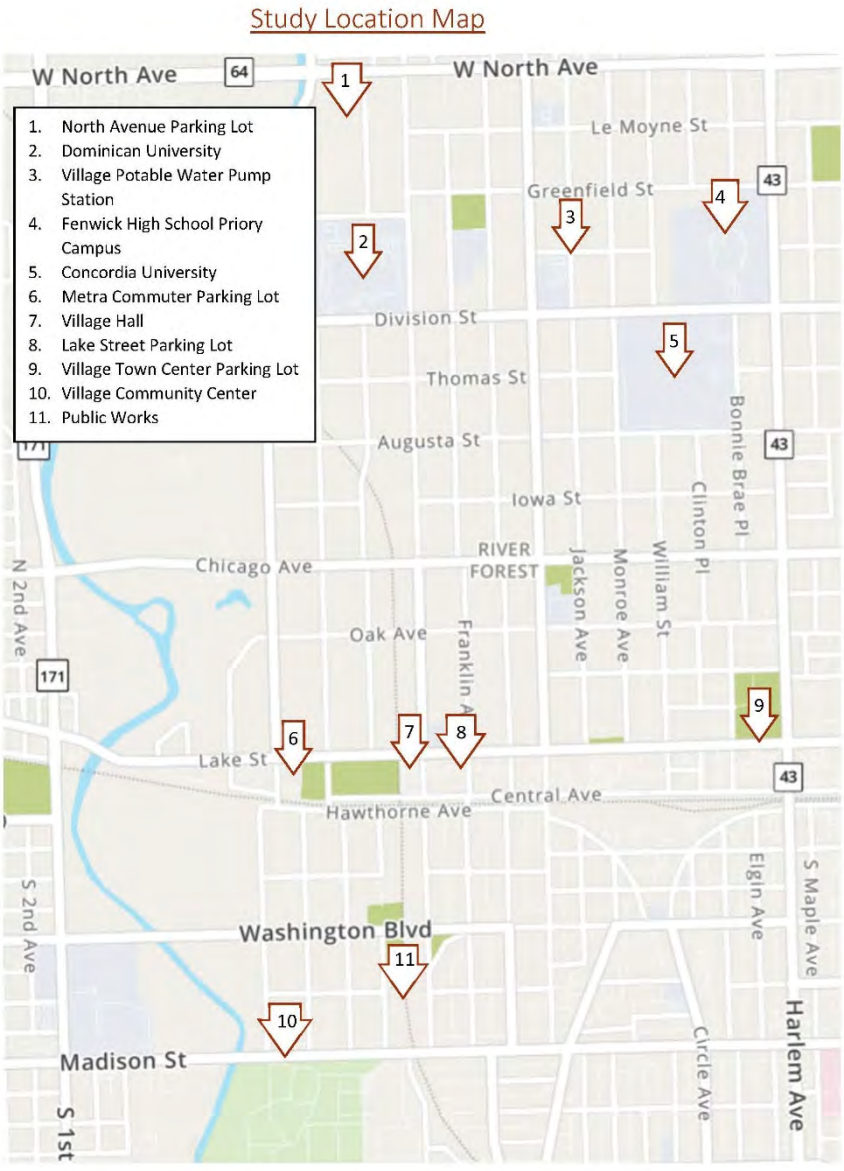


Figure 1.1: Parking Lots Included in Study

Locations included in the study are summarized in Table 1.1.

Table 1.1: General Locations for EV Charging Stations

Location No.	Location Name	Description of Use
1	North Ave Parking Lot	Village owned and maintained parking lot. This lot provides overnight parking for residents.
2	Dominican University*	Open to the public and students
3	Village Potable Water Pump Station	To be used for Village fleet vehicles
4	Fenwick High School Priory Campus (previously known as Dominican University Priory Campus)*	Open to the public and students
5	Concordia University*	Open to the public and students
6	Metra Commuter Parking Lot	Open to the public
7	Village Hall	For residents and Village fleet vehicles
8	Lake St and Franklin Ave Parking Lots	Village owned and maintained parking lots. Lake Street parking lot is open to residents. Franklin Avenue parking lot has select spots for permit only parking.
9	Village Town Center Parking Lot	This is parking lot is owned and maintained by MidAmerica, but one of the largest and high traffic areas, within the Village.
10	Village Community Center	Open to the public
11	Public Works	For staff parking only

* These institutions were included in the study given the various partnerships they have had with the Village on larger projects. Construction and maintenance of these station would responsibility of the respective university.

1.2 ELECTRIC VEHICLE TRENDS

As of 2023, electric vehicles make up 1 percent of all registered vehicles in Cook County, and 1 percent of all registered vehicles in River Forest [1]. Evaluating the number of electric vehicles registered in Illinois and adjacent communities between January 2022 to 2023, the number of electric vehicles almost doubled within the state (see Table 1.2, based on figures listed on the Secretary of State website). While the increase in registered vehicles in River Forest only increased by 38%, this number follows overall national trends. This is consistent with data from 2020 to 2021 from Clean Cities Coalition that documented a 33% increase in plug-in electric vehicles nationally (see Figure 1.2).

Table 1.2: Registered Vehicles [1]

Location	Quantity of Electric Vehicles	
	2022	2023
Illinois	37,723	59,992
Cook County	9,604	16,492
Chicago	6,750	10,589
River Forest	114	157
Oak Park	462	648
Elmwood Park	69	108
Forest Park	43	71

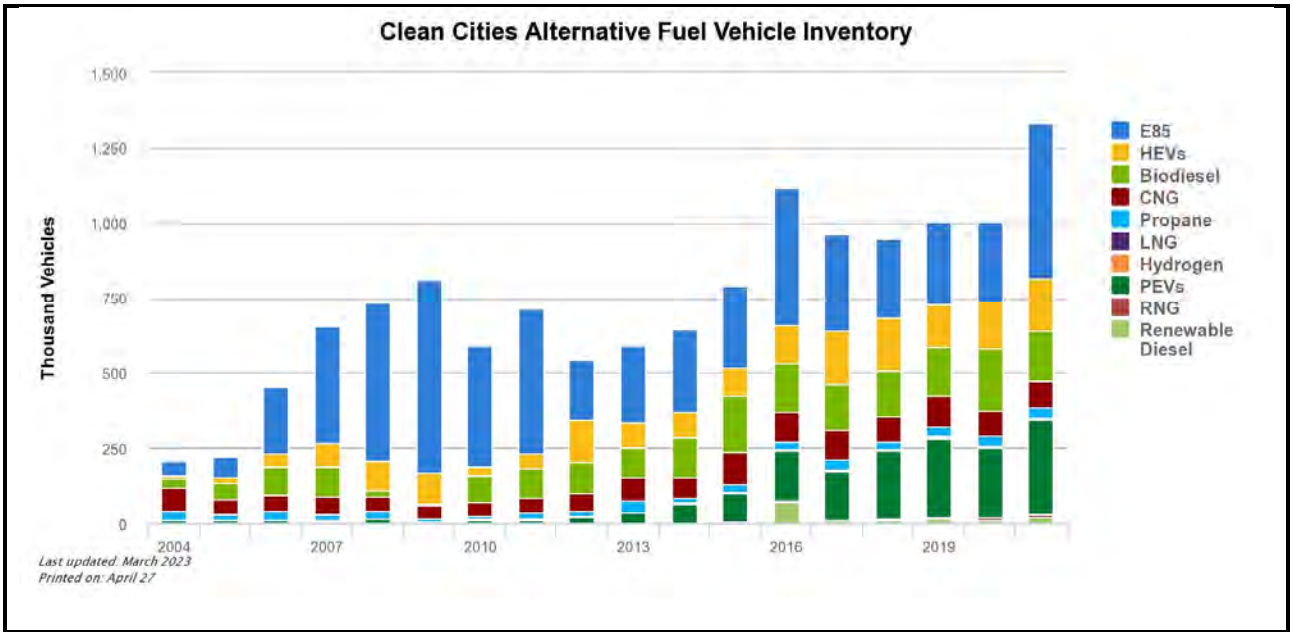


Figure 1.2: Clean Cities Coalition Inventory 2* [2]

* The Clean Cities Coalition consists of 75 active coalitions across the country, working with local decision makers to understand and implement alternative and renewable fuels, reduction measures, improvements, and emerging transportation technologies. The US DOE facilities national coordination with the coalitions through its Vehicle Technologies Office.

1.3 SUSTAINABILITY GOALS AND EV PROJECTS

The Village of River Forest, local institutions, and businesses have established internal sustainability goals, ranging from water conservation, community gardens, bicycle programs, and recycling/composting programs. Programs that are directly related to electric vehicles are summarized below.

1.3.1 Village

The Village has established a Sustainability Commission whose purpose is to enhance the quality of residents' lives through the study and promotion of sustainable practices. Two of the main focuses of the Sustainability Commission are policies focused on replacing fossil fuel sources with renewable energy and expanding green transportation options.

Current discussions focused on electric vehicles include replacement of existing fleet vehicles with EV vehicles and constructing EV charging stations and/or infrastructure at one of the sites included in the study for use by the public. Purchase of fleet vehicles will be assessed at the next replacement cycle.

Below is the current list of Village fleet vehicles, excluding fire trucks, ambulances, police vehicles, and specialized public works vehicles (for example, dump trucks, bucket truck, street sweeper) is:

- 1 Public Works engineering van
- 3 standard pickup trucks located at Public Works Garage

- 1 large pickup truck located at Public Works Garage
- 3 Fire Department administrative vehicles
- 1 Fire Department pickup truck
- 6 Police Administrative vehicles

1.3.2 Concordia University

Concordia University has already investigated the cost associated with installing an EV charging station at the public garage. The quote to install a dual Level II charging station is located under Appendix D.

1.3.3 Dominican University

Dominican University developed a sustainability plan in 2012 which details sustainability goals for the University. A copy of the plan is located under Appendix E. The plan does not detail plans for electric vehicles or infrastructure. However, Village staff is aware of a 10-year master plan being prepared by the University which will include electric vehicles and infrastructure. Unfortunately, due to recent changes in staff, specifics about what is being discussed internally was not available for this study.

1.3.4 Town Center Commercial Parking Lot

Mid-America Real Estate Group, the Property Manager for this site, was approached by Tesla to install (12) Supercharger stations in the southwest quadrant of the parking lot. Tesla indicated that they would install the EV charging stations at no cost to Mid-America and would maintain them. Mid-America is internally discussing whether to rent the spaces to Tesla to install chargers. If Mid-America decides to move forward, the charging stations will be installed Spring/Summer 2024.

Figure 1.3: Tesla Proposed Site Plan

CHAPTER 2 : EV EQUIPMENT

Electric vehicles (EV) charging stations come in a variety of charging Levels, rates, voltages, plug types, communication types and with various features. A summary of each of the key components are described under this section to assist with developing the Village's charging infrastructure.

2.1.1 EV Charging Levels

EV charging stations are classified by the rate in which they charge an electric vehicle batteries. Currently there are three classification rates for EV charging stations. They are:

- Level I Chargers
- Level II Chargers
- DC Fast Chargers (previously referred to as Level III)

A quick reference as to typical locations of where each charger is installed, required voltages, plug configuration and the approximate range are summarized in Table 2.1. This information will be discussed in detail later in this section.

Table 2.1: EV Charging Levels

Level	Typical Location	Input Voltage Requirement	EV Plug Configuration	Range (Mile) Time of Charge [3]
I	Residential Homes	120V	SAE J1772	5 miles (1 hour)
II	Residential Homes, Multiunit Residential Developments/Businesses/ Commercial Parking Lots	240V or 208V	SAE J1772 or Tesla	25 miles (1 hour)
DC Fast Charger	Interstates/Expressways, Commercial Parking Lots	480V	CCS, CHAdeMO or Tesla	100-200 miles (30 minutes)

Level I charging stations were not included in the study based on the locations that the Village requested be evaluated. All the parking lots would require that a Level II or DC fast charger be installed.

2.1.2 EV Connector Configurations

Electric vehicle connectors can vary significantly by car and by country, this is why it is important to understand the difference. There are also different types of connectors for charging station level to ensure a proper charge. Figure 2.1 provides a guide to the different connector options for Level I/Level II and DC fast charging by country for reference.

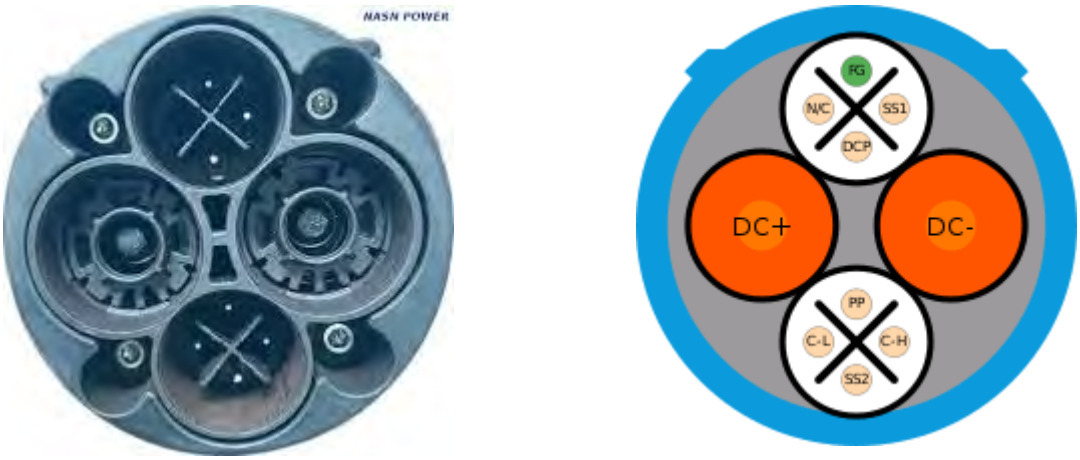
Figure 2.1: Electric Vehicle Connector Types [3]

In the US Level I and Level II charging stations require a Society of Automobile Engineers (SAE) J1772 plug (see photograph 2.1).

Whereas there are multiple plug options that are used in the US for a DC fast charging station. A Combined Charging System (CCS) is a multi-national developed standard for electric vehicle direct current faster charger, and A Charge De Move (CHAdeMO) is a Japanese developed standard for electric vehicle direct current fast charger (see photographs 2.2 and 2.3).

Photograph 2.1: SAE J1772 Connection

Photograph 2.2: CCS Connection



Photograph 2.3: CHAdeMO Connection

One thing to note is that a CCS plug has a combined SAE J1772 (five AC pins on the top) and two DC pins on the bottom (see photograph 2.2). Also, the difference between the CCS1 and CCS2 is that CCS1 if common for American vehicles and CCS2 is a standard for European and some Asian vehicles.

There has been some discussion whether a CHAdeMO connection will be continued to be offered on Japanese cars sold in the US, since most new electric vehicles on the market are provided with either a CCS1, SAE J1772 or Tesla connection.

Photograph 2.4: Tesla Connection

If federal funds, grants or Environmental Protection Agency (EPA) funds are used, then the charging stations must be provided with the following plugs:

- Level II charging stations with a SAE J1772 plug
- DC fast charging stations with a CCS or CHAdeMO plug

2.1.3 EV Charging Duration

Determining the time required to charge an electric vehicle is dependent on three components:

- The electric vehicle battery capacity, which describes the energy contained in the battery (sometimes referred to as the battery pack). The battery capacity dictates a battery's ability to deliver power (measured in killowatts) over a period of time (in hours). This typically correlates to the fuel consumption rate, in miles/gallon of standard cars.
- A vehicles onboard charger is utilized when using an AC charging station. The incoming AC voltage is internally converted to DC by the vehicle's onboard charger, to charge the vehicle's battery pack. Most onboard converters are limited to 11.5 Kw.
- The charging station rate.

Typical battery capacity and onboard converter ratings for most common EV vehicles are provided in Table 2.2 for reference. This information is important in determining recommended charging rates for equipment at each study location.

Table 2.2: Battery Capacity and Onboard Converters for Popular EV Vehicles

Manufacturer	Model	Battery Capacity (kWhr)	Onboard AC Converter (kW)
Audi	E-Tron	93	11
Chevrolet	Bolt	65	11.5
Ford*	F-150 Lightning	98/131	11.3-19.2
Hyundai	Ioniq	77.4	11
Kia	Niro	64	7.2
Nissan*	Leaf	40/62	3.6/6.6
Porsche*	Taycan	79.2/93.4	11
Rivian	R1	135	11.5
Subaru	Solterra	72.8	6.6
Tesla	Model 3,Y	75	11
Volkswagen	ID.4	58	7.4
Volvo	XS40	78	11

* Manufacturer provides optional increased battery pack to increase capacity.

Using common EV battery capacities, calculations were performed to determine how long it would take to charge a vehicle at varying charging rates. The charging rates were selected based on the common charging rates provided across the different manufacturers, as well as the maximum on board converter

size. Table 2.3 summarizes how long it would take to charge an electric vehicle's battery capacity to an 80% level.

Table 2.3: Time to Charge based on Typical Battery Capacity

Battery Capacity (kWhr)	Time to Charge to 80% (hours)			
	11.5 kW	19.2 kW	62.5 kW	125 kW
58	4.03	2.42	0.74	0.37
65	4.52	2.71	0.83	0.42
77	5.38	3.23	0.99	0.50
95	6.61	3.96	1.22	0.61
135	9.39	5.63	1.73	0.86

2.1.4 What is the 80% Rule?

Overcharging a lithium based EV battery can have a negative long-term effect on the performance and longevity of the battery. It has been documented that the battery charging rate decreases between 80% and 100%, therefore taking substantially longer to charge a battery to 100% level.

Figure 2.2 is a graph of the characteristics associated with charging a 5V lithium-ion battery. It illustrates the effects of voltage, ampacity, and time when a battery is charged. It was selected as a good representation of charging duration effect on lithium-ion batteries, like those used in an electric vehicle.

The dashed line in the graph represents the length of time it takes to charge the battery (in percentage of the battery's capacity). Initially the battery charges very quickly, only taking 1-hour to charge to an 80% level. However, as the battery continues to charge, it takes almost 2 additional hours to charge the battery between 80% to 100% level. Which is more than double the length of time initially.

This is why charging lengths for electric vehicles are commonly described based on the time it would take to charge to 80% level.

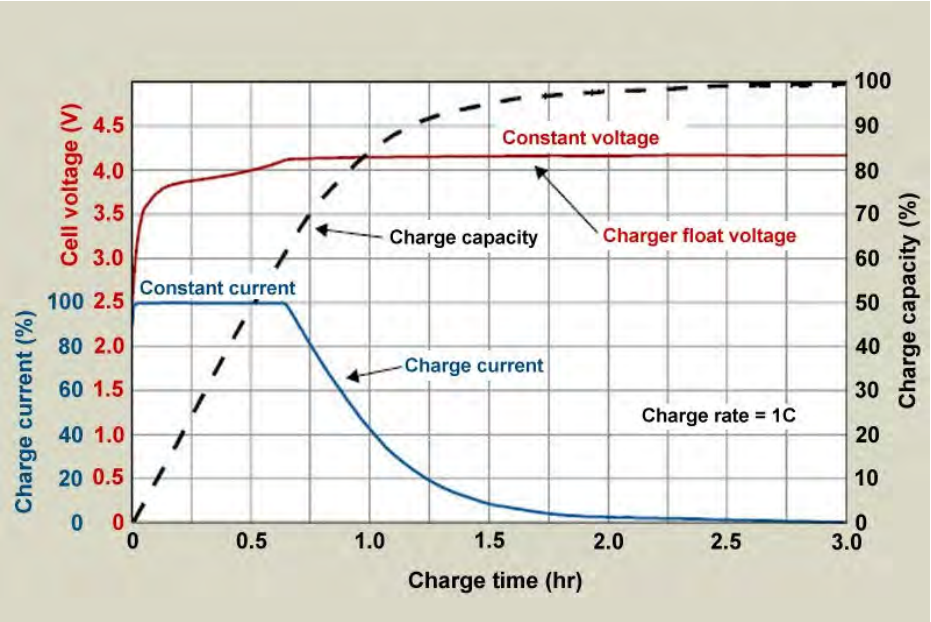


Figure 2.2: Charge Times Vs. Capacity [5]

2.1.5 EV Charging Equipment

EV charging equipment from three manufacturers has been included in this study. Only those manufacturers who have been in business for more than 10 years were selected and are summarized in Table 2.2. This criteria was selected to ensure that the manufacturers have an established history in producing equipment, would be available to provide long-term support equipment/warranties, and could provide both Level II and DC fast charging equipment. Manufacturer catalog cuts of the EV charging stations are located under Appendix F.

Table 2.2: EV Charging Station Manufacturer's and Models

Model	Mounting	Level	Charging Rate	Plug Type/Cord Length
Eaton				
Green Motion Pro	Pedestal or Wall	II	11.5 kW	SAE J1772/25 ft
Green Motion EV	Pedestal	II	19.2 kW	SAE J1772/25 ft
Green Motion DC	Ground	DC Fast Charger	50 kW/75 kW/100 kW/ 125 kW/150 kW	CCS1 CHAdeMO
ChargePoint				
CPF50	Pedestal	II	12 kW	SAE J1772/ 18 ft or 23 ft
CP6000 Fleet	Pedestal or Wall	II	19.2 kW	SAE J1772/ 23 ft
Express 250	Ground	DC Fast Charger	125 kW	CCS1/ CHAdeMO

Model	Mounting	Level	Charging Rate	Plug Type/Cord Length
Tesla				
Wall Connector	Pedestal or Wall	II	11.5 kW	SAE J1772/24 ft
Supercharger	Ground	DC Fast Charger	100 kW – 250 kW	Tesla/5 ft – 10ft

Other charging equipment manufacturers considered as part of the study were:

- ABB – Provides low profile, compact wall charging units.
- Blink (previously SemaConnect) - Offers both Level II and DC fast charging options since 2017. They have since become one of the leaders in the EV charging and EV fleet vehicles.
- Leviton – Typically offers Level II charging options but has partnered with ChargePoint for a DC Fast Charger option.
- Schneider – Offers lower DC fast charging rates.
- Siemens – Only offer Level II charging option.
- Volta (acquired by Shell, Inc.) – Offers DC fast chargers that can double as advertisement panels.

2.1.6 Manufacturer Information Gaps

Manufacturers included in the study were selected based on those manufacturers who could provide both Level II and DC fast chargers and had more than 10 years in the market. Most manufacturers provide technical specifications, instruction manuals, and brochures on their website, but where there are gaps in information, designers will typically work with a representative from the manufacturer. Below are the gaps in information that were encountered during the study and should be investigated further during design:

2.1.6.1 ChargePoint

We included ChargePoint as one of the selected manufacturers to be included in this study since there is a 7.2kW ChargePoint charging station installed at Village Hall. However, it is very difficult to find a representative from ChargePoint to respond to our calls with specific questions. ChargePoint equipment information is based on information available on the website and from assistance from Steiner Electric, a local distributor of electrical equipment. We recommend verifying the following:

- Can the CPF50 charging station be provided with an LCD display?
- Why does the Express 250 require a Cloud plan?

2.1.6.2 Tesla

Tesla was included as one of the selected manufacturers since they are the leader in the electric vehicle industry. Tesla is now offering Level II chargers on their website and has provided select details about their superchargers to be included in this report. However, it should be noted that Tesla requires supercharger station design, installation, and operation to be performed in-house. This is to provide their vehicle users with a consistent experience when using their charging stations. So detailed

information regarding supercharger equipment and design will only be provided by Tesla during the design process.

Tesla's minimum requirements to install supercharging equipment is as follows:

- A minimum of 8 parking stalls, but prefer 12-16 parking stalls
- A minimum of 4 supercharging stations per site

2.1.7 Advantages and Disadvantages

The advantages and disadvantages of the three manufacturers closely reviewed as part of the study and are described in following tables by manufacturer.

Table 2.3: Advantages and Disadvantages of Eaton Charging Stations

Advantages
The company has been in business since 1911 and has an established history manufacturing electrical components.
Are designing EV charging equipment around open protocols, and to be integrated with smart electrical equipment/controls to be used with load management systems.
DC fast chargers can be provided with dual cables to simultaneously charge up to two electric vehicles.
DC fast chargers are provided with air cooled cables, versus the typical liquid cooled cables, which reduces cost and maintenance associated with liquid cooled cables.
Disadvantages
The DC fast charging station has a large footprint and is currently unavailable.
Cost of the DC fast charging station.

Table 2.4: Advantages and Disadvantages of ChargePoint Charging Stations

Advantages
The company has been in business since 2007 and has an established history of manufacturing EV charging stations.
There is one ChargePoint charging station installed at Village Hall.
The equipment is readily stocked by local distributors.
Disadvantages
Site validation by ChargePoint is required if 5 or more charging stations are installed at a site.
Maximum rating of DC fast charger appears to be 62.5kW.
Do not offer 11.5kW charging rates in the commercial series, only in the multifamily series, which does not have a LCD display.
The multifamily charging stations requires ChargePoint Cloud Plan for operation.

Table 2.5: Advantages and Disadvantages of Tesla Charging Stations

Advantages
Chargers are manufactured by leading electric vehicle manufacturer.
Tesla now offers Level II charging stations online through their website.
Low equipment costs for Level II charging stations.
Level II charging stations are available with power sharing option, which allows up to six units to share power from one circuit breaker.
Tesla will install, maintain, and operate Level II charging stations if an owner requests. A minimum of 12 charging stations is required for this service to be offered.
Superchargers can be installed in a single row or back-to-back as required to minimize space requirements.
Tesla provides design and layout services for any stations that will be owned, maintained and operated by Tesla.
Disadvantages
Tesla supercharging stations must be installed, maintained and operated by Tesla. This is to ensure that users will have the same experience at all stations.
Tesla will not install less than 4 superchargers at a site, due to installation costs.
A minimum of eight parking spaces is required at a supercharger site.
Superchargers are only offered with a Tesla plug. Some electric vehicles can charge at select Tesla locations, but owners have to verify this on the Tesla app. Tesla has agreed to permit access to other EV manufacturers by the end of the 2024, but details have not been confirmed.
Level II chargers are only offered with a Tesla plug. An adapter may be ordered to charge electric vehicles with SAE 1772 connectors.
Level II charging stations must use Tesla app to schedule, track and pay for charging session.

CHAPTER 3 : STUDIES

3.1 GENERAL OVERVIEW

The Village requested that limited parking and electrical studies be performed to determine infrastructure and site improvements that would be required at each location to install EV charging stations. Detailed studies will have to be performed during design, since EV technology and sites may substantially change within the next several years.

The Village provided the following information for use in the study:

- GIS Maps and Shape Files
- Parking Zone Maps
- Commuter Parking Study, performed by KLOA, dated April 30, 2020
- Municipal Parking Lot Requirements
- Existing ChargePoint Station Catalog Cuts
- Existing ChargePoint Station Quarterly Usage Report, dated September 30, 2022

Based on the information collected during site visits of each location and provided by the Village, the number of charging stations, charging station rates, equipment locations, electrical infrastructure improvements could be determined.

3.2 PARKING STUDY

The parking study consisted of reviewing the number of existing parking spaces available at each site, parking usage, recommended parking space dimensions, pavement markings, and signage for proposed EV charging equipment. There are currently no national guidelines available that specifically address EV charging stations. Therefore, available references, studies and current trends were used to assist with the parking study.

3.2.1 Parking Space Counts

Since a limited parking study was performed, parking space counts were determined from the following:

- 2012 aerials (used to prepare the electrical exhibits)
- Any changes noticed in parking spaces and/or configurations from our site visits
- The Commuter Parking Study (especially for Dominican and Concordia Universities which both had parking garages)

Results and calculated parking lot utilization are listed in Table 3.1.

Table 3.1: Parking Space Counts by Location

Location No.	Location Description	Total Parking Spaces	Utilization (%)		
			2012 Aerial	2020 Commuter Parking Study	2023 Site Visit
1	North Avenue Parking Lot	26	31%	-	62%
2	Dominican University	1,102	-	95%	-
3	Village Potable Water Pump Station	1	-	-	-
4	Fenwick High School Priory Campus	47	34%	41%	-
5	Concordia University	787	-	91%	-
6	Metra Commuter Parking Lot	95	87%	69%	34%
7	Village Hall	59	63%	-	68%
8	Lake Street and Franklin Ave Parking Lot	50	40%	-	42%
9	Village Town Center Parking Lot	488	51%	-	-
10	Village Community Center	45	84%	-	84%
11	Public Works	3	100%	-	100%

Utilization percentages were calculated by:

$$\text{Utilization (\%)} = \frac{\text{Quantity of Cars Parked}}{\text{Total Parking Space Count}}$$

3.2.2 EV Parking Space Layout Considerations

Ciorba Group prepared parking layout and signage recommendations for two scenarios. One for a DC fast charger and one for a Level II charger. Exhibits are included under Appendix A. The following were considered when preparing the exhibits.

3.2.2.1 Equipment Sizes and Mounting Styles

EV charging equipment dimensions and mounting (wall, pedestal, ground) were considered in the layout, especially where they are not protected by a curb. Table 3.2 provides dimensions of equipment pedestals and base mounted DC fast chargers that were used in preparing the parking space layout exhibits. Designers will have to verify equipment dimensions during design as they vary for each manufacturer, especially when it comes to DC fast chargers.

Table 3.2: Equipment Sizes by Manufacturer for Pedestal Options

Manufacturer	Model	Charging Level	Approximate Dimensions	Cord Cable Length
Eaton	Green Motion*	II	57" H x 15" W x 4" D	25 ft
	Green Motion	DC Fast Charge	66" H x 21" W x 30" D	-
ChargePoint	CT4000	II	71" H x 14" W x 19" D	18 ft**
	CP6000 Fleet*	II	96" H x 11" W x 19" D	23 ft
	Express 250	DC Fast Charge	88" H x 46" W x 17" D	14 ft
Tesla	Wall Connector* w/ Pedestal	II	47" H x 10" W x 7" D	18 ft
	Supercharger	DC Fast Charge	Not Available	Not Available

* Manufacturer offers wall mounted option

** A 23ft option available, adds about 20" to the height of the unit

Wall mounted equipment should be considered in parking garages to protect equipment and where parking space dimensions are less than 9 feet wide and 18 feet long. The parking space dimensions within the university parking garages will have to be reviewed during design, Table 3.3 provides parking space dimensions for reference.

Table 3.3: Dimensions of Parking Spaces at University Parking Garages

Location	Width	Length
Dominican University	8'-6"	18'-4"
Concordia University	9'-0"	18'-0"

For locations where parking stall depths are a concern, ABB offers a wall mounted DC fast charging station that dimensions are 30" H x 23" W x 12" D. Catalog cut information for this unit is included under Appendix F.

3.2.2.2 Parking Space Pavement Markings and Signage

Currently there are no national guidelines available that specifically address EV charging stations space widths, signage, pavement markings, lighting, etc. During design we recommend that the Village consider:

- Additional space requirements for EV pickup trucks, large SUV/Hummers, and vans
- Cord cable management to keep spaces and walkways clear of cords when they are not in use
- Equipment location and protection
- Equipment orientation for motorist accessing touchscreens
- Wheel stops and guard post locations (if required)
- ADA clearances

The following guidelines are available and can be used in assisting with layout, markings, and signage until a national standard is adopted:

- Standards for signage as detailed in the Manual of Uniform Traffic Control Devices (MUTCD)
- California's MUTCD
- County of Santa Clara California Local Government Electric Vehicle Charging Station Siting Toolkit and Reference Guide (as referenced on the US Department of Energy's (DOE) website). California has been a leader in researching, establishment of electrical infrastructure, standards, and investment in EV vehicles. It is for this reason many of their reports and studies are referenced on the US DOE website.

3.3 ELECTRICAL STUDY

This study consisted of reviewing the existing electrical infrastructure present at each site, or potential Com Ed electric service locations, which could be used to power EV charging stations.

At locations where there is existing Village owned electric infrastructure, exhibits were prepared to identify equipment ratings/voltages that could be used to supply power to proposed EV charging stations. The available spare capacity of the equipment was not analyzed to verify whether the infrastructure could support proposed loads. This will need to be investigated further during design, along with confirming conduit/cable routings back to each power source.

At locations where there is no existing Village owned power source, existing Com Ed aerial and underground infrastructure was reviewed during site visits to determine potential service locations. The service locations should be coordinated with Com Ed during design, as they may change prior to when final design is performed.

Summary tables with EV charging station rates and quantities of stations are provided on each exhibit to assist in coordinating electrical services.

CHAPTER 4 : SITE RECOMMENDATIONS

4.1 SITE EXHIBITS

Exhibits identifying recommended EV charging station location(s), rating(s) and potential electric power sources were prepared for each study location (see Appendix B). These exhibits are preliminary and are for planning purposes only. The following information was used to prepare the exhibits:

- Information collected during various site visits.
- Meetings with building maintenance staff and directors on January 23, 2023 and February 2, 2023.
- Current EV charging equipment rates.
- Current electric vehicle offerings.
- Parking durations and patterns noticed during site visits.
- Available power sources.
- Other reports referenced under Section 5

4.2 SUMMARY OF EV CHARGING EQUIPMENT SELECTION BY LOCATION

Below is a summary of the recommended equipment, by location, and as shown on the exhibits. See Section 4.3 for a detailed description of equipment selection by location.

Table 4.1: EV Charging Equipment by Location

Location		Quantity of Level II Charging Stations		Quantity of DC Fast Charging Stations		Recommendations
No.	Description	Quantity	Load/Station	Quantity	Load/Station	
1	North Avenue Parking Lot	1	11.5kW	2	125kW	-One Level II charging station for overnight permit parking. -Two DC fast charging stations for shoppers visiting the CVS store.
2	Dominican University	3	11.5kW (Dual Port)	7	62.5kW	-Three Level II charging stations for staff and students parking adjacent to the Library/Lund Auditorium. -Replace existing hybrid parking spaces with DC fast charging stations.
3	Village Pump Station	-	-	1	62.5kW	-One DC fast charging station for Village staff/fleet vehicles only, due to security reasons since this is a potable water station.
4	Fenwick HS Priory Campus	-	-	3	62.5kW	-Three DC fast charging stations in the Park District parking lot only for use by residents attending sporting activities at Concordia University Sports Field and Priory Park.
5	Concordia University	2 2 8	11.5kW 11.5kW (Dual Port) 19.2kW	-	-	-Two Level II charging stations at the Maintenance Building for fleet vehicles. -Two Level II charging stations at the Christopher Center for staff and tailgate parking. -Eight Level II charging stations within the parking garage.

Location		Quantity of Level II Charging Stations		Quantity of DC Fast Charging Stations		Recommendations
No.	Description	Quantity	Load/Station	Quantity	Load/Station	
6	Metra Commuter Parking Lot	2	11.5kW (Dual Port)	-	-	-Two Level II charging stations for commuters.
7	Village Hall	1	11.5kW	1	125kW	-One Level II charging station for Village fleet vehicles only. -One DC fast charging station for residents visiting Village Hall.
8	Lake Street and Franklin Ave Parking Lot	2	11.5kW (Dual Port)	1	125kW	-One Level II charging station in Lake Street parking lot for Village Staff and permit holders. -One Level II charging station in Franklin Avenue parking lot for permit holders only. -One DC fast charging station in Franklin Avenue parking lot for non-permitted parking spaces.
9	Village Town Center			6	125kW (Dual Port)	-Six DC fast charging stations open to the public.
10	Village Community Center	1	11.5kW (Dual Port)	2	62.5kW	-One Level II charging station for staff and attendees of longer programs. -Two DC fast charging stations for program attendees and those dropping off/picking up children.
11	Public Works	1	11.5kW (Dual Port)	-	-	-One Level II charging station for staff vehicles only.

4.3 DETAILED DESCRIPTION OF EV CHARGING EQUIPMENT SELECTION BY LOCATION

Below is a detailed description of electrical infrastructure improvements and recommended equipment, by location. This section also includes additional considerations that could not be shown on the exhibit.

4.3.1 Location #1 – North Ave Parking Lot

This is a Village owned and maintained parking lot located just east of the intersection of North Avenue and Thatcher Avenue. There are three separate parking areas (as shown on the exhibit), with signage posted that restricts parking either overnight or 24-hours (see photograph 4.1).

Photograph 4.1: Permit Parking Signage

4.3.1.1 Equipment Recommendations

Since the parking areas are accessible by residents of the multifamily buildings and the public (shopping at CVS) we recommend both Level II and DC fast charging stations.

Level II charging station. Since there are less than 50 permit parking spaces, we recommend that one 11.5kW Level II charging station be located in the overnight parking permit area. This spot could be reserved and/or permitted specifically to a resident with EV vehicles who would charge their vehicle overnight. Most vehicles can be charged to 80% within a 6-8 hour period at this charging rate.

DC fast charging stations. Due to the proximity to the CVS store, we recommend that two 125kW DC fast charging stations be installed as shown on the exhibit. Typical parking durations for shoppers would be between 30 minutes - 1 hour while shopping or picking up prescriptions at the store. We also recommend that the Village consider contacting CVS ownership to see if they would be willing to assist with equipment and construction costs associated with this location.

4.3.1.2 Signage Recommendations

We recommend providing signage for the DC fast charging stations to discourage residents from parking in these spots during the day.

Some examples are shown in Figure 4.1 and 4.2. Maximum charging times will have to be updated, and we recommend providing an additional sign indicating additional fees that may be incurred if parking times are exceeded.

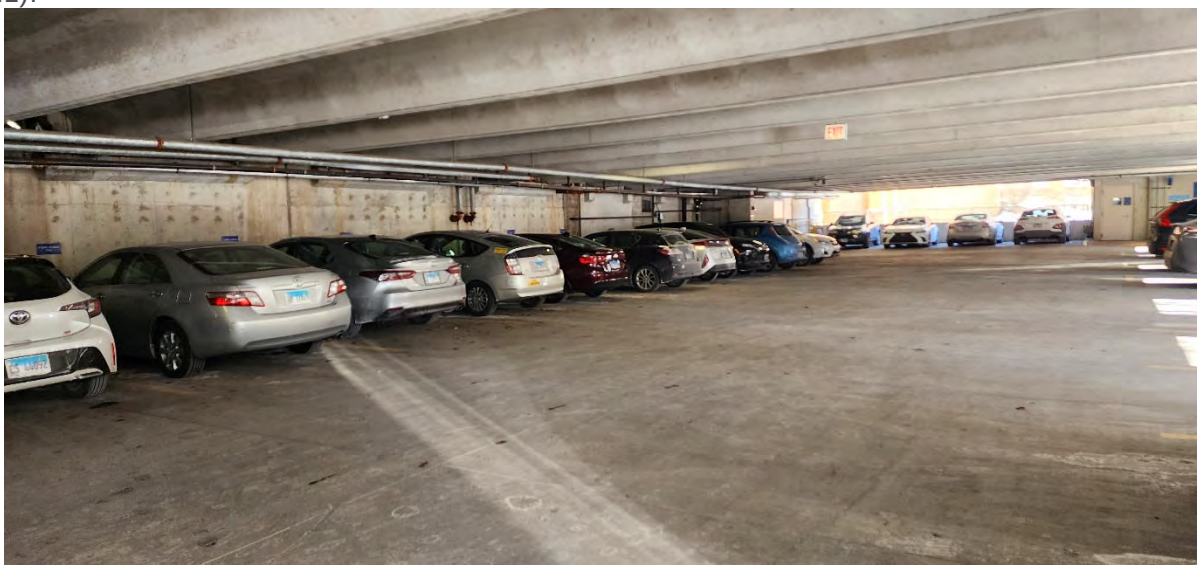
Figure 4.1: No Parking Signs for EV Vehicles [6]

Figure 4.2: Sample Parking Restriction for EV [6]

4.3.2 Location #2 – Dominican University

Ciorba and Village staff met with a maintenance representative on January 23, 2023, to document locations of existing electrical equipment, and verify if they could be potential sources of power for proposed EV charging stations. Since there was no information about where the University is considering EV charging stations be installed, proposed equipment locations are based on parking patterns observed during the site visit.

Based on our visit it appeared that students primarily park in the enclosed parking garage, where there are seven existing spots reserved for hybrid car parking. Of those cars parked in the hybrid parking spots, only one hybrid car was connected, the rest of the cars were non-alternative fuel vehicles (see photograph 4.2).



Photograph 4.2: Parking Garage Hybrid Parking Spots

4.3.2.1 Equipment Recommendations

Parking Garage. Since there are already alternative fuel parking spots within the garage, we recommend replacing the hybrid parking spots with 62.5 kW DC fast charging EV charging stations. Parking durations within the parking garage are anticipated to be between 1-4 hours. Most vehicles can be charged to 80% within four hours at this charging rate.

Additional Locations. In reviewing the site for additional EV charging station locations, we recommend installing three 11.5kW Level II charging stations near the Library and Lund Auditorium. These charging stations could be used by staff and visitors attending events at the theatre. As parking durations are anticipated being between 4-8 hours. Most vehicles can be charged to 80% within an 8-hour period at this charging rate.

4.3.2.2 Electrical Considerations

It was noted that many of the existing low voltage panels within electrical rooms were rated for 120/208V, where typical EV charging stations are rated at 240V. Some equipment charging rates are reduced when operated at 208V. So, this will have to be considered in the future when developing design drawings.

4.3.3 Location #3 – Village Potable Water Pump Station

Since this is a potable water pump station, and is only accessible by Village staff, we recommend that it only be used for charging Village fleet vehicles, for security reasons. During our site visit, it was noted that maintenance staff also park vehicles along Berkshire Street, it is for this reason we suggested it as an alternate location for equipment.

Photograph 4.3: Parking at Potable Pump Station

4.3.3.1 Equipment Recommendations

We recommend a 62.5kW DC fast charger be installed at this location. Since there is limited space to park vehicles and parking durations are typically between 30 mins – 1 hour. The charging station can be

used by fleet vehicles and is rated to charge an electric heavy duty maintenance vehicle in less than 3-hours, should the Village decide to purchase one in the future. The maintenance vehicle could be charged at the station quickly during the day, in lieu of overnight while parked at the public works building.

4.3.3.2 Electrical Considerations

There is an 800A, 277/480V, 3-phase MCC with available space located within the pump station building. Designer should verify whether there is enough capacity in the existing MCC to install a branch circuit breaker, in an empty bucket, to feed the proposed DC fast charging station.

4.3.4 Location #4 – Fenwick High School Priory Campus (previously known as Dominican University Priory Campus)

Ciorba and Village staff met with maintenance personnel who indicated that there is currently no need or plans to install EV charging stations within the loop parking lot. The site is currently being used by Fenwick High School for athletic purposes. Fenwick is still honoring parking spot rental agreements within the east lot, which had been previously negotiated by Dominican University.

During the site visit we were informed that the Park District owns the west parking lot along Division Street. The Park District parking lot is often used by visitors of Priory Park and Concordia University sports fields located along Division Street. River Forest residents also have access to these fields, and many vehicles are seen parked along Division Street during weekdays and weekends while attending practice and games.

Photograph 4.4: Park District Parking Lot

4.3.4.1 Equipment Recommendations

Despite there being less than 50 spaces within the Park District's parking lot, we recommend installing up to three 62.5kW DC fast chargers on this site. The DC fast chargers would also be used by people parking along Division Street during games and practices. Typically parking durations are anticipated to

be between 1 – 2 hours. Most vehicles can be charged to 80% within less than 2-hours at this charging rate.

4.3.4.2 Electrical Considerations

The proposed service connection for this site will have to be coordinated with Com Ed. The transformer and/or pedestal powering the Park District building could not be found. Com Ed pedestals, transformers and switchgears were noted on the exhibit for reference.

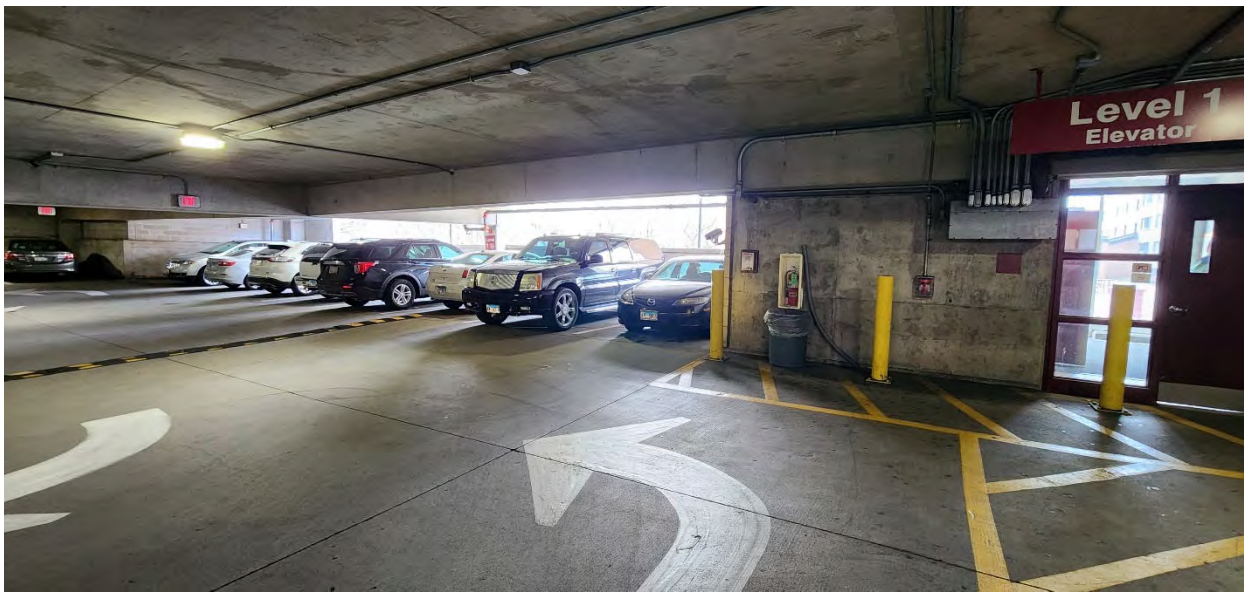
4.3.5 Location #5 – Concordia University

During a meeting with University Staff, we were informed that the University is actively looking into installing EV charging stations. Staff recently received a quote from an electrician to install two dual port Level II charging stations in the University parking garage; and are also considering replacing existing fleet vehicles with electric vehicles.

4.3.5.1 Equipment Recommendations

Parking Garage. We recommend installing eight 19.2kW charging stations within the parking garage. Parking durations will vary significantly in this lot as it is used by students, student families, and visitors attending sporting events. It is for this reason we are recommending a Level II charger. Most cars can be charged to 80% within 6-hours at this charging rate. We did not feel a DC fast charging rate was justified at this location; however, this can be discussed further during design.

Maintenance Staff did express concerns about losing spaces to install EV charging equipment. So, we recommend that equipment be wall mounted in this location to minimize reduction of parking stall lengths. Equipment manufacturer selection should be considered as ABB has many charging station options, including DC fast chargers, that are designed to be mounted to a wall. Catalo



Photograph 4.5: Preferred Equipment Location in Parking Garage

Christopher Center. Two 11.5kW Level II charging stations near the Christopher Center, since we were informed that this parking lot was primarily used by university staff. There are at least two staff

members with electric vehicles. This parking area is also used for Tailgate parking. There are typically 9-10 home games a year.

The typical parking duration is anticipated to be between 6-8 hours. Most vehicles can be charged to 80% within an 8-hour period at this charging rate.

Maintenance Building. Two 11.5kW Level II charging stations are recommended to be installed at the Maintenance Building. Typical parking durations are 8-hours, as vehicles are parked overnight. Most vehicles can be charged to 80% within an 8-hour period at this charging rate.

4.3.5.2 Electrical Considerations

It was noted that many of the existing low voltage panels within electrical rooms were rated for 120/208V, where typical EV charging stations are rated at 240V. Some equipment charging rates are reduced when operated at 208V. So, this will have to be considered in the future when developing design drawings.

4.3.6 Location #6 – Metra Commuter Parking Lot

There are two parking lots that are available to commuters using Metra's Union Pacific West (UP-W) Line (see exhibit). As a result of more people working from home, many commuter parking lots have had a substantial decrease in the number of vehicles using them. This was noted at this location, since only one of the parking lots was being used during our site visit, with an approximate 60% reduction in utilization since 2012. Other things noted during our site visit were:

- Two electric vehicles were parked in the parking lot (one Tesla and one BMW)
- There are 11 parking spots located adjacent to the entrance for Park District vehicles only

Photograph 4.6: Parking Lot #1

Photograph 4.7: Parking Lot #2

4.3.6.1 Equipment Recommendations

Since there are just under 100 spaces overall at this location, we recommend installing two 11.5kW dual port Level II charging stations. Both stations be located in parking lot #1, the primary parking lot being used by commuters. Typically parking durations are anticipated to be between 6 -8 hours. Most vehicles can be charged to 80% within an 8-hour period at this charging rate.

4.3.6.2 Additional Recommendations

We recommend considering relocating Park District parking spots to the north side of the parking lot. This would allow:

- Charging stations to be protected by the curb, instead of being installed between parking spaces within the lot.
- As an incentive to encourage EV adoption by giving electric vehicles priority spots adjacent to the station entrance.

4.3.7 Location #7 – Village Hall

Parking at the Village Hall is separated into various areas/lots, due to limited space to accommodate residents parking needs (see exhibit). The three locations that were specifically included in the study are the primary parking lot used by visitors, the staff parking lot along Park Street, and municipal vehicle parking area.

4.3.7.1 Equipment Recommendations

Staff and Visitor Parking Lot. This parking lot is primarily used by Village Staff. It is located just south of the Village Hall and includes angled parking along Central Avenue. Village residents will use available open spaces within the parking lot, or park within the angled spaces along Central Ave. During our site visit it was noted that at least two electric vehicles used the existing dual port charging station while residents visited Village Hall.

Typical resident parking durations at this lot were noted to be between 30 minutes – 1 hour. Based on this parking duration we recommend installing one 125kW DC fast charging station, in addition to the existing 7.3kW dual port Level II charging station. Providing both the Level II and DC fast charging stations could provide varying charge rates based on visitors' anticipated parking durations.

To discourage extended parking durations while using the DC fast charger, the fee structure could be programmed to increase fees when a vehicle charges beyond 80% battery capacity, or after a predetermined amount of time.

Photograph 4.8: Staff and Visitor Parking

Fleet Vehicle Parking Area. There are 11 spaces located along Central Avenue, below the overhead railroad tracks, that are dedicated for municipal vehicles only (see Photograph 4.9). Typical parking durations are between 6-8 hours. Based on the parking duration, and number of spaces, we recommend installing one 11.5kW dual port Level II charging station. Most vehicles can be charged to 80% within an 8-hour period at this charging rate.

Photograph 4.9: Municipal Vehicle Parking

4.3.7.2 Existing Charging Station Usage

Reviewing a quarterly report (generated by ChargePoint from 9/30/2022) for the usage of the existing EV charging station, it was noted that the charging station is primarily used between 6:00 AM – 12:00 AM. This could be confirmed by Village Staff, who are aware of several residents using the charging station at night, and during our site visits. The report does indicate that the ports are 80% blocked or idle over 24-hour period. We recommend that usage rates continue to be monitored based on trends in electric vehicle sales and registered vehicles.

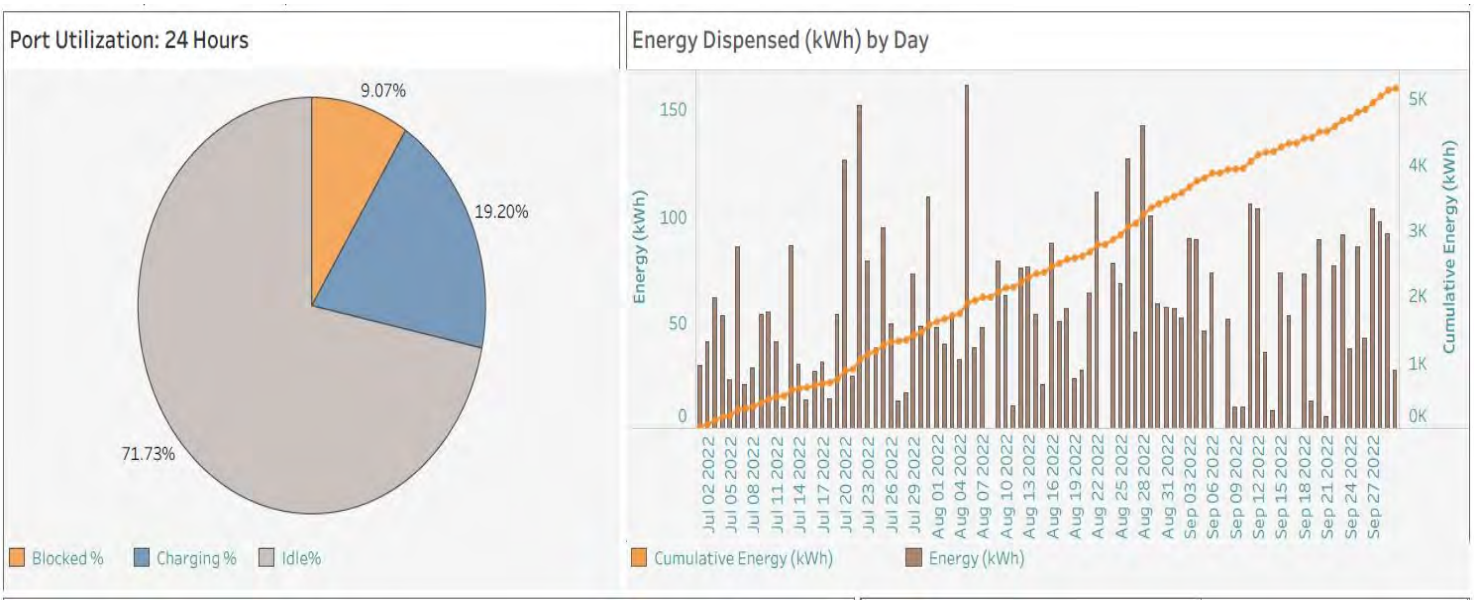


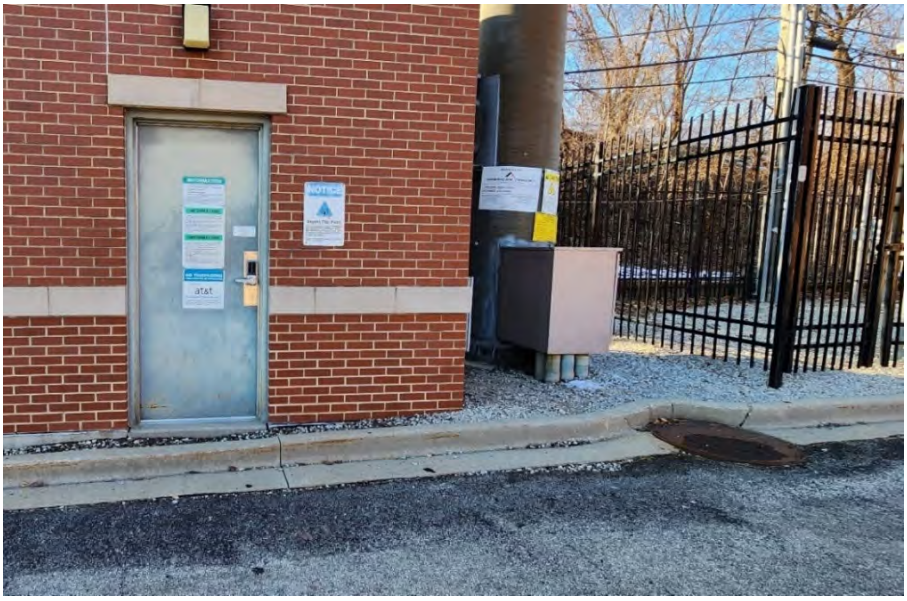
Figure 4.3: Sample Parking Restriction for EV [7]

4.3.7.3 Electrical Considerations

Visitor Parking Lot/Fleet Vehicle Parking Area. The electric service for these charging stations will require additional coordination with AT&T. As Com Ed overhead lines are located along the west side of Village Hall and there are various service drops for AT&T equipment, AT&T control building, and antenna/cellular equipment towers mounted to the wood poles (see Photographs 4.10 and 4.11).

Service equipment for the proposed EV charging stations is shown in the landscaped median, east of the overhead railroad tracks, along Central Avenue. This location will have to be confirmed during design, as the AT&T equipment, AT&T handhole and Com Ed handhole are located in the median.

Photograph 4.10: Looking Northwest at Village Hall Municipal Parking Area and Antennas



Photograph 4.11: AT&T Control Building

We also recommend considering disconnecting the existing Level II charging station from the lighting controller located along Central Avenue (see Photograph 4.12). This would:

- Provide a central power source/controller for the existing and proposed EV charging stations in this area.
- Minimize charging equipment tripping the lighting system or vice versa. Given the age of the equipment and varying equipment manufacturers, it is unknown what order circuit breakers will trip.

- Isolate lighting equipment from EV charging equipment for maintenance purposes. This is not commonly done and could lead to injury if maintenance personnel are aware that non-street lighting equipment is connected to the street lighting controller.

Photograph 4.12: Lighting Controller

4.3.8 Location #8 – Lake Street and Franklin Avenue Parking Lots

These are Village owned and maintained parking lots located just south of the intersection of Lake Street and Franklin Avenue. The parking lots contain both permitted and non-permitted spaces.

Lake Street Parking Lot. This parking lot is restricted to Village Hall Staff parking and permit parking only.

Photograph 4.13: Lake Street Parking Lot

Photograph 4.14: Parking Lot Signage

4.3.8.1 Lake Street Parking Lot Equipment Recommendations

This parking lot is primarily being used by Village Hall staff and by residents with permits. Typical parking durations are 6-8 hours. Based on the parking durations, and there being less than 50 spaces in this parking lot, we recommend one 11.5kW dual port Level II charging station. Most vehicles can be charged to 80% within an 8-hour period at this charging rate.

4.3.8.2 Lake Street Parking Lot Electrical Considerations

During design we recommend verifying whether there is a Com Ed easement that runs along the south side of the business at 7777 Lake Street, including the private parking lot (see Photograph 4.15). An easement will be required to route Com Ed conduit/cable for the proposed equipment as shown in the exhibit.

Photograph 4.15 Verify if there is a Com Ed Easement

Franklin Avenue Parking Lot. The north side of the parking lot is restricted to 3-hour parking and the south side is restricted to permit parking (see Photographs 4.16 through 4.18).

Photograph 4.16: Franklin Avenue Parking Lot

Photograph 4.17: Permit Parking Signage

Photograph 4.18: Parking Restriction Signage

4.3.8.3 Franklin Avenue Parking Lot Equipment Recommendations

Since the parking areas are accessible by residents with permits and the public, we recommend both Level II and DC fast charging stations.

DC fast charging stations. The parking spaces with a 3-hour parking restriction are primarily used by people visiting commercial businesses located along Lake Street, and for residents picking up children from Lincoln Elementary School. Typical parking durations for these spaces are between 30 minutes – 1 hour. For this reason, we are recommending two 125kW DC fast charging stations. This would allow most electric vehicles to charge to an 80% within a 30-minute period at this charging rate.

This would be another location where we recommend that the Village reach out to local business owners to see if they would be willing to assist with equipment and construction costs associated. As the EV charging stations would also benefit the businesses.

Level II charging station. The permit parking spaces are primarily used by residents living in the multifamily buildings located along Franklin Avenue. Typical parking durations for these spaces are between 6-8 hours. For this reason, we recommend one 11.5kW dual port Level II charging station. Most vehicles can be charged to 80% within an 8-hour period at this charging rate.

We also recommend considering modifying parking permits for overnight and daytime parking only if EV charging stations are installed at this location. There are a limited number of parking spaces available in this lot, and they were all empty during the day.

4.3.8.4 Franklin Avenue Signage Recommendations

We recommend providing signage for the DC fast charging stations to discourage people from parking in these spots. Some examples are shown in Figure 4.1 and 4.2.

Also, the DC fast charging fee structure can be set up so that additional fees are incurred when a vehicle charges beyond 80% battery capacity to discourage extended parking durations while using the DC fast charger.

4.3.9 Location #9 – Town Center Commercial Parking Lot

This parking lot is owned and maintained by Mid-America Real Estate Group and is one of the busiest parking lots within the Village. Stores and restaurants that are located within the shopping center are:

- Walgreens
- Whole Foods
- Ulta
- Petco
- Men's Warehouse
- Panera
- Noodle and Company
- Boston Market
- Verizon
- DSW
- Loft
- Chico's
- Lens Crafters
- Massage Envy
- Midwest Express Clinic

Ciorba and Village staff had a conference call with Mid-America management on January 23, 2023. During this call management indicated that Tesla had reached out to discuss installing twelve superchargers within the parking lot. Tesla would rent the parking spaces from Mid-America for the equipment, pay for the installation of the charging equipment and power source(s), and maintain the equipment. Preliminary site exhibits prepared by Tesla for proposed supercharger equipment are included under Section 1.2.4.

4.3.9.1 Equipment Recommendations

Key features of this parking lot are that typical parking durations are between 30 minutes – 1 hour, and the parking lot is located along a major arterial (Harlem Avenue) used by motorists to access I-290. Therefore, based on the parking durations and proximity to the expressway (less than a mile from the parking lot) we recommend only installing DC fast charging stations at this site.

The exhibit prepared for the site shows three dual port 125kW DC fast chargers, in lieu of twelve individual charging stations. This was done to minimize the number of units installed within the parking lot and impact on the existing parking space layout. If a charger station manufacturer does not offer a dual port station, we recommend that the charging stations be installed back-to-back if possible.

Another difference between the recommended layout and Tesla's proposed layout is that we recommend installing charging stations within the high traffic area to promote usage by shoppers. Our concern with locating the charging stations within the southwest quadrant of the parking lot, is that they may not get as much usage because they are less visible to the shoppers, and some may not elect to use them given distance from most frequented business within the shopping center.

4.3.9.2 Tesla Supercharger Site Drawings

On May 2, 2023, Ciorba Group was able to discuss the site drawings prepared by Tesla with Mr. Michael Lovett, the Project Developer who reached out to Mid-America. During our conversation he indicated that the Superchargers were shown to be installed in the southwest quadrant of the parking lot to minimize impact to high traffic areas. Tesla has found that Tesla drivers using superchargers will use the charging stations even if they are not located directly in front building entrances.

4.3.9.3 Future Charging Stations

We recommend monitoring the usage of EV charging stations to determine the need for additional stations. We believe six stations would be a good number to start with. Additional locations for charging stations are shown on the site exhibit, along with an existing 3-phase transformer that could be used to power the equipment. These locations are based on the high traffic areas, and proximity to power will sources.

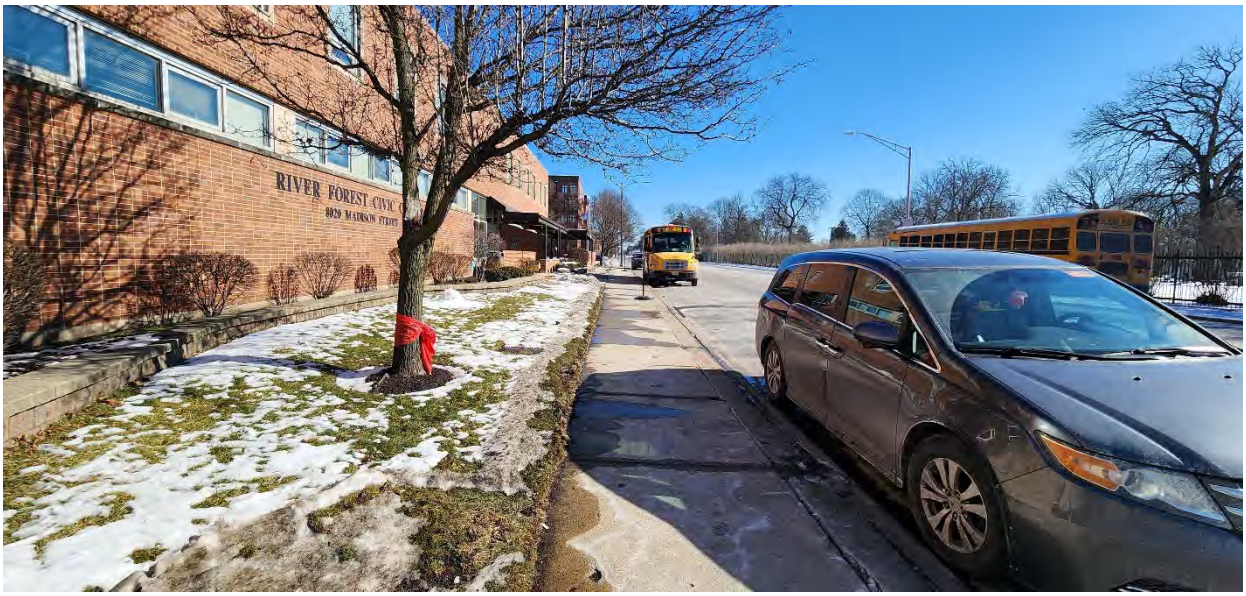
We recommend that any charging stations located along North Avenue, or that NEVI funding will be used for, should be provided with CCS1 and CHAdeMO charging ports. As the current Tesla superchargers only provide Tesla compatible plugs. Tesla is looking to provide superchargers with additional plug options; however, the release date is not known.

4.3.10 Location #10 – Village Community Center

This parking lot is owned and maintained by the River Forest Community Center, which is a self-supporting, registered non-for-profit organization. Ciorba and Village staff met with executive director on January 25, 2023. There has not been a request or need for EV charging stations at the community center, but staff are aware of the popularity and upward trend in sales of electric vehicles.

In reviewing programming offered at the community center, the two most popular programs are:

- Early childhood services, which range from childcare to summer camp. Half and full day options are available. Parents will typically drop off children along Madison Street, in front of the community center entrance.
- Adult and senior programming, which are one to two hours long. Attendees typically will park in the parking lot, or along Gale Avenue.



Photograph 4.19: Drop-Off Area along Madison Avenue

Photograph 4.20: Village Community Center Parking Lot

4.3.10.1 Equipment Recommendations

Based on the parking durations for the varying programs offered we recommend both DC fast chargers and Level II chargers be considered.

Level II charging Station. Since there are less than 50 parking spaces within the parking lot, we recommend one 11.5kW dual-port Level II charging station for staff or anyone attending longer programs. As parking durations are anticipated to be between 4-8 hours. Most vehicles can be charged to 80% within an 8-hour period at this charging rate.

DC fast charging stations. Due to the number of people who park along Madison Street for pick-up and drop-off we recommend two 50kW-62.5kW DC fast charging stations within the parking lot, along Madison Avenue. Typical parking durations would be anticipated to be between 30 minutes – 2 hours, if used while attending shorter programs at the community center. Most vehicles can be charged to 80% within a 2-hour period at this charging rate.

Some benefits to installing the DC fast chargers within the parking lot, along Madison Avenue, are:

- Allow parents dropping off children to use the charging stations.
- Increased visibility by motorist. This could entice motorists to investigate programming at the community center.

4.3.10.2 Electrical Considerations

A new electric service is recommended at this location, due to:

- Existing electrical equipment is rated at 120/208V, 3-phase.
- Due to equipment age, connecting to it may require additional work and/or upgrading equipment. One option that could be explored during design is installing a step-up transformer to allow fast chargers to be connected to existing equipment. This may be a less expensive option but should be investigated further.

4.3.11 Location #11 – Public Works

This is a Village maintenance facility and is only accessible by Village staff. For this reason, we recommend that only Village staff and/or fleet vehicles be allowed to charge at this location for security reasons.

4.3.11.1 Equipment Recommendations

During our site visit, it was noted that there are only 3 striped spaces available for Village staff vehicles. Typical parking durations are 8 hours, so we recommend one 11.5kW dual port Level II charging station be installed. It could be used by staff or Village fleet vehicles, and most vehicles can be charged to 80% within an 8-hour period at this charging rate.

4.3.11.2 Electrical Considerations

When reviewing building electrical equipment during our site visit, it was determined that equipment may require existing panelboard be upgraded, branch circuits traced and rewiring of panelboards if used to power EV charging stations (see photograph 4.21). For this reason, we recommend providing a new Com Ed service drop to power charging equipment.

Photograph 4.21: Panelboards Located in Public Works Building

4.4 PERCENTAGE OF CHARGING STATION BY LOCATION

From the parking space counts obtained during the parking study, the percentage of recommended charging stations at each location could be evaluated (see Table 4.2). This was done to assist the Village with updating the municipal ordinance off-street parking requirements for minimum number of EV charging stations based on total parking spaces.

The percentages of EV charging stations were calculated based on the total number of charging ports, instead of the total number of EV charging stations. Since we felt this was more accurate way to reflect the total charging capacity at each location. Only using the number of charging stations to analyze a sites charging capacity would not account for whether a charging station has a single or dual charging ports.

$$\text{EV (\%)} = \frac{\text{Total of Charging Ports}}{\text{Total Parking Spaces}}$$

We recommend that the Village consider how the quantity a parking spaces and/or EV charging capacity is described in the off-street parking requirements section of the municipal code. As being more general will allow business more flexibility to achieve the desired charging capacity.

Table 4.2: Percentage of EV Charging Ports to Total Parking Spaces

Location		Total Parking Spaces	Quantity of Charging Station		Percentage of EV Charging Stations Based on		Notes
No.	Description		Enclosures	Charging Ports	Total Parking Spaces	2023 Utilization	
1	North Avenue Parking Lot	26	3	3	12%	19%	The percentages do not take into consideration the CVS parking spaces. As the DC fast charging stations would primarily be used by motorist shopping at CVS.
2	Dominican University	1,102	10	13	1%	-	-
3	Village Pump Station	1	1	1	-	-	-
4	Fenwick HS Priory Campus	47	3	3	6%	19%	This does not include street parking used during sporting events and practices.
5	Concordia University	787	11	14	2%	-	-
6	Metra Commuter Parking Lot	95	2	4	4%	13%	-
7	Village Hall	80	4	7	9%	12%	There are 3 separate parking areas that are used for Village Hall, and the percentages are only based on total number of spaces and does not reflect that one EV charging station is provide per parking area.
8	Lake Street Parking Lot	29	3	4	14%	-	The number of vehicles using the parking lot for school pick up purposes was not recorded. For this reason, percentages based on utilization could not be calculated for this location.
9	Village Town Center	488	3	6	1%	2%	This calculation is based on 6 DC fast charging ports being installed; the percentages would be 1%/5% if 12 DC fast charging ports were installed.
10	Village Community Center	45	2	4	9%	11%	This does not include all the street parking used for drop-offs.
11	Public Works	8	1	2	25%	25%	-

4.4.1 Municipal Ordinance Considerations

As part of the limited parking study performed, off-street parking requirements for different States/Counties were reviewed. Many municipalities are still in the process of revising their ordinances. Findings are summarized in Table 4.3, and this table is provided for reference only.

Table 4.3: Percentage of EV Charging Equipment for Off-Street Parking

<table>
<tr><th>City, State (if applicable)</th><th>General Requirements</th></tr>
<tr><td>Maryland** and New Jersey*</td><td>1 EV charging station for 50 or fewer parking spaces.</td></tr>
<tr><td>New Jersey*</td><td>4% of parking spaces for non-residential developments.</td></tr>
<tr><td>New Jersey*</td><td>Multi-unit dwellings must designate 15% of off-street parking when fully developed.</td></tr>
<tr><td>St. Louis Park, MN**</td><td>Parking lots with 50 or more parking spaces should provide:
-Residential developments with 10% of parking spaces dedicated to Level I charging stations, and one Level II charging station.
-Non-residential developments with 1% of spaces for Level II charging station.</td></tr>
<tr><td>Salt Lake City, UT</td><td><table><tr><th>Required Minimum Number of Parking Spaces</th><th>Number of EV Parking Spaces</th></tr><tr><td>0 to 49</td><td>0</td></tr><tr><td>50 to 99</td><td>1</td></tr><tr><td>100+</td><td>2, plus 1 for each additional 100 stalls</td></tr></table></td></tr>
<tr><td>California Building Standards Commission*</td><td>For one and two-family dwellings minimum EV charging station based on the number of parking spaces is:<table><tr><th>Total Actual Parking Spaces</th><th>Number of EV Parking Spaces</th></tr><tr><td>0 to 9</td><td>0</td></tr><tr><td>10 to 25</td><td>1</td></tr><tr><td>25 to 50</td><td>2</td></tr><tr><td>51 to 75</td><td>4</td></tr><tr><td>76 to 100</td><td>5</td></tr><tr><td>101 to 150</td><td>7</td></tr><tr><td>151 to 200</td><td>10</td></tr><tr><td>201 and over</td><td>6% of total parking spaces</td></tr></table></td></tr>
</table>

For public facilities the requirements are as follows:

Total EV Charging Stations	Van Accessible EV Charging Stations	Standard Accessible EV Charging Stations	Ambulatory Accessible EV Charging Stations
1 to 4	1	0	0
5 to 25	1	1	0
26 to 50	1	1	1
51 to 75	1	2	2
76 to 100	1	3	3
101 and over	1, plus 1 for each 300, or fraction thereof, over 100	3, plus 1 for each 60, or fraction thereof, over 100	3, plus 1 for each 50, or fraction thereof, over 100

In cases in which EV charging stations can simultaneously charge more than one vehicle, the number of EV charging stations provided shall be considered equivalent to the number of electric vehicles that can be simultaneously charged.

* As listed on the US DOE website

** As listed in the Great Plains Institute Summary of Best Practices in Electric Vehicle Ordinances

Based on current trends, the proposed quantities of EV charging stations recommended per study location are in line with other municipal or building code requirements.

- A minimum of one charging port/station for parking lots with less than 50 spaces.
- Between 1% and 5% EV charging capacity for parking lots with more than 50 spaces.
- Where percentages in Table 4.1 are higher than 5%, it was typically done so to address those parking lots that had overflow parking on adjacent streets, that could not be factored into parking space counts.

CHAPTER 5 : EQUIPMENT COST AND GRANTS

A general summary of equipment costs and potential grants available for EV charging infrastructure are included in this section for reference. These will have to be updated when each study location is designed and constructed. As the details are continually changing.

5.1 EV CHARGING STATION EQUIPMENT BUDGETARY COSTS

Budgetary costs for charging equipment by manufacturer and charging Levels is listed in Table 5.1. These costs were provided by manufacturer representatives and Steiner (a local electrical distributor), who provided cost and equipment lead times. These prices and lead times are subject to change and are provided for budgetary purposes only.

Table 5.1: EV Charging Station Manufacturer's and Models

Model	Level	Standard Warranty	Equipment Budgetary Costs*	Lead Time
Eaton				
Green Motion Pro	II	3	$2,900	5-12 Weeks
Green Motion Fleet	II	3	$3,300	5-12 Weeks
Green Motion DC	DC Fast Charger	1	$106,00	Not available. Will be launched at the end of the 2023.
ChargePoint				
CPF50	II	1	$2,400	22 Weeks for Steiner
CP6000	II	1	$11,000	In Stock at Steiner
Express 250	DC Fast Charger	1	$59,000	12-16 Weeks for Steiner
Tesla				
Wall Connector	II	3	$825	Unknown (Available online)
Supercharger	DC Fast Charger	Units must be maintained by Tesla	Unavailable	Unavailable

* These costs are for standard features and does not include software or cellular connections.

5.2 GRANTS

Below is a summary of grants and incentives which are or will be available.

5.2.1 Federal Electric Vehicle Investment

On November 15, 2021 the Infrastructure Investment and Jobs Act (IIJA) was signed into law. As part of this act, $7.5 billion will be allocated to various programs to promote electric vehicles and infrastructure across the nations. The breakdown of funding is listed in Table 5.2.

Table 5.2: Funding Breakdown

Amount	Funding Usage	Administrator
$7.5 Billion (Total Program Amount)	Charging and refueling infrastructure along interstates in historically disadvantage communities – Also referred to as Alternative Fuel Corridors (AFCs)	Joint Office of Energy and Transportation
$5 Billion	National Electric Vehicle Infrastructure (NEVI) program	Federal Highway Administration
$148 Million	NEVI funding allocated to Illinois	IDOT

5.2.1.1 Charging and Fueling Infrastructure (CFI) Grant Opportunity

The CFI Grant Opportunity is a new competitive grant program under the NEVI program. The grant program is being administered by the US Department of Transportation, Federal Highway Administration. The grant program looks to make modern and sustainable infrastructure accessible to all drivers of alternative fuel vehicles. There are two funding categories under the grant:

- Community Charging and Fueling Grants (Community Program) – Up to $350 million is available
- Alternative Fuel Corridor (AFC) Grants (Corridor Program) – Up to $350 million is available

Grant application details were posted on March 14, 2023, and must be submitted by June 30, 2023. This date has been pushed back once, therefore we recommend that the Village monitor this date should additional information be published after this report was finalized. It is unclear if it will be offered again next year.

Details are summarized below and are available through grants.gov.

Table 5.3: Charging and Fueling Infrastructure Grant Opportunity Details

	Community Program	Corridor Program
Award Amounts	$500,000 (min) $15 million (max)	$1 million (min) No upper limit
What is covered	All costs associated with work (including preliminary planning study, design, material, installation, maintenance, education, and community engagement)	
Cost Sharing/Matching	Shall not exceed 80% of total project costs and can be combined with other grants/funding programs	
Eligible Applicants	State & Local Governments	
Requirements	• Located on any public road or in other publicly accessible locations, such as parking facilities at public buildings, public schools, and public parks, or in publicly accessible parking facilities owned or managed by a private entity. • Must be publicly accessible. • May use funds to contract with a private entity. • Must address environmental justice. • Expected to reduce greenhouse gas emissions and to expand or fill gaps in access to publicly accessible infrastructure. • Must be accessible to and usable by individuals with disabilities.	• Located along a designated AFC; EV charging within 1 mile and other alternative fuels within 5 miles of the AFC. • Must be publicly accessible. • May use funds to contract with a private entity. • Must address environmental justice. • Must be accessible to and usable by individuals with disabilities.

	Community Program	Corridor Program
Eligible Projects	• EV charging stations. • Hydrogen fueling infrastructure. • Propane fueling infrastructure for medium and heavy-duty trucks only. • Natural gas fueling infrastructure.	• EV charging stations. • Hydrogen fueling infrastructure. • Propane fueling infrastructure for medium and heavy-duty trucks only. • Natural gas fueling infrastructure.
Project Merit Criteria	While evaluating submittals DOT will assign each project with an overall rating of highly recommended project, recommended and not recommended based on project merit criteria. A highly recommended project is one that receives a highly qualified rating in at least 3 of the 5 project merit criteria. A recommended project is on that receives qualified in each project merit criteria. The five project criteria areas are: • Safety • Climate change, resilience and sustainability • Equity, community engagement and justice • Workforce development, job quality and wealth creation • CFI program vision	

Applications must include the following information:

- Projective Narrative
- Budget Information
- Project Merit Criteria
- Project Readiness and Environmental Risk

Unfortunately, there are no details if or when additional funding will be available.

5.2.2 IEPA

Based on the Climate and Equitable Jobs Act (CEJA) passed by the general assembly and signed into law by Governor Pritzker, the IEPA has been directed to provide funding for Level II and Level III (also referred to DC fast chargers) charging stations. The funding will have to be consistent with the Illinois Commerce Commission (ICC) approved Beneficial Electrification Plans.

The funding can be used for both public and private organizations/companies, to cover up to 80% of the costs to install the equipment. Funding is not available yet. The comment period for the charging infrastructure grant rule, 35 Illinois Administration Code, Section 285, has been closed. The final copy has not been published.

5.2.2.1 Electric School Bus Program

The Illinois Environmental Council and IEPA intend to use $27 million of the funds to purchase electric school buses. The grant funding would cover up to 75% of the cost to purchase the buses and install electric charging infrastructure. Private school bus companies that serve public schools would be eligible under this program.

The current application deadline is September 5, 2023. Applications are available online at Driving a Cleaner Illinois.

5.2.3 Cook County

In November of 2022, Cook County Board President Toni Preckwinkle announced that $5.5 million in funding would be available for EV Charging Station Program. The funding for this program was through the American Rescue Plan Act (ARPA). The County will award $100 million in funds to support clean environment initiatives.

The purpose of the EV Charging Station Program is to increase the number of EV charging stations throughout the County. This initiative would be led by the County's Department of Environment and Sustainability and Bureau of Asset Management. Their goal is to install up to 75 dual port public EV charging stations, over a four-year initiative. The County will cover the cost of the EV equipment, installation, networking fees and any fees associated with the warranty for the first five years.

The County is currently seeking input from municipal leaders, residents, business owners and community organizations to determine the locations of charging stations. Whether they be municipal buildings, public libraries, community centers, house of worship, or shopping centers. Priority will be to installing charging stations within historically disadvantage/disinvested communities.

5.2.4 Electrify America

The creation of Electrify America was from the Volkswagen $2 billion settlement for the 2.0-Liter Partial Consent Decree entered by the US District Court for the Northern District of California on October 25, 2016. This is the single largest private investment in charging infrastructure, with $2 billion in investment over 10-years in zero emission vehicle (ZEV) infrastructure.

Electrify America was established as the administrator of the funds, to ensure that infrastructure investments "builds or increase public awareness of ZEV's" and "increases public exposure and/or access to ZEV's without requiring the consumer to purchase or lease a ZEV at full market value," as described in the consent decree.

As part of the $2 billion commitment, $300 million will be spent nationally in four 30-month cycles. The program is currently within Cycle 3 (Q1 2022 – Q2 2024). Cycle 4 is schedule for Q3 2024 – Q4 2026.

Throughout Cycle 3, Electrify America will continue to review submissions and meet with stakeholders on potential infrastructure investment areas.

5.2.5 Regional Electric Vehicle (REV) Midwest Plan

Illinois joined Indiana, Michigan, Minnesota and Wisconsin signed a plan to accelerate electric vehicle infrastructure and standards in the Midwest. A memorandum was signed on September 30, 2021,

detailing the objectives and processes for the group. The states maintain coordination and report on their actions.

No funding/grant opportunities have been established for local and public sectors at this time.

5.2.6 Illinois Department of Central Management Services (CMS)

CMS is now offering assistance to state agencies identifying external funding, financing and evaluating infrastructure needs for electric vehicle fleet management. No specific details are available, the website directs agencies to contact CMS for further assistance.

5.2.7 Reimagining Energy and Vehicles (REV) Illinois Program

REV is a key component to Governor Prizker expanding growth in key industries. REV Illinois offers competitive incentives to expand, or to relocate, to Illinois to manufacture in whole or in part, electric vehicles and associated battery, charging infrastructure and recycling products, as well as renewables including solar, wind and energy storage. The program is administered by the Department of Commerce & Economic Development (DCEO). Applications are available online at Illinois.gov. The funding is geared towards manufacturing and is included for reference.

CHAPTER 6 : REFERENCES

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Figure Credits:

[1] Vehicles Registrations, Office of the Illinois Secretary of State, https://www.ilsos.gov/departments/vehicles/statistics/home.html. Accessed April 2023.

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Photo Credits:

2.1 "SAE J1772," Wikipedia, https://en.wikipedia.org/wiki/SAE_J1772. Accessed April 2023.

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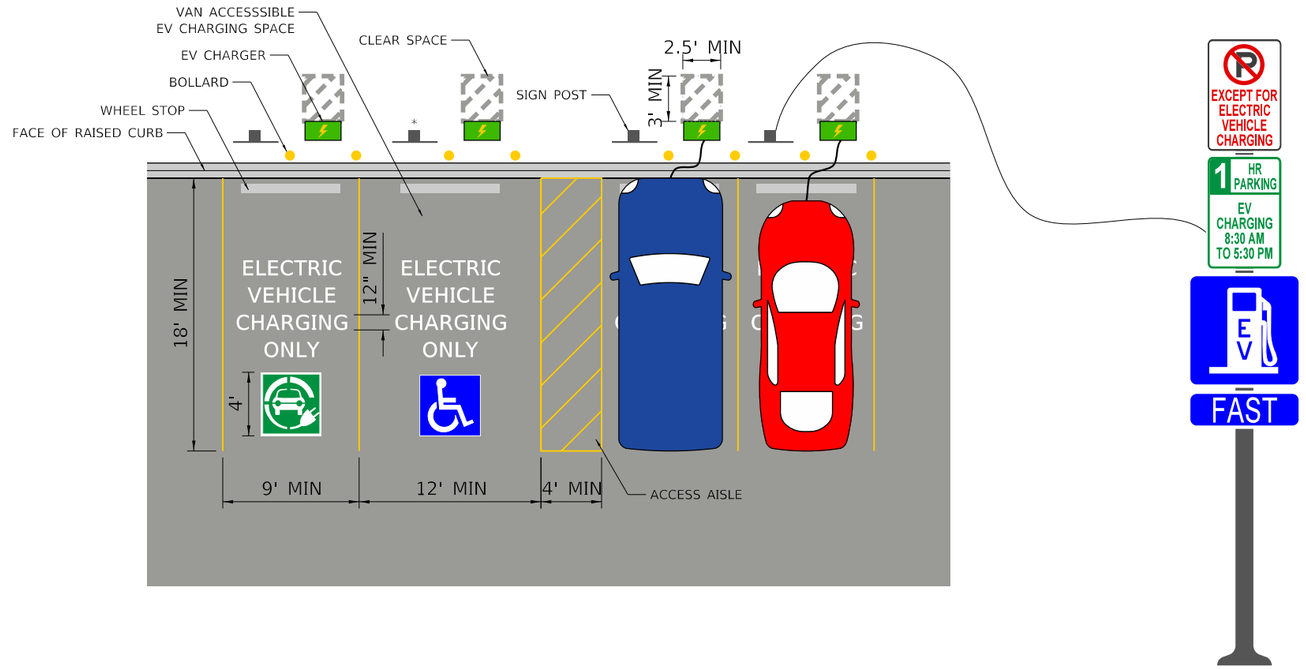
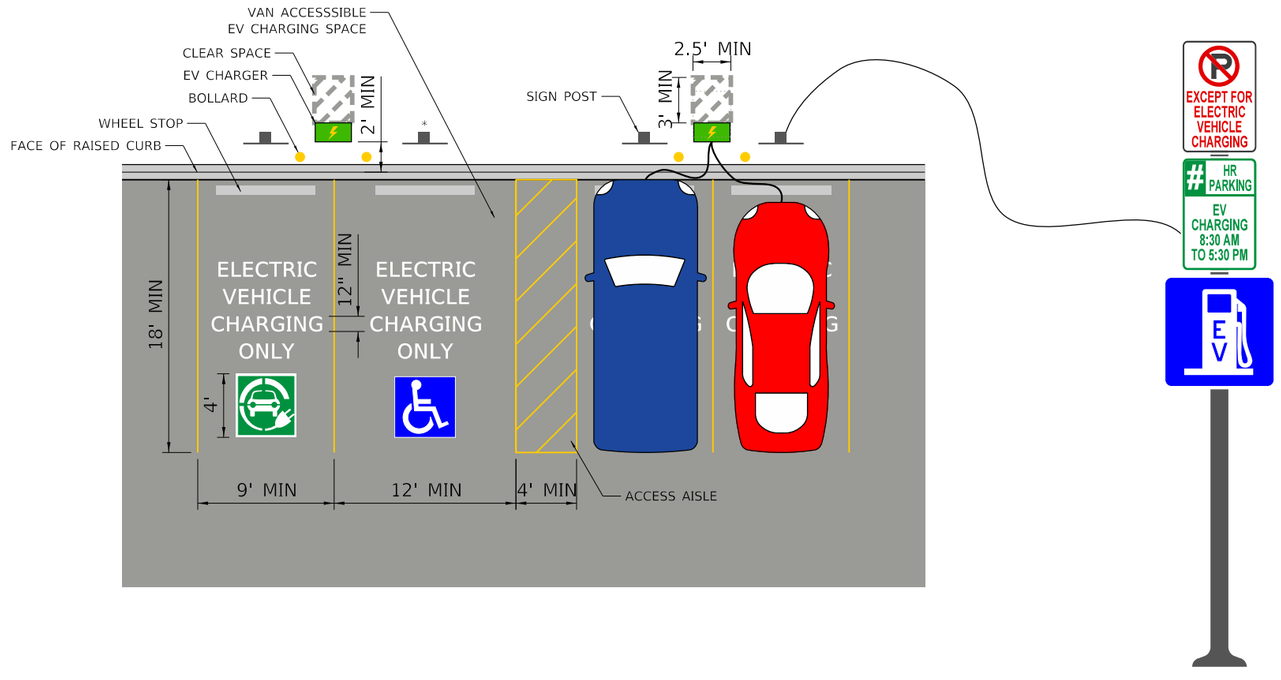
APPENDIX A

Parking Configuration Exhibits



DC /FAST CHARGING STATION

* INCLUDE ADA RESERVED PARKING SIGN (R7-8) WHEN APPLICABLE



AC /LEVEL II DUAL CHARGING STATION

* INCLUDE ADA RESERVED PARKING SIGN (R7-8) WHEN APPLICABLE

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VILLAGE OF RIVER FOREST

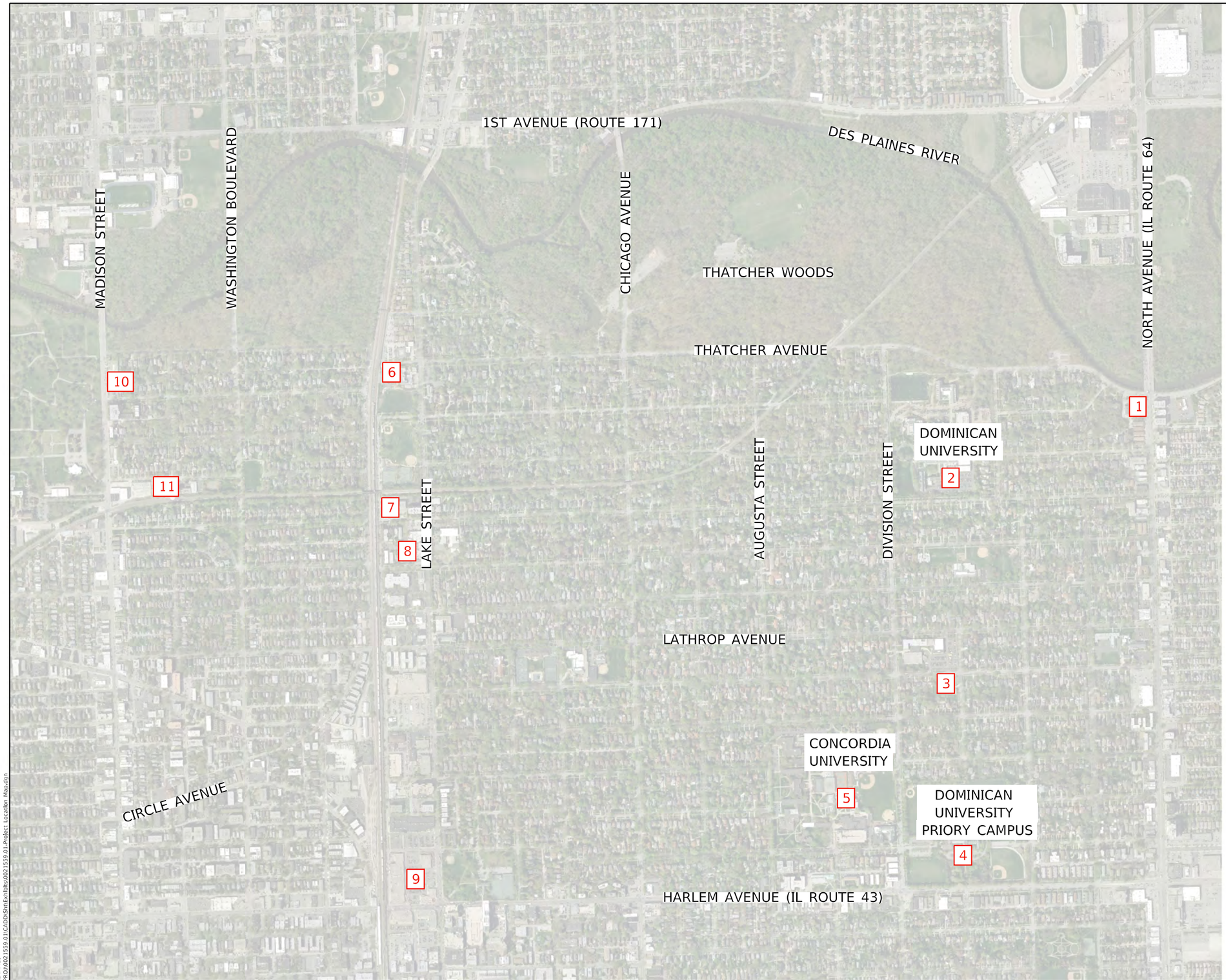
EV INFRASTRUCTURE NETWORK STUDY
TYPICAL EV PARKING SPACE LAYOUTS

SCALE: N.T.S. | SHEET OF SHEETS | STA. | TO STA.

$$$ RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
$$$	$$$	$$$	xxx	
		CONTRACT NO.		$$$
	ILLINOIS	FED. AID PROJECT		

APPENDIX B

Electrical Exhibits



0 500' 1000'

GRAPHIC SCALE

LOCATION DESCRIPTIONS

1. NORTH AVENUE PARKING
2. DOMINICAN UNIVERSITY
3. VILLAGE PUMP STATION (7525 BERKSHIRE ST)
4. FENWICK HIGH SCHOOL PRIORY CAMPUS
5. CONCORDIA UNIVERSITY
6. METRA COMMUTER PARKING LOT
7. VILLAGE HALL
8. LAKE STREET AND FRANKLIN AVENUE PARKING LOTS
9. VILLAGE TOWN CENTER PARKING LOT
10. VILLAGE COMMUNITY CENTER
11. PUBLIC WORKS

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		DRAWN -	DDS	REVISED -	
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VILLAGE OF RIVER FOREST

OVERALL PROJECT LOCATION MAP

SCALE: 1" = 500' | SHEET OF SHEETS | STA. | TO STA.

RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	12	1
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		

EX ROW

NORTH AVENUE

EX ROW

THATCHER AVENUE

10 SPACES

VILLAGE PARKING (OVERNIGHT PERMIT PARKING AREA)

DC FAST CHARGER

LEVEL II CHARGER

POTENTIAL LOCATION FOR 3-PH PAD MOUNTED COM ED TRANSFORMER AND CONTROLLER CABINET FOR EV CHARGING EQUIPMENT

3-PHASE OH ALONG THATCHER AVENUE

VEHICLE PARKING AND ALTERNATIVE LOCATION FOR DC FAST CHARGERS

CVS

3 SPACES

5 SPACES

8 SPACES

EXISTING COM ED WOOD POLE, TYP

BOLLARD LIGHTS, TYP.

SINGLE PHASE POLE MOUNTED COM ED TRANSFORMER AND OVERHEAD SERVICE FEED TO MULTIFAMILY BUILDING

CVS 3-PHASE PAD MOUNTED TRANSFORMER (#1A1) POTENTIAL ELECTRIC SERVICE LOCATION FOR DC FAST CHARGERS

VILLAGE PARKING (OVERNIGHT PERMIT PARKING AREA)

VILLAGE PARKING (24 HOUR PERMIT PARKING AREA)

SINGLE PHASE OVERHEAD PRIMARY CABLE. COM ED WILL HAVE TO ADD TWO ADDITIONAL PRIMARY CABLES TO PROVIDE 3-PHASE ELECTRIC SERVICE. CABLES WILL HAVE TO BE REROUTED FROM THATCHER AVENUE, OR SOMEWHERE ALONG POLE LINE WHICH RUNS TO GREENFIELD STREET.

POTENTIAL CONDUIT ROUTING TO NEW PAD MOUNTED COM ED TRANSFORMER (APPROX. 380 FT)

EX ROW

EX ROW

N

0 20' 40'

GRAPHIC SCALE

EV CHARGING STATION LOAD TABLE		
LOCATION #1 - VILLAGE PARKING LOT ALONG NORTH AVE		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
2	125 kW	250 kW
1	11.5 kW	11.5 kW
TOTAL		262 kW

ELECTRICAL DETAILS	
LOCATION #1 - VILLAGE PARKING LOT ALONG NORTH AVE	
POWER SOURCE LOCATION	SERVICE/ CONTROL LOCATION
NEW COM ED SERVICE	EXTERIOR

SERVICE EQUIPMENT NOTES:

1. A 277/480V, 3PH ELECTRIC SERVICE TO POWER BOTH THE AC AND DC FAST CHARGING STATIONS. A 480V PRIMARY X 240V SECONDARY STEP DOWN TRANSFORMER WILL BE REQUIRED TO OPERATE THE LEVEL II CHARGING STATION.

2. ANTICIPATE PARKING DURATION FOR VILLAGE PARKING AREA ARE:
   - 24-HOUR PERMIT AREAS = 6-8 HOURS, PRIMARILY OVERNIGHT
   - OVERNIGHT PERMIT AREAS = 30 MINS - 1 HOURS, PRIMARILY USED FOR CVS PARKING

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	DRAWN - DDS	REVISED -	
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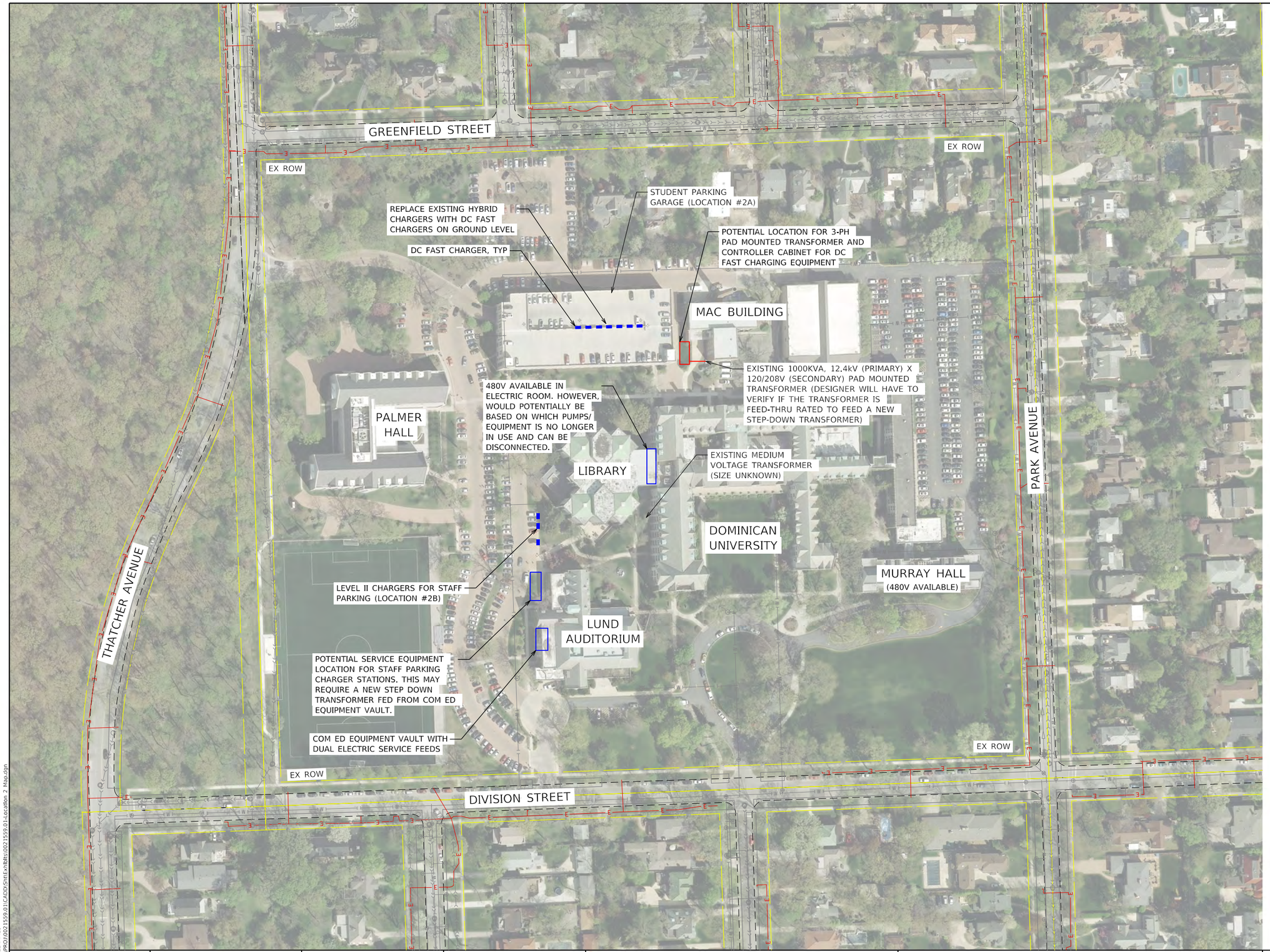
VILLAGE OF RIVER FOREST

ELECTRICAL EHXIBIT
LOCATION #1 – NORTH AVENUE PARKING LOT

SCALE: 1" = 20' | SHEET OF SHEETS | STA. TO STA.

RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	12	2
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		



N

0 80' 160'

GRAPHIC SCALE

EV CHARGING STATION LOAD TABLE		
LOCATION #2A - PARKING GARAGE		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
7	62.5 kW	438 kW
TOTAL		438 kW

EV CHARGING STATION LOAD TABLE		
LOCATION #2B -STAFF PARKING LOT		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
3 DUAL PORT	11.5 kW	69 kW
TOTAL		69 kW

ELECTRICAL DETAILS	
LOCATION #2 - DOMINICAN UNIVERSITY	
POWER SOURCE LOCATION	SERVICE/ CONTROL LOCATION
CONNECT TO EXISTING EQUIPMENT	EXTERIOR

SERVICE EQUIPMENT NOTES:

1. THE EXISTING EQUIPMENT CAPACITY WILL HAVE TO BE VERIFIED DURING DESIGN FOR THE PROPOSED CHARGING STATION CONNECTED LOADS. DC CHARGING STATIONS WILL REQUIRE 480V, 3-PH FEEDER CIRCUITS, AND LEVEL II CHARGING STATIONS WILL REQUIRE 240V, 1-PH FEEDER CIRCUITS.

2. TYPICAL PARKING DURATIONS BY PARKING AREAS ARE:
   -PARKING GARAGE = 1-4 HOURS, PRIMARILY FOR STUDENTS ATTENDING CLASSES
   -BY LIBRARY/LUND AUDITORIUM = 4-8 HOURS, PRIMARILY USED BY STAFF

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	DRAWN - DDS	REVISED -	
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VILLAGE OF RIVER FOREST

ELECTRICAL EHXIBIT
LOCATION #2 – DOMINICAN UNIVERSITY

SCALE: 1" = 80' | SHEET OF SHEETS | STA. TO STA.

RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	12	3
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		

N

0 20' 40'
GRAPHIC SCALE

EV CHARGING STATION LOAD TABLE		
LOCATION #3 - VILLAGE PUMP STATION		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
1	62.5 kW	62.5 kW
TOTAL		62.5 kW

ELECTRICAL DETAILS	
LOCATION #3 - VILLAGE PUMP STATION	
POWER SOURCE LOCATION	SERVICE/ CONTROL LOCATION
CONNECT TO EXISTING EQUIPMENT	EXTERIOR

SERVICE EQUIPMENT NOTES:

1. DESIGNER SHOULD VERIFY THAT THERE IS ENOUGH CAPACITY IN THE EXISTING MCC TO INSTALL A BRANCH CIRCUIT BREAKER, IN AN EMPTY BUCKET, TO FEED THE PROPOSED DC FAST CHARGING STATION.

2. TYPICAL PARKING DURATION IS 30 MINS - 1 HOUR, WHILE PERFORMING MAINTENANCE ACTIVITIES AT THE STATION.

3. MINIMUM RECOMMENDED EQUIPMENT CHARGING RATE FOR DC FAST CHARGERS IS 62.5kW. THIS WOULD ALLOW A HEAVY DUTY ELECTRIC VEHICLE TO BE CHARGED TO 80% LEVEL WITHIN AN HOUR, SHOULD THE VILLAGE DECIDE TO REPLACE PUBLIC WORKS FLEET VEHICLES WITH ELECTRIC VEHICLES IN THE FUTURE.

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VILLAGE OF RIVER FOREST

ELECTRICAL EHXIBIT
LOCATION #3 – VILLAGE PUMP STATION

SCALE: 1" = 20' | SHEET OF SHEETS | STA. TO STA.

RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	12	4
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		

N

0 80' 160'

GRAPHIC SCALE

EV CHARGING STATION LOAD TABLE		
LOCATION #4 - DOMINICAN UNIVERSITY PRIORY CAMPUS		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
3	62.5 kW	188 kW
TOTAL		188 kW

ELECTRICAL DETAILS	
LOCATION #4 - DOMINICAN UNIVERSITY PRIORY CAMPUS	
POWER SOURCE LOCATION	SERVICE/ CONTROL LOCATION
NEW ELECTRIC SERVICE	EXTERIOR

SERVICE EQUIPMENT NOTES:

1. THE ELECTRIC SERVICE FOR THIS LOCATION WILL REQUIRE COORDINATION WITH COM ED. IT WAS DIFFICULT TO DETERMINE WHERE THE ELECTRIC SERVICE FEED FOR THE PARK DISTRICT BUILDING IS COMING FROM; AND, WHERE THE COM ED PRIMARY CONDUIT/CABLE ARE ROUTED. A 277/480V, 3-PH ELECTRIC SERVICE WILL BE REQUIRED FOR PROPOSED DC FAST CHARGING STATIONS.

2. TYPICAL PARKING DURATION IS 30 MINS - 2 HOURS, WHILE ATTENDING SPORTING EVENTS AT THE VARIOUS FIELDS.

3. MINIMUM RECOMMENDED EQUIPMENT CHARGING RATE FOR DC FAST CHARGERS IS 62.5kW. THIS WOULD ALLOW MOST ELECTRIC VEHICLE TO BE CHARGED TO 80% LEVEL WITHIN A 2-HOUR PERIOD.

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VILLAGE OF RIVER FOREST

ELECTRICAL EHXIBIT
LOCATION #4 – FENWICK HIGH SCHOOL PRIORY CAMPUS

SCALE: 1" = 80' | SHEET OF SHEETS | STA. TO STA.

RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	12	5
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		

N

0 80' 160'

GRAPHIC SCALE

EV CHARGING STATION LOAD TABLE		
LOCATION #5A - MAINTENANCE BUILDING		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
2	11.5 kW	23 kW
TOTAL		23 kW

EV CHARGING STATION LOAD TABLE		
LOCATION #5B - STAFF PARKING LOT		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
2-DUAL PORT	11.5 kW	46 kW
TOTAL		46 kW

EV CHARGING STATION LOAD TABLE		
LOCATION #5C - PARKING GARAGE		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
8	19.2 kW	154 kW
TOTAL		154 kW

ELECTRICAL DETAILS	
LOCATION #5 - CONCORDIA UNIVERSITY	
POWER SOURCE LOCATION	SERVICE/ CONTROL LOCATION
CONNECT TO EXISTING EQUIPMENT	EXTERIOR

SERVICE EQUIPMENT NOTES:

1. THE ELECTRIC SERVICE FOR THIS LOCATION WILL REQUIRE COORDINATION WITH CONCORDIA STAFF AND EQUIPMENT SELECTION. SOME CHARGING EQUIPMENT RATINGS ARE REDUCED WHEN CONNECTED TO 208V CIRCUIT BREAKERS. IF A 240V, 1-PH CONNECTION IS REQUIRED THEN A NEW STEP DOWN TRANSFORMER WILL BE REQUIRED.

2. TYPICAL PARKING DURATIONS BY PARKING AREAS ARE:
   - -PARKING GARAGE = 1-4 HOURS, PRIMARILY FOR STUDENTS ATTENDING CLASSES
   - -BY CHRISTOPHER CENTER = 6-8 HOURS, PRIMARILY USED BY STAFF AND TAILGATING
   - -MAINTENANCE BUILDING = 6-8 HOURS, PRIMARILY OVERNIGHT.

3. BASED ON PARKING LOT USAGE AND PARKING DURATIONS, THERE DOES NOT APPEAR TO BE A NEED FOR DC FAST CHARGERS.

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USER NAME = Electrical		DESIGNED - KL		REVISED -	
		DRAWN - DDS		REVISED -	
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VILLAGE OF RIVER FOREST

ELECTRICAL EHXIBIT
LOCATION #5 – CONCORDIA UNIVERSITY

SCALE: 1" = 80' | SHEET OF SHEETS | STA. TO STA.

RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	12	6
		CONTRACT NO.		
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N

0 50' 100'

GRAPHIC SCALE

EV CHARGING STATION LOAD TABLE		
LOCATION #6 - METRA STATION COMMUTER PARKING LOTS		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
2-DUAL PORT	11.5 kW	46 kW
TOTAL		46 kW

ELECTRICAL DETAILS	
LOCATION #6 - METRA STATION COMMUTER PARKING LOT	
POWER SOURCE LOCATION	SERVICE/ CONTROL LOCATION
NEW ELECTRIC SERVICE	EXTERIOR

SERVICE EQUIPMENT NOTES:

1. A 120/240V, 1-PH ELECTRIC SERVICE TO POWER THE LEVEL II CHARGING STATIONS.

2. TYPICAL PARKING DURATION IS 6-8 HOURS.

3. MINIMUM RECOMMENDED EQUIPMENT CHARGING RATE FOR AC CHARGERS IS 11.5kW. THIS WOULD ALLOW MOST ELECTRIC VEHICLES TO BE CHARGED TO 80% LEVEL WITHIN A 8-HOUR PERIOD.

4. CONSIDER MOVING THE PARK DISTRICT PARKING SPOTS TO THE NORTH SIDE OF THE PARKING LOT.

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VILLAGE OF RIVER FOREST

ELECTRICAL EXHIBIT
LOCATION #6 – METRA STATION COMMUTER PARKING LOT

SCALE: 1" = 50' | SHEET OF SHEETS | STA. | TO STA.

RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	12	7
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		

N

0 40' 80'

GRAPHIC SCALE

EV CHARGING STATION LOAD TABLE		
LOCATION #7 - VILLAGE PARKING LOT		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
1-EXISTING DUAL PORT	7.3 kW	15 kW
1-DUAL PORT	11.5 kW	23 kW
1 DC FAST	125 kW	125 kW
TOTAL		163 kW

ELECTRICAL DETAILS	
LOCATION #7 - VILLAGE HALL	
POWER SOURCE LOCATION	SERVICE/ CONTROL LOCATION
NEW ELECTRIC SERVICE	EXTERIOR

SERVICE EQUIPMENT NOTES:

1. A 277/480V, 3-PH ELECTRIC SERVICE TO BOTH THE LEVEL II AND DC FAST CHARGING STATION FOR VILLAGE HALL. A 480V PRIMARY X 240V SECONDARY STEP DOWN TRANSFORMER WILL BE REQUIRED TO OPERATE THE LEVEL II CHARGING STATIONS.

2. A 120/240V, 1-PH ELECTRIC SERVICE TO POWER CHARGING STATION FOR STAFF PARKING LOT.

3. THE EXISTING CHARGEPOINT STATION SHOULD BE DISCONNECTED FROM THE EXISTING STREET LIGHTING CONTROLLER CABINET AND CONNECTED TO THE PROPOSED EQUIPMENT.

4. TYPICAL PARKING DURATIONS BY PARKING LOT/AREA ARE:
-VISITOR PARKING LOT = 30 MINS - 1 HOUR
-STAFF/PERMIT PARKING AREA = 6-8 HOURS
-MAINTENANCE VEHICLE PARKING AREA = 6-8 HOURS

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INCORPORATED 1880 RIVER FOREST Proud Heritage Bright Future

VILLAGE OF RIVER FOREST

ELECTRICAL EXHIBIT
LOCATION #7 – VILLAGE HALL

SCALE: 1" = 40' | SHEET OF SHEETS | STA. TO STA.

RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	12	8
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		

N

0 40' 80'

GRAPHIC SCALE

EV CHARGING STATION LOAD TABLE		
LOCATION #8A - LAKE STREET PARKING LOT		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
1-DUAL PORT	11.5 kW	23 kW
TOTAL		23 kW

EV CHARGING STATION LOAD TABLE		
LOCATION #8B - FRANKLIN AVENUE PARKING LOT		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
1-DUAL PORT	11.5 kW	23 kW
2 DC FAST	125 kW	250 kW
TOTAL		273 kW

ELECTRICAL DETAILS	
LOCATION #8 - VILLAGE PARKING LOTS	
POWER SOURCE LOCATION	SERVICE/ CONTROL LOCATION
NEW ELECTRIC SERVICE	EXTERIOR

SERVICE EQUIPMENT NOTES:

1. A 277/480V, 3-PH ELECTRIC SERVICE TO BOTH THE LEVEL II AND DC FAST CHARGING STATION. A 480V PRIMARY X 240V SECONDARY STEP DOWN TRANSFORMER WILL BE REQUIRED TO OPERATE THE LEVEL II CHARGING STATION.

2. OWNERSHIP OF THE WOOD POLE WITH LUMINAIRES MOUNTED TO IT SHOULD BE VERIFIED DURING DESIGN. IT MAY BE A PRIVATELY OWNED WOOD POLE.

3. TYPICAL PARKING DURATIONS BY PARKING AREA ARE:
   - 3-HOUR PARKING AREA = 30 MINS-1HOUR, PRIMARILY FOR RESIDENTS SHOPPING ALONG LAKE STREET
   - PERMIT PARKING AREA = 6-8 HOURS

4. MINIMUM RECOMMENDED EQUIPMENT CHARGING RATE FOR AC CHARGERS IS 11.5kW. THIS WOULD ALLOW MOST ELECTRIC VEHICLES TO BE CHARGED TO 80% LEVEL WITHIN A 8-HOUR PERIOD.

5. MINIMUM RECOMMENDED EQUIPMENT CHARGING RATE FOR DC FAST CHARGERS IS 125kW. THIS WOULD ALLOW MOST ELECTRIC VEHICLES TO BE CHARGED AT 80% LEVEL WITHIN A 30-MINUTES PERIOD.

6. USING THE ELECTRIC SERVICE FOR THIS PARKING LOT TO POWER AC CHARGING STATION LOCATED IN THE STAFF PARKING LOT SHOULD BE INVESTIGATED DURING DESIGN. IT WOULD BE AN APPROXIMATE 500 FT RUN FOR BRANCH CIRCUIT CABLES.

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VILLAGE OF RIVER FOREST

ELECTRICAL EXHIBIT
LOCATION #8 – LAKE STREET AND FRANKLIN AVENUE PARKING LOTS

SCALE: 1" = 40' | SHEET OF SHEETS | STA. TO STA.

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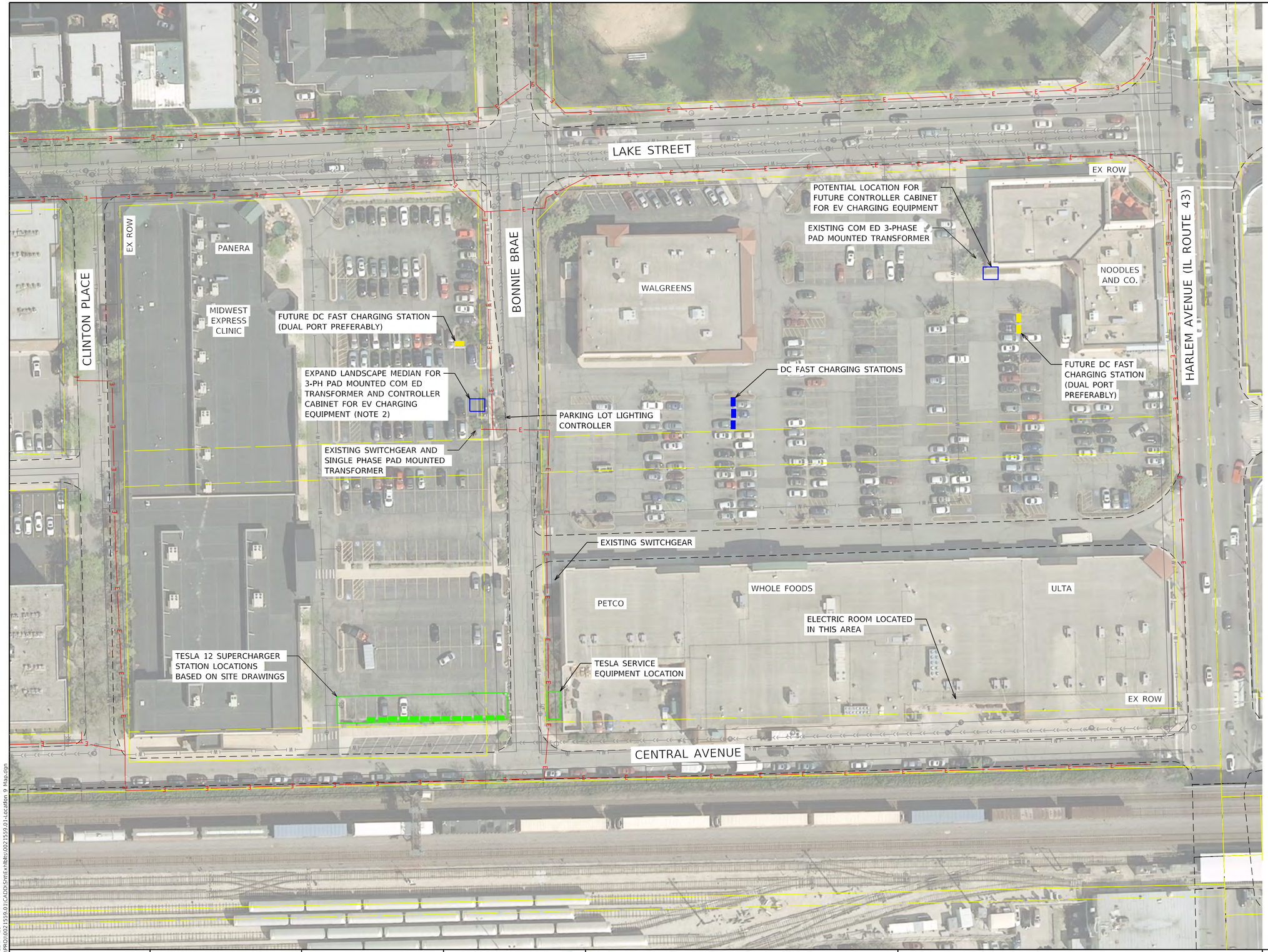
		COOK	12	9
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		



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GRAPHIC SCALE

EV CHARGING STATION LOAD TABLE		
LOCATION #9 - VILLAGE TOWN CENTER		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
3-DUAL PORT	125 kW	750 kW
3-DUAL PORT (FUTURE)	125 kW	250 kW
TOTAL		1,500 kW

ELECTRICAL DETAILS	
LOCATION #9 - VILLAGE TOWN CENTER	
POWER SOURCE LOCATION	SERVICE/ CONTROL LOCATION
NEW ELECTRIC SERVICE	EXTERIOR

SERVICE EQUIPMENT NOTES:

1. A 277/480V, 3-PH ELECTRIC SERVICE WILL BE REQUIRED TO POWER THE DC FAST CHARGING STATIONS.

2. WE RECOMMENDED INSTALLING A NEW 3-PHASE PAD MOUNTED TRANSFORMER AND CONTROLLER TO POWER EV CHARGING EQUIPMENT WITHIN A LANDSCAPE AREA. THIS WILL REQUIRE EXPANDING THE EXISTING LANDSCAPE MEDIAN, BUT WILL ALLOW THIS EQUIPMENT TO BE MORE CENTRALLY LOCATED. THIS WILL ASSIST WITH ADDING EV CHARGING STATIONS IN THE FUTURE.

3. PARKING DURATION AT THE SHOPPING CENTER ARE TYPICALLY BETWEEN 30 MINUTES - 1 HOUR. THEREFORE, 125kW DC FAST CHARGER ARE RECOMMENDED FOR THE SITE.

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VILLAGE OF RIVER FOREST

ELECTRICAL EXHIBIT
LOCATION #9 – VILLAGE TOWN CENTER PARKING LOT

SCALE: 1" = 40' | SHEET OF SHEETS | STA. | TO STA.

RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	12	10
		CONTRACT NO.		
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GRAPHIC SCALE

EV CHARGING STATION LOAD TABLE		
LOCATION #10 - VILLAGE COMMUNITY CENTER		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
1-DUAL PORT	11.5 kW	23 kW
2	62.5 kW	125 kW
TOTAL		178 kW

ELECTRICAL DETAILS	
LOCATION #10 - VILLAGE COMMUNITY CENTER	
POWER SOURCE LOCATION	SERVICE/ CONTROL LOCATION
NEW ELECTRIC SERVICE	EXTERIOR

SERVICE EQUIPMENT NOTES:

1. A 277/480V, 3PH ELECTRIC SERVICE TO POWER BOTH THE LEVEL II AND DC FAST CHARGING STATIONS. A 480V PRIMARY X 240V SECONDARY STEP DOWN TRANSFORMER WILL BE REQUIRED TO OPERATE THE LEVEL II CHARGING STATION.

2. A 62.5kW DC FAST CHARGER IS RECOMMENDED FOR THE PARKING LOT BASED ON 1-2 HOUR ANTICIPATED CHARGING TIMES FOR PEOPLE ATTENDING CLASS AT THE COMMUNITY CENTER

3. A 11.5kW LEVEL II CHARGER IS RECOMMENDED FOR VILLAGE STAFF PARKED IN THE LOT. THIS IS BASED ON A 6-8 HOUR TIMEFRAME THAT VEHICLES ARE ANTICIPATED TO BE PARKED DURING THE WORK DAY.

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VILLAGE OF RIVER FOREST

ELECTRICAL EHXIBIT
LOCATION #10 – VILLAGE COMMUNITY CENTER

SCALE: 1" = 20' | SHEET OF SHEETS | STA. TO STA.

RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	12	11
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		

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GRAPHIC SCALE

EV CHARGING STATION LOAD TABLE		
LOCATION #11 - VILLAGE PUBLIC WORKS		
QUANTITY OF STATION	LOAD PER STATION	TOTAL LOAD
1-DUAL PORT	11.5 kW	23 kW
TOTAL		23 kW

ELECTRICAL DETAILS	
LOCATION #11 - VILLAGE PUBLIC WORKS	
POWER SOURCE LOCATION	SERVICE/ CONTROL LOCATION
NEW ELECTRIC SERVICE	EXTERIOR

SERVICE EQUIPMENT NOTES:

1. A 120/208V, 1-PH ELECTRIC SERVICE FOR PROPOSED LEVEL II CHARGING STATION.

2. A 11.5 kW LEVEL II CHARGING STATION IS RECOMMENDED FOR PARKING LOT BASED ON A 6-8 HOUR PARKING DURATION VEHICLES ARE PARKED DURING THE DAY.

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VILLAGE OF RIVER FOREST

ELECTRICAL EHXIBIT
LOCATION #11 – PUBLIC WORKS

SCALE: 1" = 20' | SHEET OF SHEETS | STA. | TO STA.

RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	12	12
		CONTRACT NO.		
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APPENDIX C

Santa Clara County Electric Vehicle Charging Station Siting Toolkit and Reference Guide

Local Government Electric Vehicle Charging Station Siting Toolkit & Reference Guide

Driving to Net Zero

Submitted to: Santa Clara County
Submitted by: ICF

County of Santa Clara Office of Sustainability

FUNDED THROUGH A GRANT AWARDED BY THE CALIFORNIA STRATEGIC GROWTH COUNCIL

MARCH 9, 2018

CALIFORNIA STRATEGIC GROWTH COUNCIL

ICF

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Disclaimer

The statements and conclusions of this report are those of the County of Santa Clara and/or ICF and not necessarily those of the California Strategic Growth Council or of the California Department of Conservation, or its employees. The California Strategic Growth Council and the California Department of Conservation make no warranties, express or implied, and assume no liability for the information contained in the succeeding text.

Table of Contents

1. Purpose and Content of this Guide

Developed as part of the Santa Clara Driving to Net Zero Project, this report provides guidance on the key planning considerations for local governments in Santa Clara County who are seeking to install and support the regional deployment of electric vehicle charging stations (EVCS).

This report provides information and guidance on the following topics:

- Charging Infrastructure Types and Uses – reviews the different types of charging equipment, uses, and appropriate locations.
- Charging Infrastructure Deployment – provides an overview of California EV policy and goals and projections of EV charging needed in Santa Clara County to support wide spread adoption.
- Charging Infrastructure Siting Analysis – discusses the charging infrastructure siting analysis conducted as part of the DNZ project. Includes discussion of purpose and use of the analysis, methodology, and resulting maps.
- Planning Considerations – provides an overview of key planning element local governments should consider when deploying charging infrastructure, such as the level of charging needed and site assessments.
- Public Infrastructure Requirements and Design Guidelines – reviews the design requirements of public charging infrastructure that need to be followed based on state policy and regulations. Provides sample design guidelines and site drawings that local jurisdictions can use for public infrastructure projects.
- Station Ownership and Management Options – reviews the various ownership structures of hosting EV charging stations, as well as guidance on setting fees, time limits, and enforcement.
- Charging Infrastructure Costs Estimates – provides estimates on the capital costs for EV charging hardware, permitting, and installation, as well as on-going operations and maintenance.
- Emerging Issues and Opportunities – discusses two topics that DNZ stakeholders requested guidance on: power management/smart charging and supporting the electrification of car-sharing and ride-sharing fleets.

Note that this report serves as combined deliverable for two DNZ tasks: Task 2A - Electric Vehicle Charging Station Siting Plan Toolkit and Reference Guide, and Task 3A - Public Infrastructure Standards Evaluation and Recommendations Guide.

2. Charging Infrastructure Types and Uses

Electric vehicle (EV) charging infrastructure is typically differentiated by the maximum amount of power that can be delivered to the vehicle's battery. This determines the time that it takes to charge the vehicle's battery. Table 1 below provides a summary of the three types of charging infrastructure types – Level 1, Level 2 and direct current (DC) fast chargers. The charging equipment is referred to as electric vehicle supply equipment (EVSE), and each EVSE has at least one (but often more than one) charge port or plug.

Table 1. Electric Vehicle Charging Types

	Level 1 Alternating Current	Level 2 Alternating Current	Level 2 & 3 Direct Current (aka DC fast charging)		
Description	Uses a standard plug - 120 volt (V), single phase service with a three prong electrical outlet at 15-20 amperage (A)	Used specifically for PEV charging ~ 240 V AC split phase service that is less than or equal to 80 A.	Used specifically for BEV charging Typically requires a dedicated circuit of 20-100 A, with a 480 V service connection.		
Connector type(s)	 J1772 charge port	 J1772 charge port	 J1772 combo	 CHAdeMO	 Tesla combo
Use	Residential or workplace charging	Residential, workplace, or opportunity charging	Rapid charging along major travel corridors		
Limitations	Low power delivery lengthens charging time	Requires additional infrastructure and wiring	Can only be used by BEVs currently. Provides power much faster than the AC counterparts, but are more expensive to deploy and operate		
Time to charge	2 to 5 miles of range per 1 hour of charging Depending on the vehicle battery size, PHEVs can be fully charged in 2-7 hours and BEVs in 14-20+ hours	10 to 25 miles of range per 1 hour of charging Depending on the vehicle battery size, PHEVs can be fully charged in 1-3 hours and BEVs in 4-8 hours	50 to 70 miles of range per 20 minutes of charging Depending on the vehicle battery size, BEVs can be fully charged in 30-60 minutes.		

EV charging occurs at various locations and use is based on driver needs.

- **Residential charging** occurs at home and can occur at Level 1 or Level 2.
- **Workplace charging** would typically be provided by an employer to employees via on-site charging facilities. Workplace charging would typically occur at Level 1 and Level 2.
- **Opportunity charging** is a broad category that captures non-residential and non-workplace charging. It can occur at retail locations, shopping centers, gas stations, or other areas where the amount of time a person typically spends parked is similar to the

amount of time needed to charge. Level 1, Level 2, and DC Fast Charging are suitable for opportunity charging, depending on the location and type of site host.

- **Fleet charging** refers to the charging of electric vehicles in a commercial or government fleet, which is assumed to occur at some fleet-owned location.

3. Charging Infrastructure Deployment

3.1. State Policy & Goals

The primary legislation driving EV adoption throughout California is the Zero Emission Vehicle (ZEV) Program. The program today requires 15 percent of light-duty vehicles sold in California be ZEVs by 2025, which includes battery electric vehicles (BEVs), fuel cell vehicles, and transitional ZEVs such as plug-in hybrid electric vehicles (PHEVs). The Governor's Office followed up this Executive Order with its California ZEV Action Plan, which details more than 100 specific actions that state government is taking to accelerate the ZEV market. The ZEV program is largely responsible for the growing number of PEV models available on the market today.

In March 2012, Governor Jerry Brown issued an Executive Order that set a target of 1.5 million ZEVs on California's roadways by 2025. In January 2018, the Governor set a new more ambitious goal of 5 million ZEVs on the road by 2030. The Administration is also proposing a new eight-year initiative to continue the state's clean vehicle rebates and spur more infrastructure investments. This $2.5 billion initiative will help bring 250,000 vehicle charging stations to California by 2025.[1]

3.2. Projections of EVSE Required in Santa Clara County

It is important for local governments to have an understanding of how much charging infrastructure is needed to support regional EV adoption required by the ZEV program and outlined in the Governor's goals. Since the EV market is still in the early stages of adoption and vehicle technology is developing rapidly, the industry's understanding of driver behavior and charging patterns is evolving. Given this uncertainty, ICF developed EV charging infrastructure projections based on a scenario model. The methodologies detailed below and resulting scenario estimates are not meant to be definitive. Ultimately, more data and improved understanding of consumer behavior will help the DNZ stakeholder community make more robust decisions regarding the quantity of charging required.

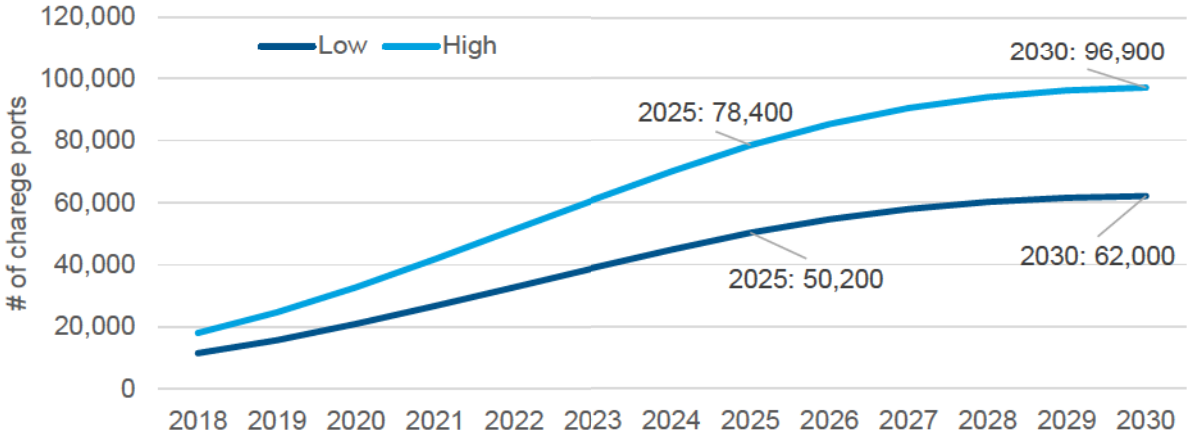
ICF assumes that the demand for charging will be a function of electric vehicle deployment (including vehicle architectures) and the type of charging considered (including residential, workplace, and away-from-home charging). We developed projections for regional EV deployment by taking the current county-level vehicle registration data from IHS Markit and applying the EV adoption growth curve from the EMFAC model. There were 46,570 plug-in EVs

[1] California Executive Order B-48-18. https://www.gov.ca.gov/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/

registered in Santa Clara County as of the end of 2017. ICF estimates that by 2025 there will be close to 250,000 EVs and by 2030, a little over 450,000 EVs in Santa Clara County.

Using the methodology detailed below, we estimate that by 2025, there will need to be 50,200 to 78,400 L2 charge ports deployed within Santa Clara County at workplaces, multi-family housing, and public charging locations to support projected regional EV growth. Table 2 presents our annual estimates by year from 2018 to 2030.

Figure 1. Estimated Need for L2 Charge Ports to Support EV Adoption in Santa Clara County



It is important to note that some of the forecasted EV charging deployment may be satisfied by L1 charging equipment; however, the level of charging would ultimately be determined by the host, and the EV service provider, which will likely be based on a variety of factors including an assessment of likely demand for charging and access to power. Further, the demand for Level 2 charging may be dampened by increased deployment of DC fast charging. At this time, however, it is unclear what the market will need to satisfy the diverse driving characteristics of PHEVs and BEV drivers.

For these infrastructure projections, ICF drew from internal research and modeling and a presentation from the Electric Power Research Institute (EPRI) regarding the amount of charging infrastructure needed to satisfy the demand for electric vehicle charging.

- ICF used an updated version of an EVSE deployment model that we developed for the Bay Area PEV Readiness Plan[2] that decreases the demand for chargers over time to account for potential market saturation and the benefits of increased station utilization. This is a simple model with the structure as follows:

$$Infrastructure = (gPHEV_{deployment} + BEV_{deployment}) \times \alpha e^{-\beta t}$$

  Where $PHEV_{deployment}$ and $BEV_{deployment}$ represent the total number of electric vehicles on the road, α and β are constants and t is years from initial date of deployment. ICF notes

[2] ICF, Bay Area PEV Readiness Plan: Background & Analysis, Available online at: http://www.baaqmd.gov/~/media/files/strategic-incentives/ev-ready/bay-area-pev-readiness-plan-background-and-analysis-web-pdf.pdf?la=en

that for our low and high scenarios, we vary the value of γ, which accounts for the fact that it is unclear how much public charging will be required by PHEVs – we vary this value between 0.1—1.0.

- Research at EPRI reviewed how much electric vehicle charging is needed, with a focus on workplace and public usage.[3] EPRI reviewed the impacts of free charging and a benefits tested scenario on usage as a measure of charging stations per vehicle. EPRI's analysis yields a benefits tested scenario in which the charging station-to-vehicle ratio ranged from 0.01 to 0.15 for BEVs and PHEVs, respectively.

Based on our own modeling and the vehicle-to-charger ratios from the aforementioned EPRI presentation, ICF estimated the charging infrastructure that would be required for the corresponding electric vehicle deployment scenario for workplace, opportunity, and multi-family housing (as shown in Figure 1 above). ICF notes that these estimates are not intended as forecasts or predictions of market outcomes. Rather, they are intended to portray the level of infrastructure that may be required to support the mix of PHEVs and BEVs in various scenarios.

For a point of comparison, consider an alternative approach employed by the National Renewable Energy Laboratory (NREL) in the *California Statewide Plug-in Electric Vehicle Infrastructure Assessment*.[4] In this document, NREL sought to estimate the demand for charging infrastructure in two scenarios:

- *Home Dominant*: In this scenario, most PEV charging occurs at home, with workplace and public charging supporting only a fraction of total electric miles.
- *High Public Access*. In this scenario, NREL assumed that many PEV drivers place a "high premium" on public available charging, and that the market responds with workplace and public charging stations.

In both cases, the modeling is based on parameters including, but not limited to, access to home charging, average miles traveled daily, load profiles, total number of charging stations per unit area, and the level of charging through consumer demand. Similar to our own results, the intent of the modeling outcomes presented by NREL is meant to capture a range of options, rather than represent an explicit forecast or market outcome.

For the point of comparison, NREL reports the following estimates for charging points by 2020 for the entirety of the San Francisco Bay Area by 2020, assuming the deployment of 149,000 PHEVs and 74,000 BEVs (representing 25% of the total statewide population). Table 2 below highlights the results of NREL's analysis.

Table 2. NREL's Bay Area EV Estimates

Scenario	Home		Workplace		Public		
	L1	L2	L1	L2	L1	L2	DC
Home Dominant	126,000	90,000	5,000	20,200	400	5,000	133
High Public Access	128,000	72,000	5,700	36,000	520	11,500	377

[3] D. Bowermaster, EPRI. *How Much Electric Vehicle Charging is Needed?* California Plug-in Electric Vehicle Collaborative Meeting, August 2012.

[4] Melaina, Marc, Michael Helwig. National Renewable Energy Laboratory. 2014. California Statewide Plug-In Electric Vehicle Infrastructure Assessment. California Energy Commission. Publication Number: CEC-600-2014-003. Available online at: http://www.nrel.gov/docs/fy15osti/60729.pdf

4. Charging Infrastructure Siting Analysis

As part of the Driving to Net Zero (DNZ) project, ICF conducted a charging infrastructure siting analysis to assess the areas in Santa Clara County that are most likely to experience increased demand for EV charging.

4.1. Overview & Purpose

The purpose of the analysis is to employ a flexible methodology that can be updated and used to understand where EV drivers will likely live, work, and visit within Santa Clara County. It is best to consider the results of the analysis as a useful guide to coordinating and prioritizing investments in charging infrastructure at a high level for engaged stakeholders.

The siting analysis is an analytical exercise that looks at key EV ownership indicators and regional travel patterns to identify areas where there will likely be demand for charging infrastructure. The results can be used to identify areas where the deployment of chargers will likely be the most cost effective, as chargers located in an area where EV drivers are most likely to travel will be utilized more. Recent research by Idaho National Laboratory, for instance, demonstrated that charging equipment deployed in areas that fell within a planning process experienced nearly 90 percent greater utilization (as measured by charging events per week) compared to charging equipment deployed in unplanned locations.[5] It is important to note that the results of the siting analysis are not a deterministic approach that excludes certain areas from charging.

4.2. Methodology

Residential and Multi-family Charging

ICF initiated the analysis by identifying where EVs owners are most likely to live, which required identifying the most likely EV adopters. Table 3 reviews the information available regarding the characteristics of initial EV buyers from various surveys.

Table 3. Overview of Research on Early Adopters of EVs

Data Source	Income	Home Ownership	Dwelling Type	Household Vehicles	Hybrid ownership
2012 California EV survey —vehicles: LEAFs —region: California [1]	54%, $150k + 25%, $100k-$150k 18%, $50k-$100k 3%, <$50k	n/a	91% in single family w/ an attached garage 6% single family, detached garage 3% in apartment <1% other	n/a	n/a
2013 California EV survey —vehicles: LEAFs, Volt, Prius Plug-in —region: California	50%, $150k + 18% $100k-$150k 10%, $50k-$100k 2%, <$50k	93% own their home	88% in a single-family detached home 7% in single-family attached home	n/a	n/a

[5] Idaho National Laboratory. April 2015. How Does Utilization of Non-Residential EVSE Compare Between those Installed in Oregon in Planned versus Unplanned Locations? http://avt.inl.gov/pdf/EVProj/UtilizationOfNonResEVSEInstallationVsPlan.pdf.

Data Source	Income	Home Ownership	Dwelling Type	Household Vehicles	Hybrid ownership
[2]	20%, Unknown		4% in an apartment/ condominium 1% in other dwellings		
Bay Area LEAF survey —vehicles: all LEAFs —region: SF Bay Area, CA [3]	n/a	n/a	n/a	nearly all households have at least 1 other vehicle 30% have more than 2 vehicles	34% had a HEV in their home
Tal *et al*, California Survey —vehicles: mostly LEAFs —region: California [4]	46%, $150k + 37%, $100k-150k 16%, declined	96% own their home	96%, single family house		32% owned a HEV before they purchased EV 11% replaced a HEV w/ a EV 25% own HEV and EV
Chevrolet information [5]	average income, $170k	n/a	n/a	n/a	7% of buyers replaced a Toyota Prius HEV with the Volt
Nissan Information [6]	household income, $159k	home value of $640k			

[1] California EV Owner Survey. California Center for Sustainable Energy, data collected in February 2012. Available online at: http://energycenter.org/index.php/incentive-programs/clean-vehicle-rebate-project/vehicle-owner-survey

[2] California EV Owner Survey. California Center for Sustainable Energy, data collected in May 2013. Available online at: https://energycenter.org/clean-vehicle-rebate-project/vehicle-owner-survey/feb-2014-survey

[3] Bay Area LEAF Survey. Conducted by Bay Area Air Quality Management District, analyzed by ECOtality and ICF International. October 2012.

[4] Tal, G; Nicholas, MA; Woodjack, J; Scrivano, D. Who Is Buying Electric Cars in California? Exploring Household and Fleet Characteristics of New Plug- In Vehicle Owners. Submitted to Transportation Research Record, August 2012. Available online at: https://sites.google.com/a/ucdavis.edu/gil-tal/evs-market

[5] Cristi Landy, Chevrolet. The Customer Experience: Reaching Buyers Beyond Early Adopters. GM Marketing, February 2012. Available online at: http://umtri.umich.edu/content/Crisit.Landy.GM.Marketing.PT.2012.pdf

[6] Nissan EV Information, handout from EVS26

Based on these surveys of initial adopters, ICF identified the key indicators for EV ownership. We used these key indicators to develop a scoring methodology that estimates the likelihood of EV adoption in a given census block group. The following parameters were selected for further consideration, with corresponding weighting factors highlighted below:

- **Income:** Market research suggests that households with higher incomes are more likely to purchase an electric vehicle. Because electric vehicles tend to have higher upfront costs, income can also be a limiting factor. In other words, individuals with low income might not be able to afford an EV.

- **Hybrid Electric Vehicle (HEV) Ownership:** Based on survey results, ICF gave HEV ownership a significant weighting factor. In addition to correlating with income, HEV ownership correlates well with influencing factors such as environmental stewardship and price sensitivity to gasoline, both of which have proven to play a significant role in the level of interest in EVs.
- **Home Ownership:** Households who own their property are more likely to adopt a EV than those who rent, according to market research by most major automobile manufacturers and the University of California, Davis. Home ownership reduces both financial and non-financial barriers to charging infrastructure deployment. The influence of home ownership will likely change considerably by 2020; however, in the near future, it will likely be a significant driver. There is already some correlation between home ownership and income, so the weighting for this parameter is designed to distinguish between census block groups that are already likely to include EV adopters based on the income profile. ICF only considered census block groups that had both an income greater than median income for the region and home ownership greater than the median level of home ownership for the region.
- **Dwelling Type:** Dwelling type (e.g., single-family detached, single-family attached, or multi-unit) is an important parameter because drivers are expected to charge their vehicles at home. We assume that consumers with a single-family detached home generally have fewer barriers to EV adoption. Only census block groups that were above the median income and above the median percentage of single-family residences were considered for the residential analysis. For multi-family units, ICF filtered for areas with high multi-family ownership by increasing the value of the weighting factor for dwelling type, and changing the structure of the scoring to favor areas with above median income, above median hybrid ownership, and a high share of multi-family dwellings (instead of a higher rate of single family units).

ICF used census data from the American Community Survey (ACS), an ongoing statistical survey that samples a percentage of the population every year. For the purposes of this exercise, ICF determined that the most complete datasets for census block groups were the 5-year estimates; ICF used data for years 2010-2015. ICF extracted demographic data on income, home ownership, and dwelling type in the Santa Clara County, as well as other counties where trips to Santa Clara originate. ICF analyzed vehicle registration data from IHS Markit to establish hybrid vehicle ownership rates by census block group.

Opportunity Charging

Opportunity charging covers a wide range of situations where an EV driver could potentially charge when away from home or work. Unlike residential and workplace charging, where vehicles are parked for long enough that they achieve a significant charge even with Level 1 charging, opportunity charging will take place at locations where drivers are parked for varying times; therefore, the level of charging bears much greater consideration when siting opportunity charging. Table 4 shows the preferred charging method based on the available charging time at different venues.

Table 4. Recommended Charging Level for Different Venues

Typical Venue	Available Charging Time	Charging Level (Primary/Secondary)
Shopping Centers	0.5–2 hours	Level 2/DC Fast
Other	< 1 hour	Level 2/DC Fast
Street/Meters	1–2 hours	Level 1/Level 2
Parking Garages	2–10 hours	Level 2/Level 1
Hotels/Recreation Sites	8–72 hours	Level 2/Level 1

To identify likely areas for opportunity charging, ICF used data from the Santa Clara Valley Transportation Authority (VTA) travel model to identify the origin-destination pairs for non-work related trips, such as home to shopping and home to social or recreational activity.

Similar to the residential charging analysis, U.S. Census ACS demographics on income, home ownership and dwelling type, as well a hybrid ownership rates were used to weight the trips on EV likelihood.

Workplace Charging

To identify likely areas for workplace charging, ICF used data from the Santa Clara Valley Transportation Authority (VTA) travel model to identify the origin-destination pairs for home-based work trips made between various TAZs. Using the areas that have the most likely EV adopters (see the previous subsection), ICF weighted trips based on the likelihood that it would be completed with an EV.

4.3. Accessing the Results & Mapping Tool

Jurisdictions can view the charging infrastructure siting analysis maps by visiting the following website: https://ecosystems.azurewebsites.net/SantaClara/

4.4. Scenario Analysis

The siting analysis methodology and resulting maps were presented to DNZ project partners for review and feedback. Based on these conversations, a common theme arouse around the need for jurisdictions to assess where to deploy charging infrastructure in disadvantaged communities (DACs). The initial analysis methodology and assumptions, as described above, is based on key EV ownership indicators of early adopters, who are more likely to have a higher income, perhaps own a hybrid, live in single-family homes, and own their home. These demographics are not typical characteristics of DAC populations. Therefore, ICF developed a set of scenarios and resulting charging demand maps that seek to target residents of multi-family buildings and DACs. The demographics of EV owners will likely evolve as vehicles become more affordable and the network of charging stations is built out. To address the evolving nature of the market, ICF also developed additional scenarios varying the weighting of key EV ownership indicators so that jurisdictions can compare results and use as needed, depending on their outlook and priorities. Table 5 below describes the key assumptions of these scenarios. Note that the “reference cases” reflect ICF’s initial analysis.

Table 5. Siting Analysis Scenario Descriptions

Scenario	Description
Focusing on single-family residential charging demand:	
Scenario 1 – Likely EV Buyers in Single-family Homes	Reference case, focusing on socioeconomic factors that favor EV ownership
Scenario 2 – Home Owners	Focus on single-family home owners as potential EV buyers; recognizes that there is still demand for EVs where home charging may be convenient i.e., in areas of high home ownership and high single-family homes
Scenario 3 – Hybrid Owners	Increases focus on hybrid ownership as proxy for environmental awareness as the key driver for EV interest
Scenario 4 – Workplace Charging as a Solution	Areas to target for workplace charging that could alleviate challenges of home charging for potential EV buyers (as determined by high income and high rates of renters and hybrid ownership)
Scenario 5 – Education & Outreach	Areas to target for education and outreach based on likely EV buyer characteristics, after removing hybrid ownership as a metric
Focusing on multi-family residential charging demand:	
Scenario 6 – Likely EV Buyers in Multi-family Units	Reference case, focusing on socioeconomic factors that favor EV ownership in multi-family units
Scenario 7 – Low Income in Multi-family Units	Targets low income population in multi-family units
Scenario 8 – High Income in Multi-family Units	Targets higher income populations in multi-family units

5. Planning Considerations

After identifying areas with potentially high demand for charging infrastructure through the siting analysis, the next step is to assess specific sites or parking areas within areas that would make good locations for charging infrastructure. Potential sites should have amenities to support the amount of time a driver will spend at the site while the vehicle is charging. In addition to amenities, key site considerations include safety, accessibility, and visibility to drivers.

For publically accessible L2 charging, which is the major focus of local government funded deployments, typical charging times range from 1-2 hours. A DC fast charging units requires significantly less dwell time and are typically sited along interstate highways. Level 1 equipment may be a good option for some workplace and fleet charging needs as they are easy and cost-efficient to install and vehicles need to be parked several hours to get a significant charge. This is the case for many employee owned vehicles that remain in the same parking spot during an eight hour shift, or fleet vehicles that are parked overnight. Using Level 2 charging for workplace and fleets may require vehicle rotation to ensure that multiple users have access to charging and that all charging needs are met.

5.1. Site Assessment

The specific location of charging equipment can impact station utilization and installation costs. Placing chargers in locations convenient to drivers is important. Note that Section 8 of this report includes EV charger cost estimates.

The most cost-effective charging installations are those in close proximity to an existing electrical panel that has the capacity to handle the additional load required for vehicle charging. The California Department of General Services recommends that the following factors should be accounted for when choosing a location for charging equipment:[6]

- Existing electrical panel distribution voltage – Does the existing voltage meet the requirement of the desired charging station? If not, can transformers be added to obtain the desired voltage?
- Existing panel capacity evaluation – The sum of the proposed charging equipment full load amperage and existing loads may overload the existing electrical distribution equipment. Load testing can potentially determine if the panel will exceed the capacity.
- Distance between the electrical panel and charger location – the length of the conductors will affect installation design and material costs. Factors such as conduit size, conductor sizing, trenching, circuit voltage drop and other requirements will need to be assessed, especially if additional future charging equipment is planned.
- Networking access – If “smart” chargers are planned, strong reception of cellular phone signals or wired phone lines are needed.
- Lighting – charging locations should have illumination levels that meet or exceed the minimum necessary for operation of the equipment.

[6] California Department of General Services. 2014. Electric Vehicle Supply Equipment Guidance Document. Retrieved from https://www.documents.dgs.ca.gov/green/EVSE.pdf.

6. Public Infrastructure Requirements & Design Guidelines

The State of California has created requirements to ensure that chargers are Americans with Disabilities Act (ADA) accessible and easy to find via signage. To make it easier for charging station hosts to determine the best configuration of their installation while also meeting building code requirements, local jurisdictions should adopt uniform charging station design guidelines that address the many unique considerations associated with EV charging stations. The following section outlines the ADA and signage requirements, evaluates whether any local jurisdictions in Santa Clara County have existing EV public infrastructure standards, and provides example site drawings for various EV charging configurations.

6.1. Requirements

Accessibility

If the charging equipment is installed in a parking lot and will be made available for use by the public, then it will need to be designed so that it meets the California requirements for ADA accessibility. It is important to take these requirements into account when planning to install chargers, because they impact the spatial requirements, and potentially the cost, of installations. The first new charger constructed is required to be accessible and be significantly wider than a typical parking space, not including space for adjacent access aisles, so property owners may have to sacrifice multiple regular parking spaces to build the first charging space.

Table 6 shows the number of each type of accessible space that is required based on the total number of chargers at a location, according to the 2016 California Building Code. These requirements went into effect on January 1st, 2017 and encompass three types of ADA access:

- Ambulatory parking spaces designed for people with disabilities who do not require wheelchairs, but may use other mobility aids;
- Standard accessible spaces designed for people who use wheelchairs but can operate vehicles; and
- Van accessible spaces for vehicles carrying people who use wheelchairs who cannot operate their own vehicles.

Table 6. Number of accessible chargers required at installations of new public charging spaces[7]

Total number of EVCS[8]	Minimum required van accessible chargers	Minimum required standard accessible chargers	Minimum required ambulatory chargers
1-4	1	0	0
5-25	1*	1	0
26-50	1*	1*	1
51-75	1*	2*	2
76-100	1*	3*	3
101+	1, plus 1 for each 300 over 100*	3, plus 1 for each 60 over 100*	3, plus 1 for each 50 over 100

* Indicates a case where at least one charger is required to be identified with an international symbol of accessibility and restricted to vehicles with an ADA accessible parking placard.

Note that International Symbol of Accessibility (ISA) signs are not required for small scale installations with 1 to 4 EVCS, however at least one accessibly designed EVCS is required.

The California Building Code describes in detail the site configuration requirements for accessible charging,[9] which include:

- Level ground with a slope of less than 1:48
- Vertical clearance of at least 98”
- Location along an accessible route to the associated facility
- Minimum widths of 144” (van accessible), 108” (standard accessible), 120” (ambulatory), 204” (drive-up)[10]
- Accompanying access aisles at least 60” wide

There are also ADA requirements and guidelines relating to the actual charging equipment.

- Charging cables need to be kept off the ground and the cable receptacle should not be more than 48 inches above the surface of the surrounding ground area.
- The charger handle should not require undue strength to pull, lift, or operate the handle. Based on federal ADA guidelines, the amount of pulling of lifting strength required should be less than five pound force.

Signage

Surface street directional signage serves two important functions. It directs EV drivers to the nearest public charging infrastructure locations and educates non-EV drivers about the availability of charging infrastructure in their community, allowing them to consider how an EV might work for them.

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[7] California Building Standards Commission, 2016 California Building Standards Code; Section 11B-228.3 describes the number of accessible chargers required and Section 11B-812 describes spatial requirements for accessible chargers.

[8] Where an EV charger can simultaneously charge more than one vehicle, the number of EVCS provided should be considered equivalent to the number of electric vehicles that can be simultaneously charged.

[9] California Building Standards Commission, 2016 California Building Standards Code, Section 11B-228.3

[10] A drive-up EVCS is an EVCS in which use is limited to 30 minutes maximum and is provided at a location where the EV approaches in the forward direction, stops in the vehicle space, charges the vehicle, and proceeds forward to depart the vehicle space. California Energy Commission, Accessibility Requirements for Electric Vehicle Charging Infrastructure.

Signage can also be used to enforce parking restrictions. With the passing of Assembly Bill 1452 in October 2017, California now gives local jurisdictions the authority, by ordinance or resolution, to designate stalls or spaces in off-street and on-street parking for the exclusive purpose of charging. The bill, which amends the California Vehicle Code, authorizes the removal of a vehicle from a designated stall or space on a public street if the vehicle is not connected for electric charging purposes, provided the appropriate signage is installed.[11] The codes requires that signage installed for on-street pubic EV parking must be consistent with the California Manual of Uniform Traffic Control Devices (MUTCD).

The MUTCD, which creates consistent standards for signage on public roads, contains several signs and markings to designate spaces for EV chargers,[12] including:

- General service signs to indicate the location of chargers (Figure 2), which can be combined with directional arrows to guide drivers to chargers
- Parking signs to designate restrictions or time limits on charging spaces (Figure 3)
- Pavement markings to designate restrictions on charging spaces (Figure 4).

These signs should be used wherever applicable to provide consistency for drivers in search of charging. General service signs should be used at all charging stations, and parking signs and pavement markings should be used where applicable. Note that pavement markings for on-street EV parking spaces in the MUTCD is optional. Although not required, some charging station hosts also choose to install educational signage about the benefits of EVs.

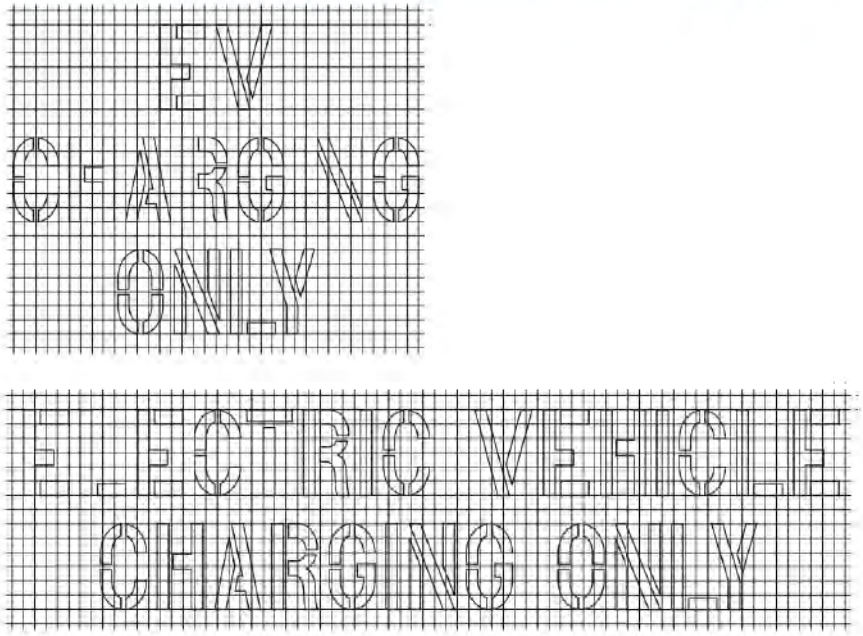
Figure 2. General service sign for chargers and additional signage to indicate DC fast chargers

[11] California Assembly Bill 1452 - Parking: exclusive electric charging and parking on public streets. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB1452

[12] California Department of Transportation (Caltrans), California Manual on Uniform Traffic Control Devices, Section 2I.03; summarized in Caltrans Policy Directive 13-01. http://www.dot.ca.gov/trafficops/camutcd/docs/2014r2/CAMUTCD2014_rev2.pdf

Figure 3. Parking signs to place restrictions or time limits on charging spaces

Figure 4. Pavement markings indicating restrictions on charging spaces



6.2. Evaluation of Existing Public Infrastructure Standards

Currently, local jurisdictions in Santa Clara County lack consistent public (non-residential) EV charging infrastructure development guidelines or standards that reflect the most recent requirements for site design, accessibility and signage. The City of Cupertino does offer some guidance, which references the Tri-Chapter Uniform Code Committee's EV charging system guidelines, but these are outdated (last updated in 2014). The City of San Jose mentions some EV charging station requirements in its Code of Ordinances (such as meeting applicable health, safety, and performance standards) but no actual guidance on how to site and configure the charging equipment is given. Therefore, there is a clear need for design guidelines that address the many unique considerations associated with EV charging stations.

6.3. Design Guidelines and Site Drawings

Local governments will likely need to create multiple sets of EV parking guidelines that apply to a wide variety of parking scenarios. Design guidelines will vary depending upon the configuration of the parking and upon the context in which parking is located. At a minimum, design guidelines should address the following issues:

- Minimum dimensions of EV parking spaces
- Parking configurations, including guidance on whether it is preferable to locate chargers in perpendicular, parallel, or angled parking spaces, and on the location of wheel stops, guard posts, and signage
- Adopted technical standards that apply to electric vehicle charging stations
- Regulatory signage and signs directing drivers to available PEV parking
- Area lighting
- Clearances, including minimum clearances around chargers to maintain access to controls, as well as on adjacent walkways to maintain pedestrian access. Pedestrian clearance guidelines should include recommendations for keeping sidewalks and walkways clear of cords and cables. Clearance recommendations should also address needs for snow plowing during the winter months, where applicable.
- Location relative to other spaces, adjacent land uses (i.e., setbacks), and electrical infrastructure. For example, guidance on locating on-street parking could include language such as "the last space on the block in the direction of travel will usually minimize cord management issues, and places user closer to crosswalks and curb ramps."
- Additional considerations that apply in overlay zones, such as flood control zones.
- Design of disabled access spaces (i.e., ADA compliance) within existing developments, including requirements for the number of spaces in areas that must be accessible in areas with multiple EV parking spaces and design standards for accessible spaces.

Example Site Drawings

There are many possible configurations for EV charging stations, depending on where they are sited and who will be using them. Jurisdictions may wish to specify preferences that fit with local conditions. For example, not every jurisdiction will be able to accommodate charging

installations in on-street parking spaces due to high demand or space limitations. The figures that follow illustrate a variety of different EV charging station configurations. Agencies can use these site drawings to establish standards or guidelines, or modify as needed.

ADA Accessible Charging Stations

Public access charging stations that must comply with the ADA accessibility mentioned in the previous section and need to meet certain requirements. The figures below present sample configurations of ADA compliant public access charging stations for standard, van, and ambulatory accessible spaces.

Figure 5 illustrates a standard accessible electric vehicle charging space, outlined in red.

Figure 5. Standard Accessible Multi-port Charging Configuration

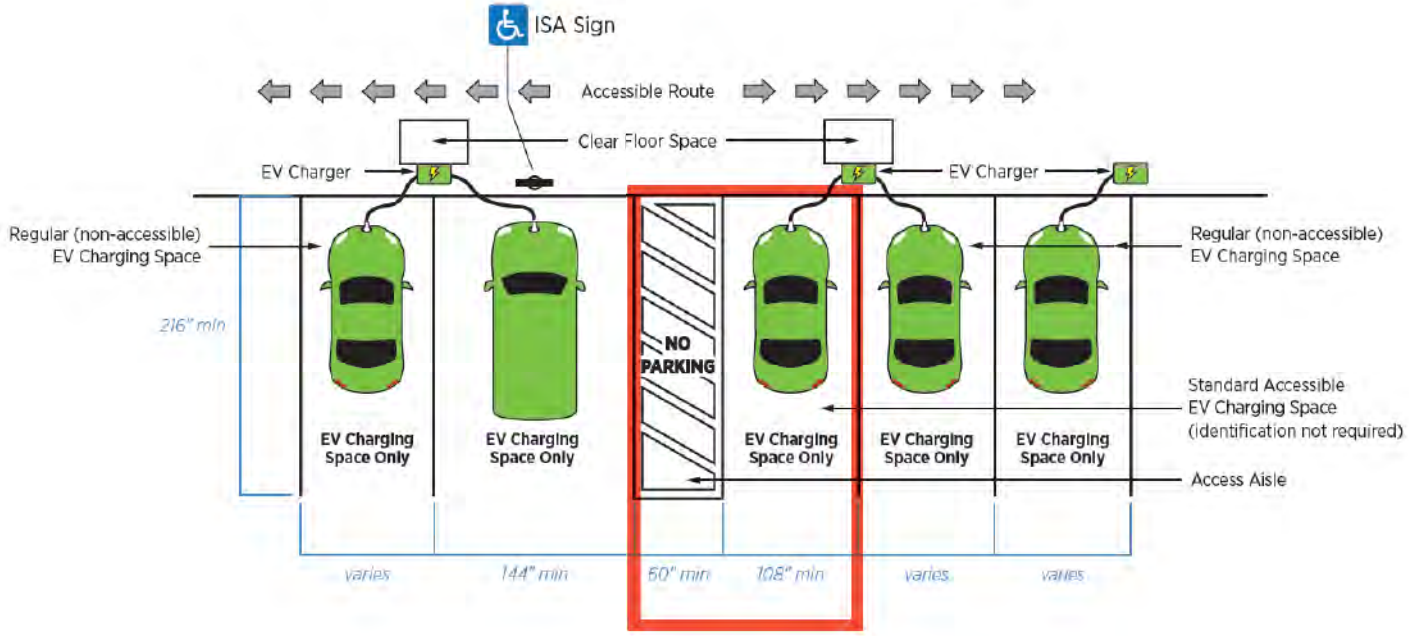


Figure 6 is similar to the previous drawing but highlights a van-accessible charging space.

Figure 6. Van Accessible Multi-port Charging Configuration

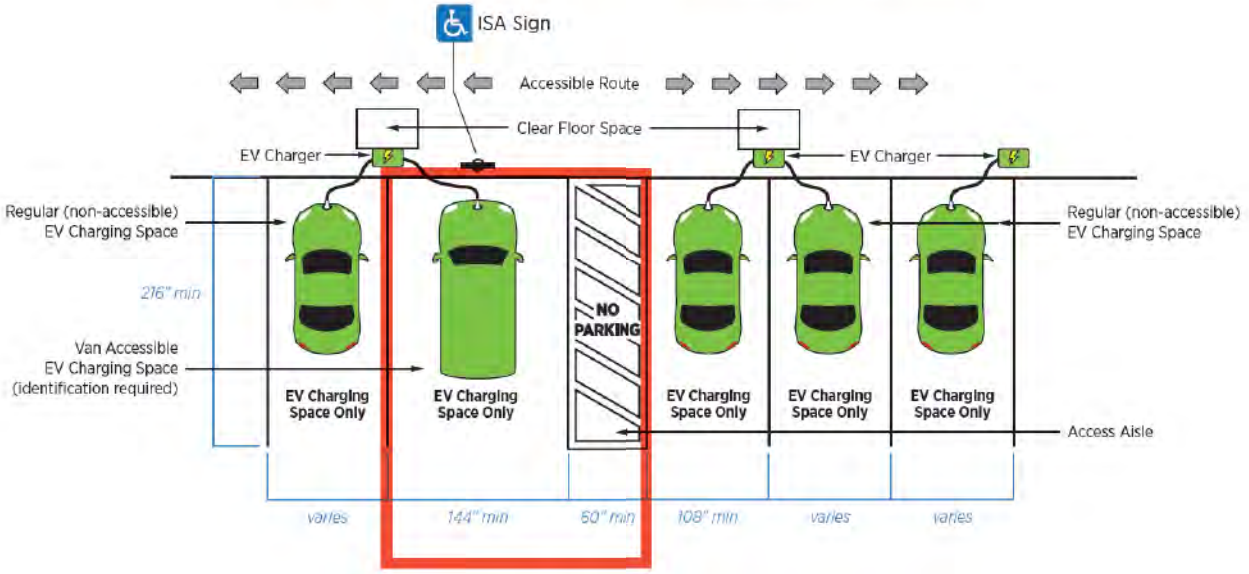
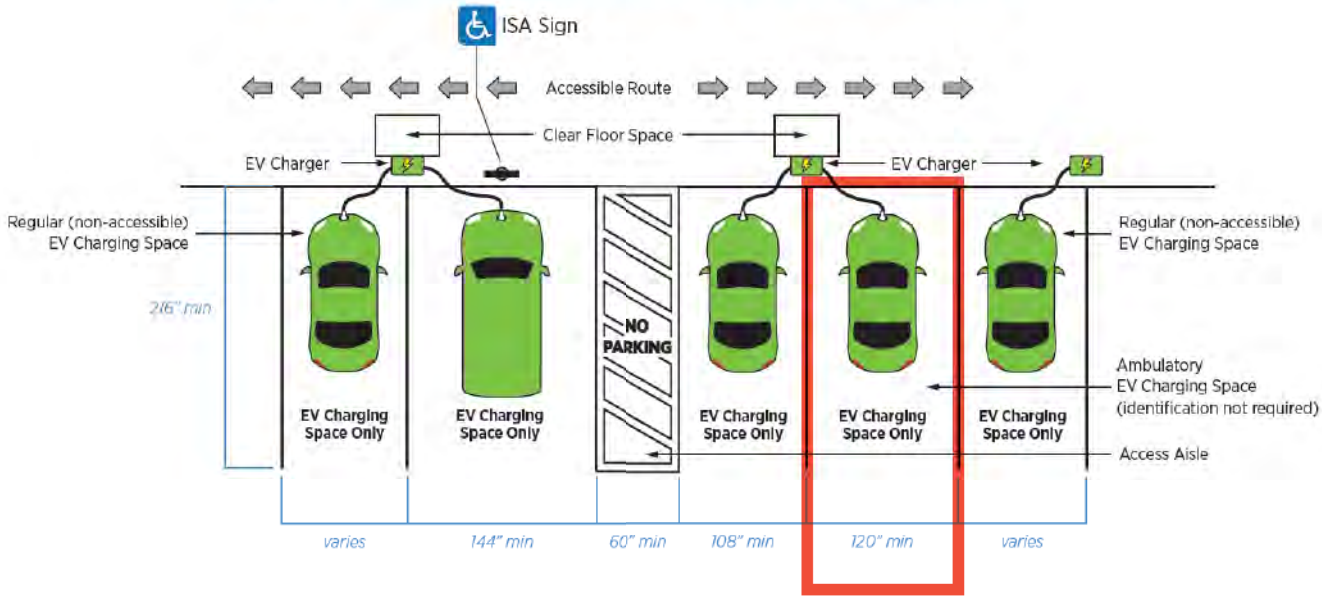


Figure 7 is an ambulatory charging space. Note the larger dimensions, with a 120-inch minimum, compared to the standard accessible space. The additional width provides better access for individuals with mobility challenges.

Figure 7. Ambulatory Accessible Multi-port Charging Configuration



Private Charging Configurations: Fleets and Workplace

EV charging stations that are not publically accessible, such as private multi-family parking garages and private fleet/workplace parking lots are not required to comply with the ADA requirements set forth in the California Building Code. However, it is important to note that there may be future obligation for "reasonable accommodation" request based on ADA Title I Employment provisions.

Figure 8 illustrates a configuration found often at multiple indoor and outdoor sites, including workplaces, multi-unit dwellings, and commercial areas. The recommended charger location corresponds with the existing electrical panel.

Figure 8. General Configuration for EVCS (not ADA accessible)

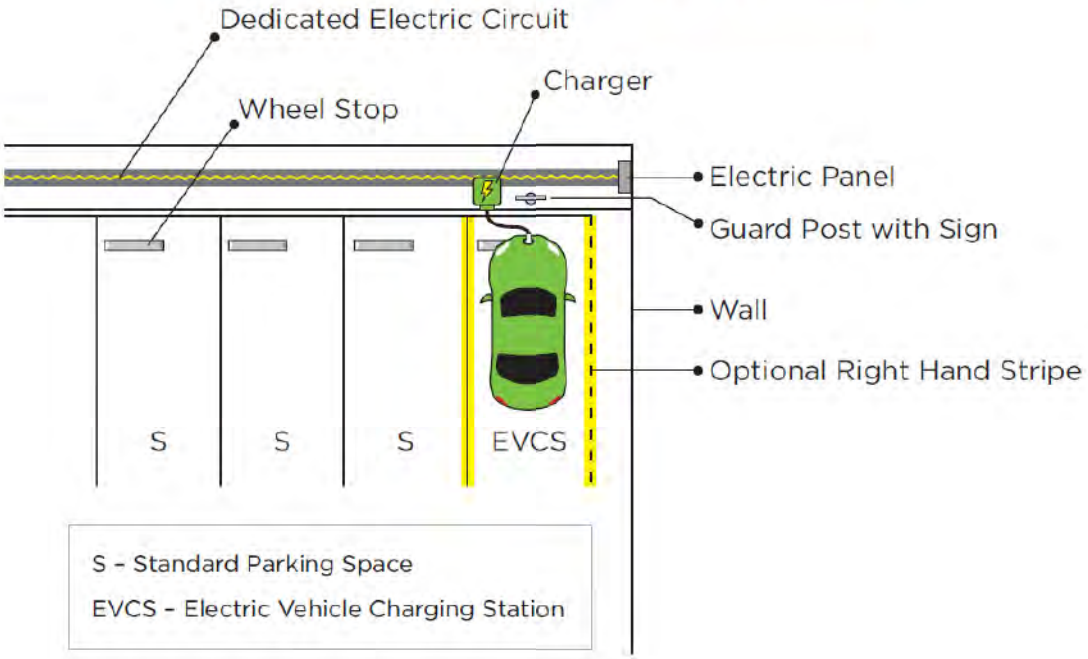


Figure 9 shows a configuration that allows for four charging spaces with a central location for the equipment. This example most closely aligns with a parking garage, though the configuration could also be applied to a surface lot, such as at a shopping mall.

Figure 9. Multiport Configuration for EVCS (not ADA accessible)

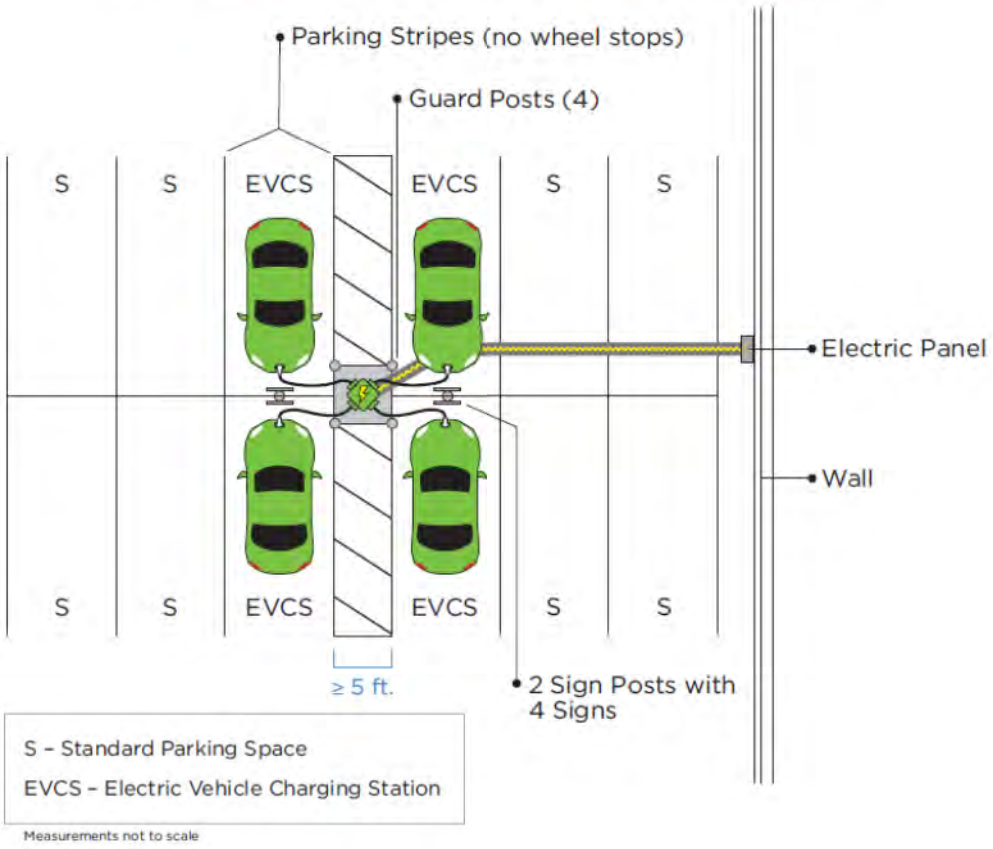
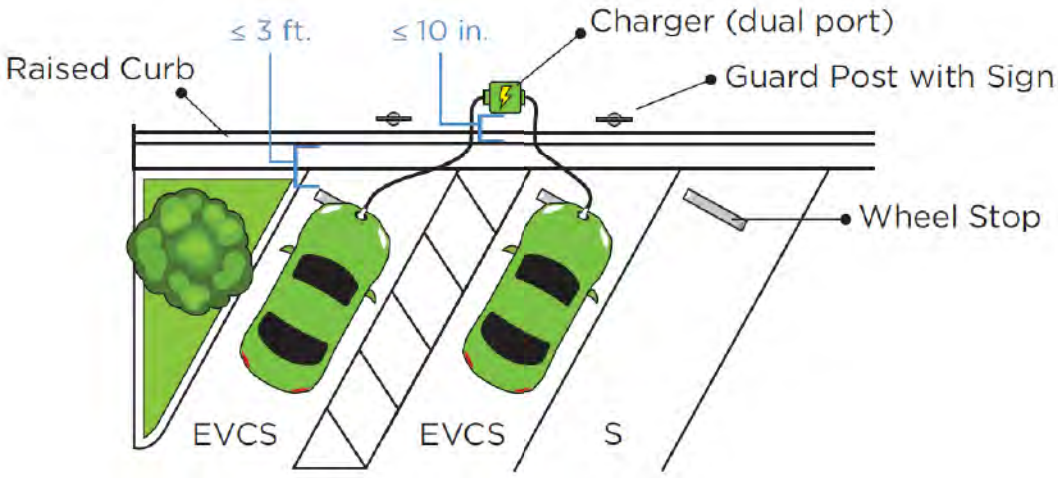


Figure 10 displays a charging station installed at angled parking spaces, which may be found outside office or retail locations.

Figure 10. Dual Charger at Angled Parking Spaces (not ADA accessible)

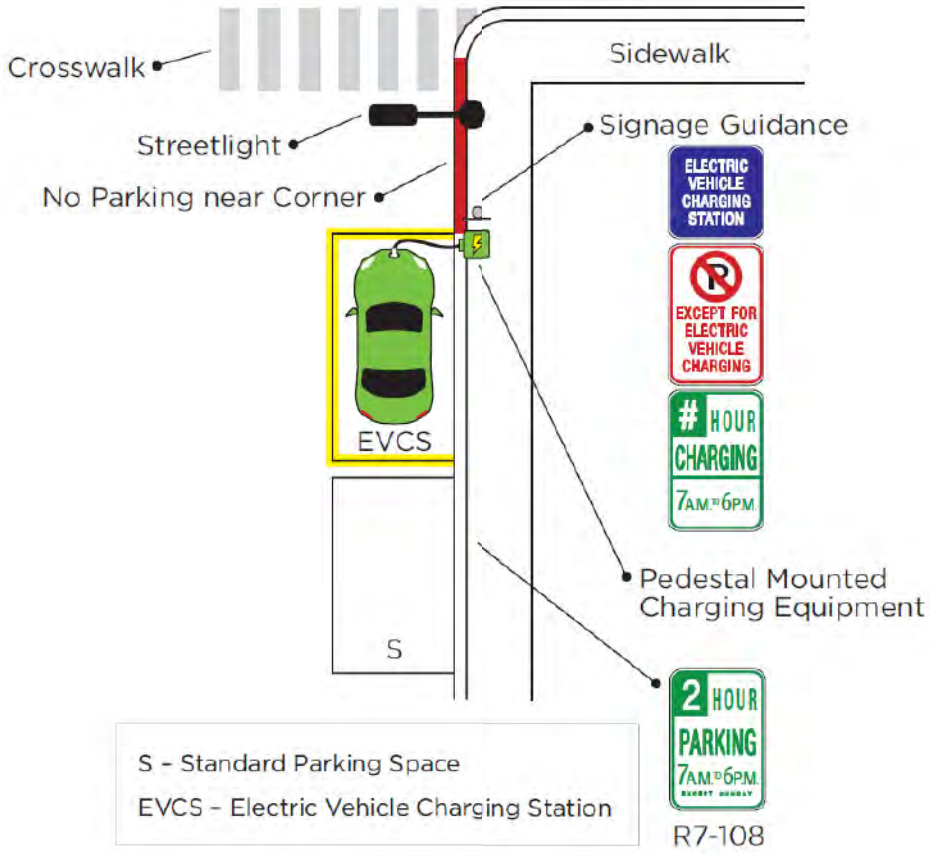


On-Street Charging Configuration

The California Building Code does not regulate EV charging station in the public right-of-way, therefore they are not required to be ADA accessible. However, accessibility is still required under the federal Americans with Disabilities Act. Since there are no explicit regulations, it will be up to site hosts to provide an accessible solution which is acceptable to local jurisdictional authorities, and for local jurisdictions to decide what is acceptable.

Figure 11 illustrates an on-street parking configuration that is not ADA accessible. Since on-street charging stations will most likely be accessible to the public, corresponding signage is included.

Figure 11. On-street EVCS Configuration



7. Station Ownership and Management Options

7.1. Ownership Structures

Charging infrastructure ownership can be retained by the station provider or transferred to the charging site host or another third party. The traditional sale method would make the host the owner and operator of the charging equipment and responsible for the operation and maintenance of the equipment. Under some contracts, the charging station provider may retain ownership of the charging equipment and provide compensation to the host for the use of the site. The charging station provider then may be responsible for the maintenance and operation of the equipment.

Some charging infrastructure business models relate to providing charging at no cost to the driver. Access fees, whether through the subscription method or pay per use generate revenue (discussed in more detail below), are expected to be charged at most publicly available charging sites. This revenue may be shared with the charging site host; some ownership models will provide a percentage split with the host based upon negotiated terms with the charging station provider. This method encourages the host to maximize the utilization of the equipment. Other contracts may provide a fixed rate to the host, and is typically designed to compensate for the host's identified costs associated with hosting the charging infrastructure and/or rent for the parking space. The balance of any revenue then would be retained by the charging station provider.

7.2. Setting Fees for EV Charging

Often, owners of charging spaces contract with electric vehicle service providers or third party operators who install, operate, and set the fees on charging equipment. However, when owners do have the ability to set fees—either explicitly or implicitly through their choice of operator—they face conflicting goals. Site hosts often need to recoup the costs of installing, maintaining, operating chargers, and may also wish to price charging strategically encourage turnover so chargers are available to those who need them most. On the other hand, pricing charging so that driving an electric vehicle is cheaper on a per-mile basis than a gasoline-powered vehicle creates an incentive for people to purchase electric vehicles or charge plug-in hybrids so that they use more electricity and less gasoline.

When access fees are assessed, they may be set on a fixed fee, a fixed rate or a pay per energy consumed basis.

- **An Access Fee** is a fee associated with gaining access to the charging station irrespective of if the vehicle is charging and/or how long it remains connected. It is essentially a flat rate for initiating a session by connecting to the charging station.
- **A Station or Time Based Fee** is a fee associated with the length of time a connection is established with the station, irrespective of whether the vehicle is charging or not (typically $1-2 per hour). As long as the vehicle is connected to the charging station this fee would apply. A fixed rate fee may be charged if high utilization and turnover of vehicles is desired. Fees may be charged per hour or other intervals for AC Level 2 charging and a per minute basis for DC fast charging.

- **An Energy Fee** is a fee associated with the amount of energy consumed by the connected vehicle. This is based on a per kilowatt-hour flat rate and only applies when the vehicle is actively charging. This fee is typically not applied when the vehicle is not receiving power even if the vehicle remains connected to the EV station. A multiplier on this cost may be applied to recover other operational costs.

Some jurisdictions have implemented graduated pricing schedules to increase vehicle turnover so that there is greater availability of charging and utilization of assets. Typically, the fees are increased after a two to four hour period of charging at a lower rate. Fees should be periodically reassessed to ensure that costs are being recouped and stations are utilized.

Over the long term, infrastructure owners should pilot innovative agreements with utilities and charging station providers to make charging cost-competitive with driving a gasoline-powered vehicle. Over the short term, however, infrastructure owners may need to establish higher fees in order to recoup costs and encourage turnover. Various regional Infrastructure owners should consider adopting the same fee, particularly in high-demand locations, to create consistency throughout the region. With these types of fees, vehicles are less likely to remain parked after their charge is complete and other drivers are drawn to spaces that they know are more likely to be available. Local governments looking to adopt an EV charging fee may need or want to conduct a study to demonstrate that the fee is necessary to cover their costs and/or create a revenue-sharing agreement with private infrastructure operators.

7.3. Time Limits and Enforcement

Time limits can help ensure turnover at chargers so that they are available to drivers who need them. Otherwise, EV owners may keep their vehicles at chargers after a charge is complete in order not to interrupt their business. When setting time limits, charging station owners should consider how much of a charge vehicles parked at a given location will likely need. Time limits mostly apply in commercial areas, and the type of trips that drivers take to these areas—for shopping, eating out, or socializing—tend to be relatively short, so most drivers traveling from their homes should be able to recharge from their trips in under 2 hours. However, drivers running a series of errands may be looking for a more significant charge time. The time needed to achieve a significant charge is shown in Table 7.

Table 7. Time needed to achieve a significant charge, by charging type

Charger type	Time needed to achieve a significant charge
Level 1	4 to 6 hours
Level 2	1 to 2 hours
DC Fast	15 to 45 minutes

Consistency with time limits for regular parking may also influence time limits on charging. Having longer time limits at charging spaces than at regular parking spaces may enable more EV drivers to achieve a significant charge and create incentives for EV ownership, but it can also make enforcement challenging.

The California Vehicle Code allows the owner of a space to remove a vehicle if it occupies a space in violation of posted regulations,[13] including signs designating spaces for charging vehicles or time limits on charging spaces. In order for signs to be enforceable, governments in the Santa Clara County must specify time limits, penalties, and provide all of the necessary definitions through a local ordinance.

Enforcement is key to making sure that chargers are available for drivers who need them, but it can be challenging, potentially requiring increased funding for parking agents as well as education to ensure that agents can differentiate a charging vehicle from a non-charging one in the absence of any universal standard for indicating a vehicle's state of charge. Instead of devoting resources to effective enforcement of time limits, it may be more effective to charge fees that escalate steeply after a certain time to encourage turnover at stations.

8. Charger Infrastructure Cost Estimates

The cost of installing and managing charging stations vary depending on the number and type of equipment used and where the stations are sited. It is important for potential site hosts to understand these costs in order to make informed decisions regarding long term EV charging station planning and development.

8.1. Capital Costs

Charging infrastructure costs are primarily comprised of hardware, permitting, and installation. Total costs vary by charging level, site characteristics, and equipment features. However, in workplace charging, fleet charging, and opportunity charging, there may be significant costs attributable to trenching and concrete, as well as ensuring ADA accessibility.

Table 8 below summarizes the expected costs of Level 1, Level 2, and DC fast charging installations in non-residential applications.

Table 8. Cost ranges for single port electric vehicle charging stations in non-residential applications[14]

Cost Element	Level 1		Level 2		DC fast charge	
	Low	High	Low	High	Low	High
Hardware	$300	$1,500	$400	$6,500	$10,000	$40,000
Permitting	$100	$500	$100	$1,000	$500	$1,000
Installation	$0*	$3,000	$600	$12,700	$8,500	$51,000
Total	**$400**	**$5,000**	**$1,100**	**$20,200**	**$19,000**	**$92,000**

* The $0 installation cost assumes the site host is offering an outlet for EV users to plug in their Level 1

The values presented in the table above are based single charge ports being installed at each location. It is also worth noting that the marginal cost of the next charge port installations—for each level of charging infrastructure shown in the table above – is a fraction of the total installed

[13] California Vehicle Code §22511.1(a).

[14] Cost ranges are based on data from U.S. Department of Energy. 2015. Costs Associated With Non-Residential Electric Vehicle Supply Equipment and EPRI. 2013. Electric Vehicle Supply Equipment Installed Cost Analysis.

cost listed. The charging equipment hardware is the only cost element that does not yield some benefit with increased number of installations. This is particularly relevant because the hardware represents a small fraction of the overall cost for both Level 1 and Level 2 equipment. Even for DC fast charging equipment, there is potentially significant savings with about 25-60% of the installed cost represented by the hardware.

Factors that affect the cost of electric vehicle charging infrastructure include:

- **Type of mounting**: Charging hardware are available as wall mounted or pedestal mounted units. Pedestal mounted units typically costs $500-$700 more than their wall mounted counterparts due to material, manufacturing, and install construction costs.
- **Technological Features**: The simplest units provide a charging port and electricity, however there are many amenities and features that can be included in hardware and subscriptions such as data collection, usage monitoring, user communication, and billing options.
- **Location:** The further away the charging station is from the electrical panel, the higher the installation costs. This is due to the need to trench or bore long distances to lay electrical supply conduit from electrical panel to the charging location. A 2013 EPRI study found that L2 sites that that required special work such as trenching or boring were about 25% more costly.
- **Electrical needs:** In most cases, charging stations need a dedicated circuit for each EVSE unit on the electrical panel, sufficient electrical capacity from the utility connection the electrical panel, and sufficient electrical capacity at the panel. If the selected site does not meet these three key electrical needs, then electrical upgrades are required. The most common electrical upgrade for installing a L2 electric vehicle charging station is a re-organization of the panel to create space for a 40 amp circuit. However, more significant electrical work such as upgrading transformers is more expensive.
- Another consideration is **ADA compliance** which can require special curb cutouts, van accessible parking spaces, level parking spaces, and specific connector heights, all of which affect the design and cost.

Clean Cities' Tips for Minimizing EV Charging Station Costs

EVSE Unit Selection

- Choose the EVSE unit with the minimum level of features that you will need.
- Choose a wall mounted EVSE unit, if possible, so that trenching or boring is not needed.
- Choose a dual port EVSE unit to minimize installation costs per charge port.
- Determine the electrical load available at your site and choose the quantity and level of EVSE units to fit within that available electrical capacity.

Location

- Place the EVSE unit close to the electrical service to minimize the need for trenching/boring and the costs of potential electrical upgrades.
- Instead of locating the EVSE at a highly visible parking spot that may be a great distance from the electrical panel, use signage to direct EV drivers to the EVSE unit.
- If trenching is needed, minimize the trenching distance.
- Choose a location that already has space on the electrical panel with a dedicated circuit.

Long Term Planning

- Contact your utility early in the planning stages to discuss electricity consumption and demand charges as well as electrical service needs. Avoid utility demand charges by balancing charging time windows with other electricity usage and working closely with your utility.
- Consider the quantity and location of EVSE that you plan to install over the next 10-20 years when installing your first unit. Upgrade your electrical service for your anticipated long-term EVSE load and run conduit to your anticipated future EVSE locations. This will minimize the cost of installing future units.
- Consider the electricity infrastructure for EVSE when building a new facility. It is less expensive to install extra panels and conduit capacity during initial construction than to modify the site later.

Additional information available from the DOE Clean Cities report on the Costs Associated with Non-Residential Electric Vehicle Supply Equipment

8.2. Operation & Maintenance Costs

Operation and maintenance (O&M) costs of EV charging stations vary depending on the type and quantity of charging equipment, station utilization, and ownership structure. Typical on-going O&M costs include electricity charges, station management and maintenance, and network fees.

Electricity Costs

EV charging station owners pay for the cost of electricity supplied by the equipment. These costs are comprised of two separate factors – the electricity consumption charges and demand charges. Electricity consumption charges are determined by the utility rate ($/kwh) and the amount of electricity consumed. The consumption of electricity will vary based on the number of vehicles using the chargers, power output of the equipment, vehicle power acceptance rate, and amount of time the vehicles charge.

Large commercial and industrial electricity rate structures also have demand charges that can be costly if not managed properly. Demand charges are additional fees based on the maximum energy load drawn by a customer during the billing period. Utilities use demand charges to cover the wear-and-tear on the distribution system components (i.e., transformers, substations,

and primary conductors) and some portion of the transmission system, if the load is large enough. They are meant to cover the maximum capacity needed to satisfy all their customers' peak energy needs. Demand charges are typically not a big financial burden in smaller L2 deployments, but can be high for DC fast chargers or larger deployments of L2 chargers.

The metering configuration of chargers also affects demand chargers. If an L2 charger is put on an existing building meter that already has high overall demand, then charging events may not cause a spike, but rather blends in with the existing usage. It is worth noting that PG&E does have a small general time of use rate that does not have a demand charge, but its limited customers who have less than 75kW of total peak electricity consumption.[15]

Maintenance

Maintenance and repair costs vary on the type and features of charging equipment deployed. Basic L1 and L2 chargers (non-networked) do not generally require regular maintenance. Basic equipment is typically modular in design, so any malfunctioning components can be replaced separately rather than replacing an entire unit. Networked chargers with advanced features or communications systems may require more periodic maintenance. The most common issue with these is wear on the pins in the connector due to frequent use which may eventually not make a good connection and need to be replaced.

Depending on the station ownership structure, maintenance and extended warranties may be included in agreements or provided as a fixed annual fee by charging network companies.

Network and Charging Session Fees

If the EV charger unit is networked, station owners will have to pay a fee that covers the cost for cellular/Wi-Fi network communications and back office support. Network fees will vary from $100-$900 annually, depending on the type of EVSE unit (Level 1, Level 2, DCFC), the EVSE unit features, and the EVSE manufacturer or provider. Typically for L2 chargers, network fees are around $250 per charge port.

Networked charger owners may also be responsible for paying a charging session fee to the network provider, which is typically 10% of the total fees.

Table 9 below shows an example of the annual operations and maintenance cost estimate of a charging station deployment by the City of Berkeley where two dual port chargers are installed onto an existing building meter.

[15] See PG&E rate options A6 and A10, described in more detail on page 9 of the EV Charge Network Program Guide.

Table 9. City of Berkeley Annual O&M Cost Estimate for Two Networked Dual Port Chargers [16]

Expense	Cost per charge port ($/year)	Notes
Network Service Fee	$230	
Charging Session Fees	$219	10% of collected charging station fees
Electricity Consumption	$871	Assumes charger is utilized 4 hours per day (3.3 kW average delivery, $0.15/kWh for 350 days, $0.90/kWh for 15 days)
Electricity Demand Charges	$504	Assumes marginal demand charge based on 14 kW at an average of $12/kW (at a meter with 4 charging ports)
Maintenance	$375	Assumes annual dual-port charging station maintenance of $750

[16] City of Berkeley Annual Operations and Maintenance Estimate for Two Networked Dual Port Chargers. Available online: https://www.cityofberkeley.info/Clerk/City_Council/2015/05_May/Documents/2015-05-26_Item_31k_Fees_for_Use_of_Electric_Vehicle.aspx

9. Emerging Issues and Opportunities

Through outreach conducted as part of the Driving to Net Zero Project, we heard feedback from partner jurisdictions requesting some information and guidance on a few emerging EV issues and opportunities.

9.1. Power Management Strategies and Smart Charging

Power management strategies – which take form as network software capabilities – can be used to dynamically manage and split the amount of power delivered to each charge port based on site-specific factors. Vehicle charging can be controlled and staggered during high consumption periods or prioritized by need based on the existing state of battery charge.

Smart charging allows for either the EV owner, station owner, or grid operator to control the timing and amount of power the charger delivers to the vehicle based on driver preferences and grid conditions. In non-residential applications, smart charging strategies can be implemented to match charging power with network capacity to help alleviate demand charges or limit charging when rates are highest. More sophisticated smart charging that's currently being piloted involves vehicle-to-grid integration, in which a utility provider can slow charge when demand gets high, then return to regular charging when demand on the grid lightens.

The more sophisticated and "smart" charging equipment is, the more expensive it will be to purchase and maintain. Jurisdictions should assess these costs and benefits for each charging station deployment, as a one-size fits all approach does not apply. Power management and smart charging strategies may reap cost savings for some site hosts whose stations involve many charge ports or who are faced with limits on available electrical capacity and do not want to take on the cost of electrical upgrades.

9.2. Supporting the Electrification of Car and Ride Sharing

Exposure to EV technology, whether it's by test driving or riding along as a passenger, has proven to be one of the key ways of convincing consumers about EV benefits. Ride-sharing and car-sharing programs are uniquely suited to potentially provide EV exposure to the masses. So how can local governments support the electrification of car-sharing and ride-sharing fleets to support technology diffusion, as well as their climate change and air quality goals?

Local governments have very limited regulatory power over these types of service providers. Deploying EVs in car-sharing fleets can be difficult because they typically do not own the parking spots where shared cars live. If the municipality is a site host to a car-sharing vehicle, then there may be some opportunity for collaboration or cost sharing for installing a charging port.

While the taxi industry is regulated by cities, ridesharing companies are regulated by the State. Both major Transportation Network Companies (TNCs) have plans and goals for electrifying a portion of their rides. Even if some TNCs do install and maintain chargers for their fleet's use, electrified ride-sharing drivers will also rely on the pubic charging network. Local governments can be supportive of these efforts by making it easier and cost effective to install charging infrastructure (e.g., through streamlined permitting, zoning).

APPENDIX D

Concordia EV Quote

JOB NAME: CONCORDIA EV CHARGERS	**Date:**	**February 6, 2022**		
CUSTOMER: GLEN STEINER	**By:**	**GC**		
COMPANY: CONCORDIA UNIVERSITY	**Letter #**	**210889**		*CONTINENTAL ELECTRICAL*
ADDRESS:	**of**			*CONSTRUCTION COMPANY*

Description	***Quantity***	***Unit Cost***	***Per***	***Extension***
BASE BID				$0.00
				$0.00
SCOPE:		$0.00	E	$0.00
INSTALL (1) 2 CAR DUAL EV CHARGER ON SOUTH SIDE OF PARKING GARAGE EAST OF STAIRWELL. INSTALL ALL GRC CONDUIT		$0.00	E	$0.00
		$0.00	E	$0.00
		$0.00	E	$0.00
INSTALL (1) 100 AMP 2 POLE BREAKER IN EXISTING DISTRIBUTION	1.0	$1,031.57	E	$1,031.57
INSTALL (1) 100 AMP 208 VOLT 1 PHASE FEEDER TO EV CHARGER.	1.0	$5,031.41	E	$5,031.41
INSTALL (2) NEMA 3R 60 AMP FUSIBLE DISCONNECTS AT EV CHARGERS. T TAP 100 AMP FEEDER.	2.0	$1,337.35	E	$2,674.70
CHARGER CONNECTIONS	6.0	$305.78	E	$1,834.70
INSTALL CHARGERS	2.0	$551.57	E	$1,103.14
DUAL CHARGER COST	1.0	$5,520.00	E	$5,520.00
WALL CORES	2.0	$275.78	E	$551.57
STARTUP	1.0	$0.00	E	$0.00
MISC. MATERIAL	1.0	$120.00	E	$120.00
		$0.00	E	$0.00
TOTAL COST		$0.00	E	**$17,867.09**
		$0.00	E	$0.00
		$0.00	E	$0.00
EXCLUSIONS		$0.00	E	$0.00
PREMIUM TIME		$0.00	E	$0.00
PERMIT FEES		$0.00	E	$0.00
		$0.00	E	$0.00
		$0.00	E	$0.00
		$0.00	E	$0.00

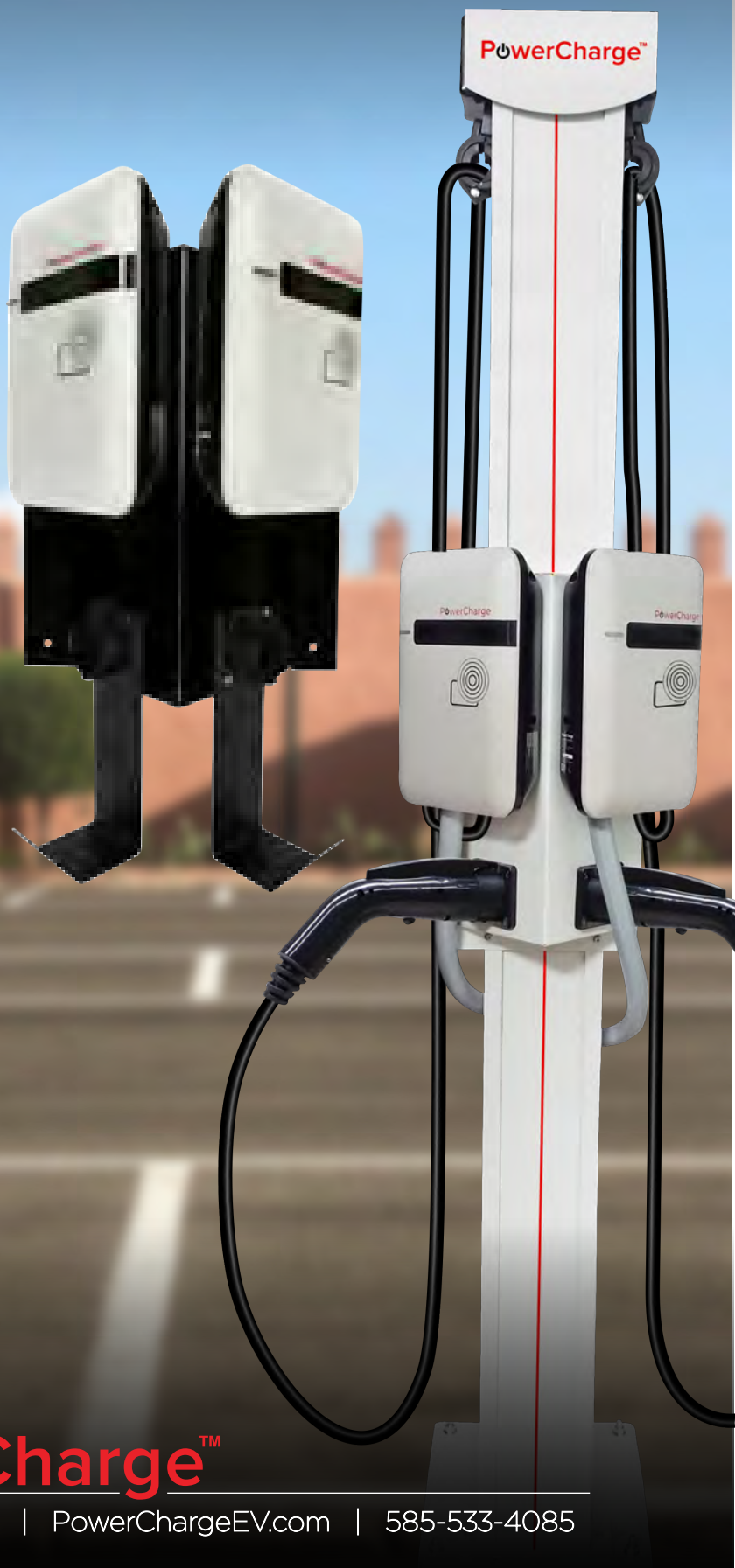
PowerCharge™

PowerChargeEV.com

Charge Up!

COMMERCIAL ENERGY SERIES

Multiple configurations and mounting options makes the Energy Series the most versatile series in the PowerCharge™ line-up.



PowerCharge™

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COMMERCIAL ENERGY SERIES

PowerCharge™

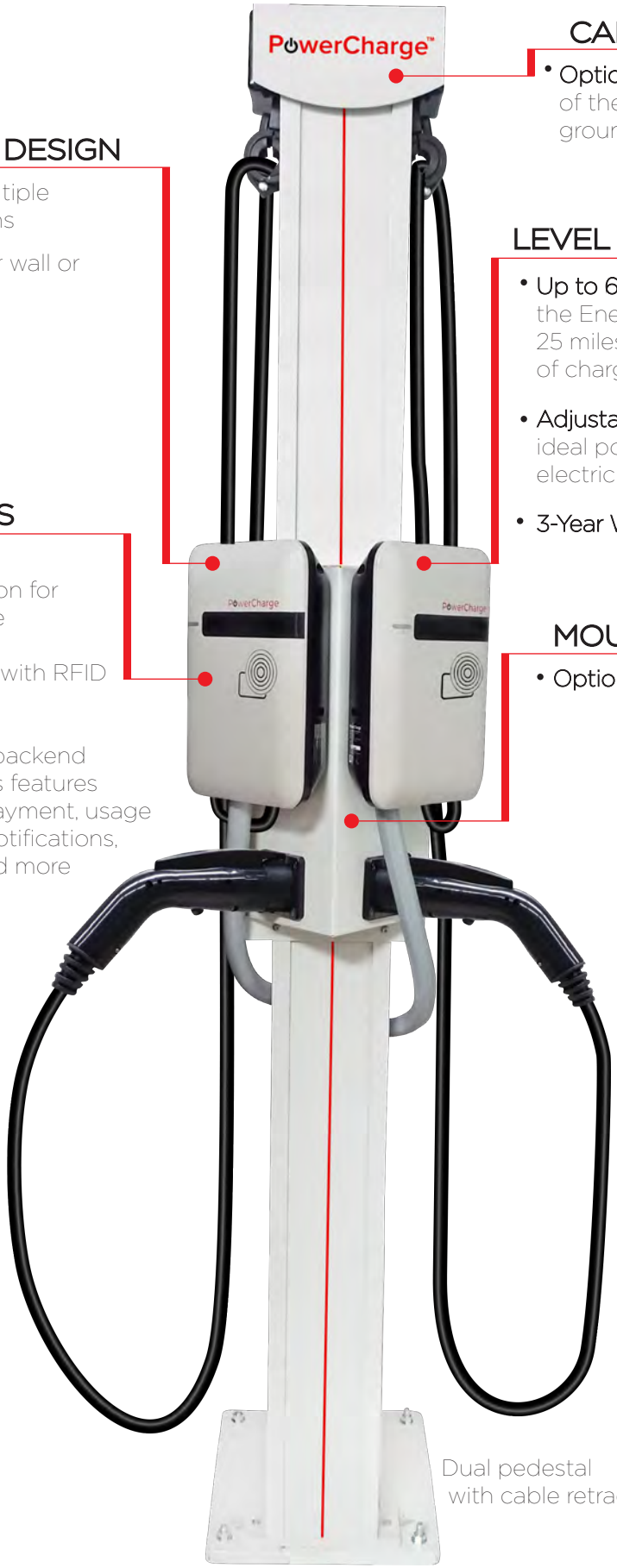
OVERVIEW

SLIM & DURABLE DESIGN

- **Outdoor rated** with multiple mounting configurations
- **Small** footprint whether wall or pedestal mounted

MULTIPLE MODELS

- **Open Access Control**
  Non-networked common for residential and fleet use
- **RFID Access Control**
  Non-networked model with RFID Card access control
- **Networked**
  When connected to a backend software plan it unlocks features such as point of sale payment, usage data reporting, driver notifications, remote diagnostics, and more



Dual pedestal with cable retractor

CABLE RETRACTOR

- **Optional** cable retractor extends the life of the cables by elevating them off the ground, also creating a safe environment

LEVEL 2 CHARGING STATION

- **Up to 6x faster** than a standard 110v plug, the Energy Series safely delivers up to 25 miles of driving range for every hour of charge time
- **Adjustable power** output allows for the ideal power to match your supply panel, electric vehicle, and driving range
- **3-Year Warranty** standard (5-Year optional)

MOUNT CONFIGURATIONS

- **Optional** mounting options available

Single Wall Mount

Dual Wall Mount

Single Pedestal

Dual Pedestal

Quad Pedestal

Energy Star certified as the result of low power consumption while in stand-by mode

UL-Listed meets safety criteria for use in North America

Meets standards for Americans with Disabilities Act

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COMMERCIAL ENERGY SERIES

SPECIFICATIONS

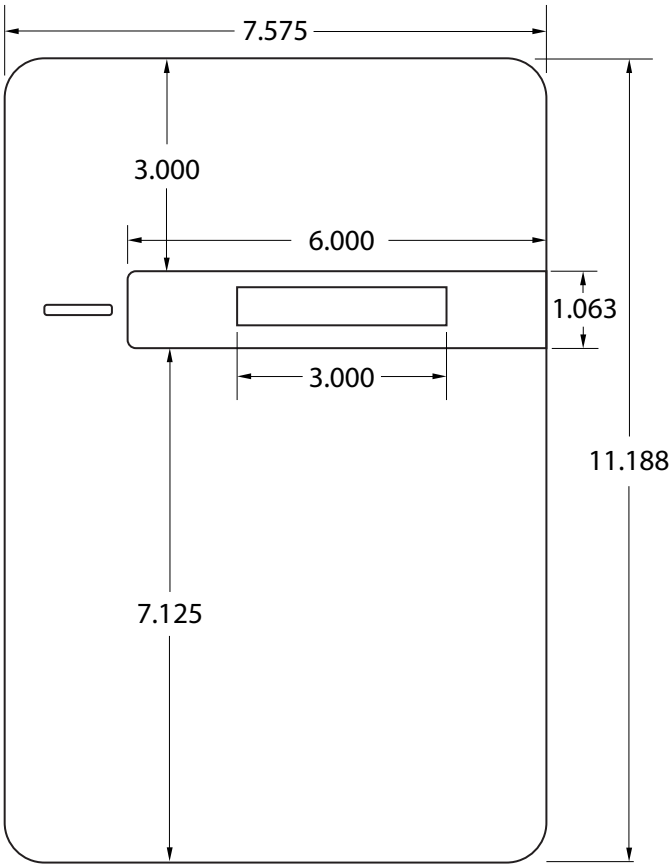
PowerCharge™

ITEM	E20-XXE	E20XXP
APPLICATION	Commercial	
VOLTAGE (Vac)	208/240VAC, Single Phase	
FREQUENCY (Hz)	60 Hz	
CURRENT (Rms)	Adjustable: 16A/24A/32A (3.8kW/5.8kW/7.6kW)	
CIRCUIT BREAKER	16A=20A/24A=30A/32A=40A	
CHARGING CONNECTOR	SAE J1772	
CHARGING CABLE LENGTH	18 ft.	
METERING ACCURACY	N/A	Embedded 3%
REAL TIME CLOCK	N/A	Yes (7 days)
WI-FI	N/A	802.11 b/g/n
CELLULAR	N/A	LTE CDMA/GSM
RFID	N/A	ISO 14443 A/B ISO 15693 NFC NEMA interoperability protocol
DISPLAY	Color LED Status Lights	116(L)*8.5(W)*37(H)mm 5.57mm CHARACTER HEIGHT 5*8 DOT MATRIX OLED 20x2
DATA PROTOCOL	N/A	OCPP 1.6 J
OPERATION TEMPERATURE	-30C/-22F to 50C/122F	
STORAGE TEMPERATURE	-40C/-40F to 70C/158F	
MOUNTING TYPE	Wall Mount / Pedestal Mount	
WIRING TYPE	Hard-wired	
IP PERFORMANCE	NEMA 4	
IMPACT RESISTANCE	IK10	
DIMENSION (HxWxH, INCHES)	11.14" x 7.56" x 3.11"	
WEB PORTAL MANAGEMENT	N/A	Yes
CERTIFICATION	UL 50/991/1449/1998/2231/2594 FCC Part 15B	
	N/A	FCC Part 15.225 (RFID 13.56MHz) FCC Part 15.247 (WLAN 2.4GHz)
	N/A	FCC Part 27 (AT&T) or FCC Part 27 (Verizon)
PEDESTAL DIMENSIONS	6x6x48"	
PEDESTAL CONSTRUCTION	Aluminum, Grey Powder-Coat Finish, Stainless Steel Hardware	
WARRANTY	3-year (5-Year optional)	

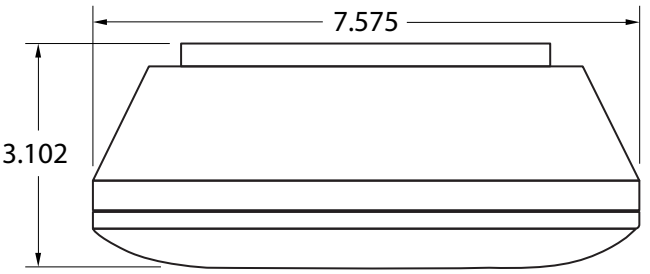
COMMERCIAL ENERGY SERIES

PowerCharge™

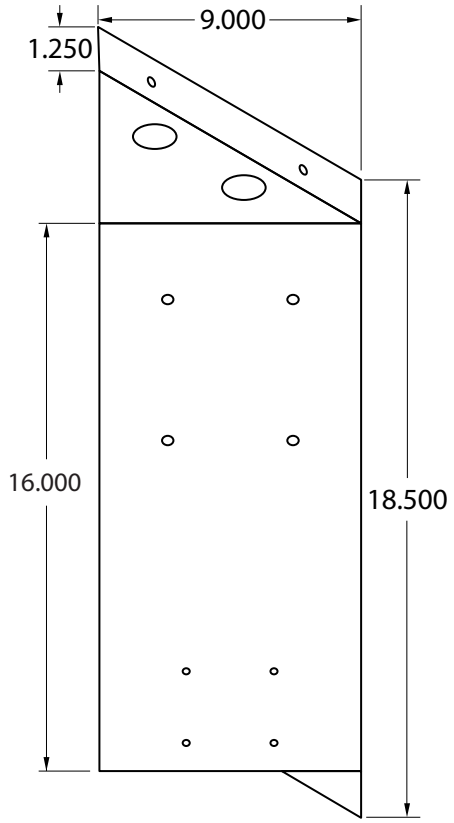
DIMENSIONS



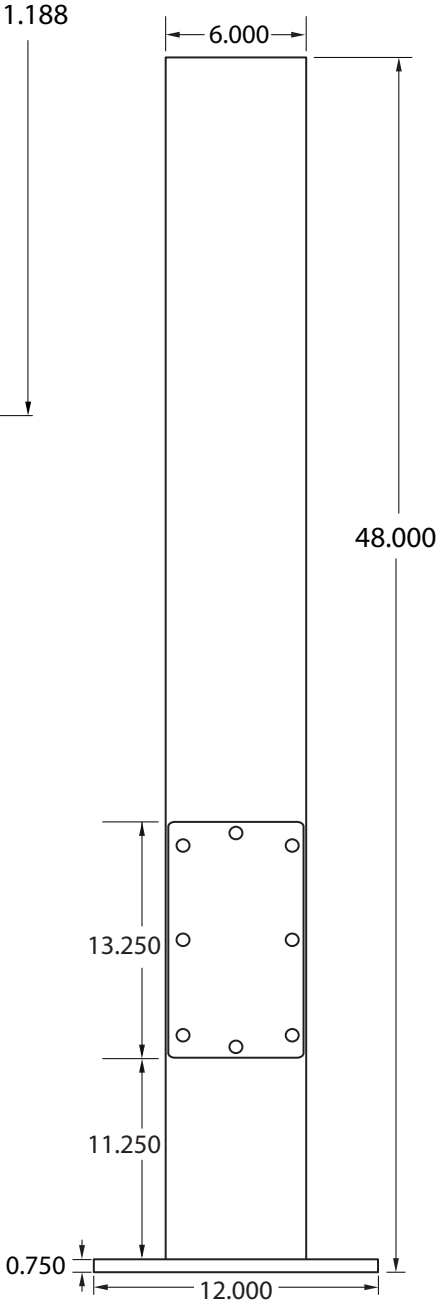
FRONT



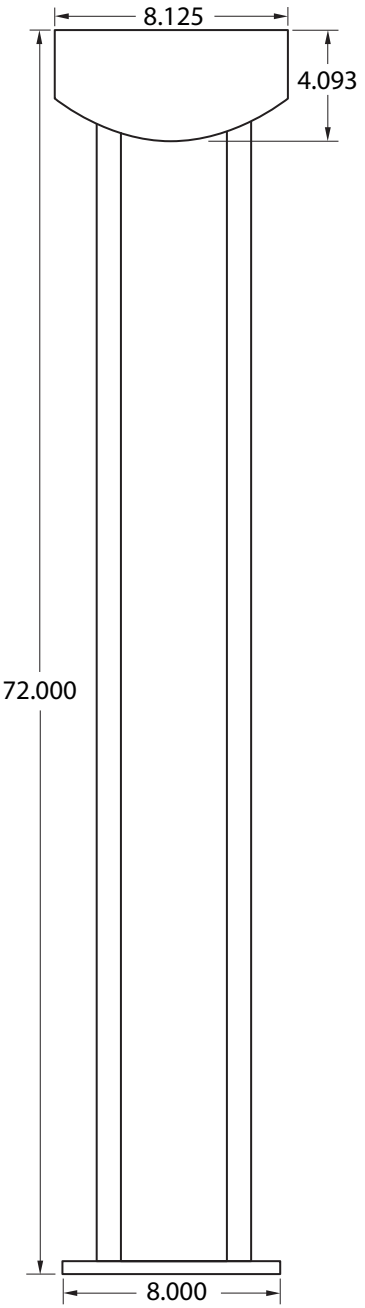
TOP VIEW



DUAL WALL MOUNT



6x6 PEDESTAL



DUAL RETRACTOR

APPENDIX E

Dominican University Sustainability Plan

Sustainability Plan
Dominican University

11/5/12

Dominican University is firmly committed to sustainability. For us, sustainability means not only being good stewards of the natural resources available to us, but also leveraging our educational leadership to prepare and promote others to be respectful and responsible citizens of the world.

This Sustainability Plan outlines Dominican's approach to sustainability, and is intended to be a guiding document while the more detailed Climate Action Plan is being developed. Areas addressed are as follows:

Sustainability: Core to the Mission

Dominican University's commitment to sustainability finds its roots in its Catholic Dominican ethos, which includes an environment of Caritas et Veritas, in which we contemplate the meaning of existence and strive collaboratively for a more just and humane world. It enables students to develop a sense of care and responsibility for oneself, one's community and the wider creation. It affirms the sacredness of all creation, the dignity of every living being, and concern for the common good.

In his recent encyclical, *Caritas in Veritate*, Pope Benedict XVI writes: "The environment is God's gift to everyone and in our use of it we have a responsibility towards the poor, towards future generations and towards humanity as a whole." As we uphold the dignity of the environment, we also uphold the dignity of our sisters and brothers, including those yet to come, and especially those most in need. Dominican University lives these responsibilities both through its own sustainability practices and by educating for environmental sustainability.

Our ongoing commitment to sustainability includes respecting the environment, managing our resources, and fostering a culture of social justice and environmental sustainability through education and collaboration.

Dominican University is a member of the Association for the Advancement of Sustainability in Higher Education (AASHE) and agrees with their position that sustainability should be defined "in an inclusive way, encompassing human and ecological health, social justice, secure livelihoods and a better world for all generations".

Several green initiatives have been implemented, and many more are being planned. Going forward, our goal is to organize and integrate these efforts, as well as broaden the scope within the university.

Organizational structure

4R*future* was developed as the umbrella framework for Dominican's sustainability efforts. It consists of five inter-related components.

1. Dominican's 2010-2015 Strategic Plan, *Pathways to Distinction*, which was approved at the Board of Trustees level in October 2010, establishes sustainability as a university priority.
2. *Supporters of Sustainability ("SOS")* is the working group comprised of approximately twenty faculty, staff and students that developed the sustainability plan and shapes the institution's approach to sustainability, as well as gathers ideas and provides guidance for implementation of specific green initiatives. The SOS council is divided into four subcommittees, each pertaining to a targeted area of concentration:
   - Water, Energy, and Transportation
   - Food and Waste
   - Community Outreach, Partnerships/Collaborations
   - Education/Programming
3. *Friends of* 4R*future* is a large body of interested faculty, staff and students that are role models and advocates, and provide enthusiasm and momentum for sustainability efforts.
4. *Eco Club* is a student organization whose focus is to encourage environmental stewardship and sustainability from a student perspective.
5. *Staff Responsibilities* – Headed by the Senior Vice President for Finance and Administration, five staff positions formally include "assist with implementation and communication of sustainability" as part of their responsibilities for furthering Dominican's sustainability plan, and they meet regularly to coordinate. In addition, student workers and student internships are specifically employed to work on sustainability related activities.

External Commitments

Dominican University actively participates within several communities: its neighbors/village, the association of other higher education institutions, members of its catholic heritage, etc. Beyond the involvement managed under the SOS's Community Outreach, Partnerships/Collaborations committee, Dominican is also researching the commitment to sign the President's Climate Commitment, has already signed the Illinois Campus Sustainability Compact and is a founding member of the Villages of Oak Park and River Forest's PlanIt Green Sustainability Plan. These institutional commitments expand the focus of sustainability efforts to beyond our campus.

Plan Goals

While improvement in every aspect of sustainability is intended, this plan establishes overarching and quantifiable goals where feasible, recognizing that alternative means of measurement may be used for specific initiatives. Using the village's PlanIt Green goals as guidelines, Dominican has developed the following sustainability goals for the university.

Water, Energy and Transportation

Dominican aspires to reduce their carbon footprint and processed water usage, while still maintaining acceptable standards with respect to occupant health and comfort. Specific goals over the next 10 years are as follows:

1. *Energy:* Reduce energy consumption for the campuses by an average of 3% per year, for a total of 30% over the next 10 years.
2. *Energy:* Increase the percent of renewable energy procured an average of 2.5% per year, for a total of 25% over the next 10 years.
3. *Energy:* Reduce greenhouse gas emissions by an average of 3% per year, for a total of 30% over the next 10 years.
4. *Water:* Through reduced consumption and alternative sources of water, reduce the quantity of potable water purchased through the village by 10% over the next 10 years.
5. *Transportation:* Increase the number of hybrid or electric vehicles in the university fleet to 50% and increase bike program usage by 3% each year for the next 10 years.

Food and Waste

In conjunction with Chartwells, the university food service vendor, Dominican intends to provide healthier food choices and sustainable food information for the campus community, to help them make better consumption choices. Dominican also intends to reduce the environmental impact of our waste by reducing unnecessary consumption, increasing the re-use and recycled content of materials that are purchased, and improving the rate of recycling on campus.

1. *Waste:* Increase waste diversion to a total of 50% within the next 10 years.
2. *Food:* Increase goods locally purchased to a total 25% over the next 10 years.

Community Outreach, Partnerships/Collaborations

Dominican strives to forward sustainability by being leaders in the local community movement, building relationships, and initiating and strengthening partnerships within university divisions and in the larger community.

Education/Programming

Dominican will utilize its position as an institution of higher education to teach not only its students, but also the greater community on the need and the means to achieve a sustainable future.

1. *Education/Programming:* Increase formal recognition from external organizations, targeting two over the next five years. Recognition should take the form of ratings, awards, articles, etc. for Dominican's sustainability related education offerings and/or co-educational programs.

Areas of concentrations and strategies

Dominican's sustainability efforts are focused in four areas. Those areas and a list of initial strategies to address in 2012 are listed below. There is a master list of additional items in each area that is under review and updated regularly.

Water, Energy, and Transportation

1. Install water, electricity, and gas metering in each building, to facilitate the gathering of utility usage data (both baseline measuring and improvement). Given funding considerations, the expected approach is to purchase the master controls system in 2012, then assign a budget line in following years to address existing areas on campus. The first priority is to install additional

metering in the residence halls to allow for awareness building and measurable initiatives with students.
2. Research ways to reduce vehicle usage through carpooling systems, rental car (I-Go) availability, and awareness building for public transportation. Identify policies for parking and fleet management that support a reduction in greenhouse gas emissions.
3. Educate the campus community about power saving settings on computers and overhead projectors. Research potential of IT to make this standard setting on all computers and projectors.
4. Remove the hot water option on all but one laundry wash machine per bank in the residence halls.
5. Install lighting controls such as occupancy sensors and timers to use them most efficiently. Approach is to include as part of all new construction/renovation, plus assign a budget line each year to address existing areas on campus.
6. Purchase a thermal scanner and an electrical power monitor, to both identify energy waste on campus and to make available for community use.

Food and Waste

1. Pilot the Reusable Lunch Bag program for catering events. Develop marketing and procedures for Chartwells (the university's food service vendor) and users of the program, and analyze cost savings and waste reduction.
2. Continue to market and track the Battery Tube Recycling Programming, Electronics Recycling Program and Terra Recycling Program.
3. Develop an herbal garden at the Priory Campus Dining Hall.
4. Monitor waste usage in offices, across campus and in residence halls. Review current locations of garbage and recycling containers, specify items that can be recycled, and identify move out procedures of Residence Halls that could reduce waste.
5. Work with office services to re-use envelopes and paper, including making free paper pads from scratch paper to give to offices. Review and identify alternatives to the current use of personalized pads of paper.
6. Develop a pilot Zero Waste Program, including identifying concerns/issues, marketing, and reviewing the success of the program.
7. Gather a core team to review the composting process. Identify what can be composted and issues with cross contamination. Develop a Food Waste Audit to be implemented as a Student Honors Project and coordinated with PlanITGreen and Seven Generations Ahead.

Community Outreach, Partnerships/Collaborations

1. As a University, and with employee time allotted & responsibility given, continue to align, promote, be involved in & be a leader in PlanItGreen, the OPRF sustainability initiative.
2. Continue to develop Dominican University's Garden, with particular focus on creating wider ownership and a part-time position to coordinate the garden & ensure its future. Coordinate these efforts with the work of other subcommittees.
3. Establish sustainability service learning initiatives and a sustainability component in all service learning outcomes.
4. Recruit a future Lund-Gil chair invited because of her/his expertise in sustainability &/or commit to recruiting several sustainability experts to give talks for several high-profile speaking events.

5. Support and grow the Green Growth Scale project; define, implement & communicate a Green Steward Pledge project
6. Consider and develop a long term structure to promote and implement sustainability initiatives across departments and provide resources to make university sustainability initiatives sustainable.

Education/Programming

1. Expand the sustainability aspects in the existing service learning programs.
2. Add green facts on the myDU web page.
3. Develop internal internships addressing sustainability.
4. Open communication lines within the community by starting a wiki, hosting seminars, sponsoring lectures, etc. to invite further progress towards more comprehensively and inclusively defining sustainability, and understanding what is needed to create a sustainably just and flourishing world.
5. Review the recent survey data regarding sustainability within our existing curriculum, to inform ideas about a sustainability minor and ideas for incorporating more sustainability awareness into existing classes.

Criteria for prioritizing initiatives

The following criteria will be used to determine and prioritize the initiatives which best fit Dominican's culture, available resources, and finances.

- Financial: Initial cost and payback period
- Educational and awareness building
- Reduction of carbon footprint and waste
- Impact on social justice
- Influence on positive behavioral change

Measurement and Data

Tracking quantitative measures and comparing those benchmarks to both our past performance, as well as the performance of similar institutions, provides good information for decision making. Benchmarking helps guide which projects would yield the best results and, after they are completed, how successful the projects actually were.

Appropriate assessment measures will be determined and tracked for each area of concentration and initiative. In addition, overall campus data will be collected, assessed and benchmarked annually, both in gross numbers and in pro-rated usage as a percent of student population and/or square feet of built space. Examples of overall campus tracking in gross numbers:

- Waste: tons sent to landfill, recycled, and composted
- Electric: kWh, peaks
- Gas: therms
- Water: gallons (potable water)
- CO2 Emissions: metric tons

Baselines will be calculated from both current (2011) data, as well as retrospective (2001 and 2006), so that the impact of past initiatives can be recognized.

In addition, Dominican is considering adoption of two reporting structures already established for measuring sustainability at universities. Clean Air Cool Planet's Campus Carbon Calculator is a comprehensive tool for measuring institutional greenhouse gas emissions (GHG), commonly called "the carbon footprint" of a facility. The Sustainability Tracking and Rating System ("STARS") was developed by the Association for the Advancement of Sustainability in Higher Education ("AASHE") and is structured as a checklist that encompasses a broad range of sustainability aspects: educational, operational, financial and social justice, among others. Both systems require significant time commitments for completing, as they require an in-depth review of campus functions.

Funding

Finding outside funding opportunities in the form of grants, earmarks, loans, designated donations, etc. will allow more projects to be completed, and will build awareness. In addition, providing internal funding for green initiatives provides more control in the planning process. Ideas for university funding sources include a green fee, alumni or senior gift designations, percentage allocation of green project savings into a green funding pool, and dedicated line items in the university budget. It should also be acknowledged that the university funds the personnel to staff the committees and implement most initiatives within departmental budgets. A more detailed framework for determining how projects will be funded will be an important part of the forthcoming Climate Action Plan.

Next Steps

The next steps on Dominican's sustainability path have been identified as follows:

1. Continue with departmental efforts to be green and build awareness for sustainability.
2. Proceed with implementation of the SOS subcommittees' initial strategies for 2012.
3. Gather additional "green" ideas from the campus community by implementing an electronic suggestion box system.
4. Develop a tracking/measurement system
5. Finalize a comprehensive calculation of Dominican's carbon footprint of green house gas emissions
6. Start gathering data to complete the STARS checklist
7. Draft a Climate Action Plan for the university
8. Regroup on Campus Sustainability Day (3rd Week in October) to formally review and celebrate progress
9. Utilize the greenhouse gas emission calculations and Climate Action Plan draft to inform the decision for signing the Presidents' Climate Commitment.

Formalizing sustainability at Dominican is aptly named 4R*future*. This plan is truly "for our future, for your future".

APPENDIX F

Manufacturer Catalog Cuts

EATON

CiorbaGroup
CONSULTING ENGINEERS

Green Motion
Electric vehicle charger

GMEV48CME1-WC

ALL PICTURES SHOWN ARE FOR ILLUSTRATION PURPOSE ONLY.
ACTUAL PRODUCT MAY VARY DUE TO PRODUCT ENHANCEMENT.

Description

Eaton Green Motion Building Pro combines fast AC charging at 11.5kW, energy metering, remote access into a premium wall-box. This forward-thinking solution provides additional versatility with multiple installation options for maximum flexibility. The EV charger is intended for charging plug-in hybrid and all-electric vehicles and is compatible with the Society of Automotive Engineers J1772 charging standard.

Design features

- 48A, 11.5kW at 240Vac, AC Level-2 Charger
- Ability to control remotely – ON, OFF, adjustable rate of charge
- 1% accurate metering
- Adjustable output current (48A, 40A, 32A)
- Complies with SAE J1772 standards
- Open platform with support for OCPP (Open Charge Point Protocol) 1.6J
- Bi-directional communication via Wi-Fi, Ethernet and Cellular(4G)
- Real-time access to device state: ready to charge, charging, fault
- Access to the charger through the internet (cloud connectivity)
- Over the Air Updates (OTA)
- Wi-Fi signal strength indication
- 5" touch LCD for a convenient user interface
- RFID and QR code for access control
- NEMA-3R rated enclosure for outdoor installation
- Energy Star Certified for efficient performance

Powering Business Worldwide

Applications

The Green Motion Building Pro enhances the charging experience with higher charge current, easy to use interface and remote access capabilities. The advanced functionality built into the charger allows customized energy usage and helps save on energy costs. This new level of control and insight provides more efficient way to charge your electric vehicle.

Our approach with open protocols gives customers the flexibility to integrate with preferred CPO providers. Green Motion Building Pro's rich feature set makes it ideal for various commercial and destination charging applications.

Table 3. Specifications

Description	Specification
Catalog number	GMEV48CME1-WC, GMEV48CMC1-WC
Electrical input	
Input power	11.5kW at 240Vac; 9.9kW at 208Vac
Input voltage	208/240 Vac
Input (amperage) current	48 A
Input OCPD (Breaker) rating	60 A
Electrical output	
Power output	11.5kW at 240Vac; 9.9kW at 208Vac
Output voltage	208/240 Vac
Output amperage	48 A
Connector	SAE J1772
Installation	Hardwire
Cable length (in feet)	25
Safety	UL
Interlocked power protection	Yes
Ground fault protection	20 mA
Overcurrent protection	Yes
Automatic reset after nuisance trip feature	Yes
Randomized restart on power failure (delay before charging resumes after a power failure)	Yes
Frequency rating	60Hz
Ambient operating temperature	-35°C to +55°C
Humidity	0 to 95% Relative Humidity, Non-Condensing
kAIC rating	10kA
Warranty	3 years
Enclosure	NEMA-3R rated for outdoor installation
Certifications	UL, CSA, SAE, NFPA, FCC Part 15, Energy Star

Green Motion
Electric vehicle charger

GMEV80CME1-WC

ALL PICTURES SHOWN ARE FOR ILLUSTRATION PURPOSE ONLY.ACTUAL PRODUCT MAY VARY DUE TO PRODUCT ENHANCEMENT.

Description

Eaton Green Motion EV charger combines fast AC charging at 19.2kW, revenue-grade metering, remote access into a premium wall-box. This forward-thinking solution provides additional versatility with multiple installation options for maximum flexibility. The EV charger is intended for charging plug-in hybrid and all-electric vehicles and is compatible with the Society of Automotive Engineers J1772 charging standard.

Design features

- 80A, 19.2kW at 240Vac, AC Level-2 Charger
- Ability to control remotely – ON, OFF, adjustable rate of charge
- ±1% accurate metering
- Complies with SAE J1772 standards
- Open platform with support for OCPP (Open Charge Point Protocol) 1.6J
- Bi-directional communication via Wi-Fi, Ethernet and Cellular(4G)
- Real-time access to device state: ready to charge, charging, fault
- Access to the charger through the internet (cloud connectivity)
- Wi-Fi signal strength indication
- Green Motion Driver app for iOS and Android to commission and control the charger
- 5" touch LCD for a convenient user interface
- RFID and QR code for access control
- NEMA-3R rated enclosure for outdoor installation
- Energy Star Certified for efficient performance

Powering Business Worldwide

Applications

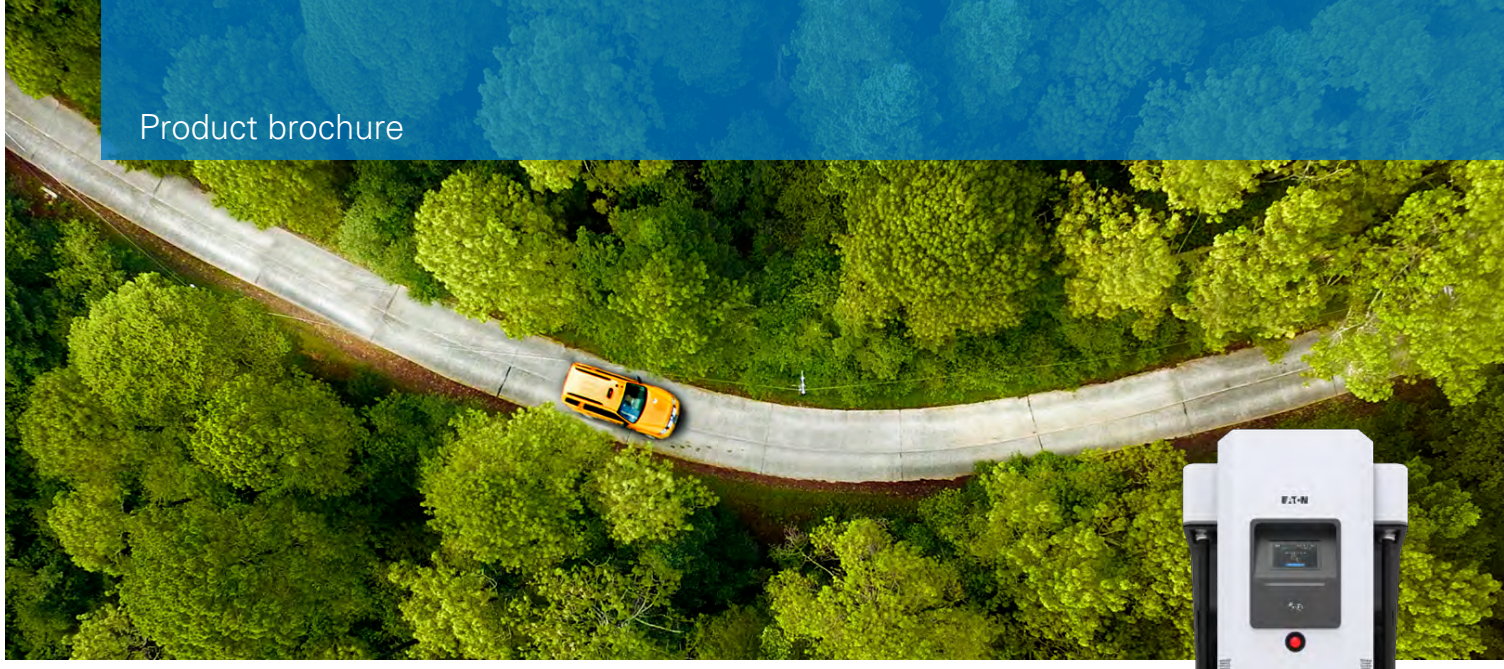
The Green Motion EV charger enhances the charging experience with higher charge current, easy to use interface and remote access capabilities. The advanced functionality built into the charger allows customized energy usage and helps save on energy costs. This new level of control and insight provides more efficient way to charge your electric vehicle.

Open APIs, powered by Brightlayer, allow flexibility to integrate with preferred software systems. Our documentation provides detailed instructions on the functionality supported by the APIs to help developers incorporate our solutions into their applications. You can find the API documentation at: Eaton.com/ev-charging

Table 3. Specifications

Description	Specification
Catalog number	GMEV80CME1-WC, GMEV80CMC1-WC
Electrical input	
Input power	19.2kW at 240Vac; 16.6kW at 208Vac
Input voltage	208/240 Vac
Input (amperage) current	80 A
Input OCPD (Breaker) rating	100 A
Electrical output	
Power output	19.2kW at 240Vac; 16.6kW at 208Vac
Output voltage	208/240 Vac
Output amperage	80 A
Connector	SAE J1772
Installation	Hardwire
Cable length (in feet)	25
Safety	UL
Interlocked power protection	Yes
Ground fault protection	20 mA
Overcurrent protection	Yes
Automatic reset after nuisance trip feature	Yes
Randomized restart on power failure (delay before charging resumes after a power failure)	Yes
Frequency rating	60Hz
Ambient operating temperature	-35°C to +55°C
Humidity	0 to 95% Relative Humidity, Non-Condensing
kAIC rating	10kA
Warranty	3 years
Enclosure	NEMA-3R rated for outdoor installation
Certifications	UL, CSA, SAE, NFPA, FCC Part 15, Energy Star

Product brochure



The new Eaton Green Motion 50–150 kW DC Fast Charger

Powering the electric vehicles of today and tomorrow

The new Eaton Green Motion 50–150 kW DC Fast Chargers combine electric vehicle charging hardware with Eaton digital power management capabilities and electrical infrastructure products and services. With hardware and software solutions for Electric Vehicle Charging Infrastructure (EVCI), Green Motion 50-150 kW DC Fast Chargers are part of an EVCI strategy to power the electric vehicles of today and tomorrow.

Eaton is committed to improve the quality of life and the environment through the use of power management technologies and services. With advances in electric transportation, Eaton can leverage existing expertise in adjacent technologies and services to help power EVCI for personal, business and industrial use.

Features and benefits

- **Vehicle compatibility** provides charging for current and future light and medium-duty electric vehicles
- **300 amp, passively cooled charging cables** on higher power models ensures more peak power delivered to vehicles with greater reliability and reduced capital cost
- **ISO 15118 plug-and-charge** allows for easy charging and eliminates the need for apps or credit cards at the time of charge for payment (future support)
- **Ethernet or 4G cellular communication** provide the ability to perform firmware updates remotely, which eliminates the need for a planned visit to a remote site to perform an update, ultimately saving time and money
- **OCPP v1.6J support** provides compatibility and integration with various charging network management and fleet software management solutions

More power means you can get on the road quicker

Unlike many competitive solutions that use 200 A power cables, the Green Motion 50–150 kW DC Fast Chargers provide more power for 400 Vdc battery pack vehicles, such as the Ford Mustang Mach-E and Ford F-150 Lightning. Each Green Motion DC Fast Charger rated at 100 kW, 125 kW and 150 kW are equipped with 300 A CCS1 cables, allowing for higher rates of charge for most battery electric vehicles (BEVs) produced between 2010–2022 that use lower voltage, 400 V class battery packs. By using passively-cooled cables, the Green Motion 50–150 kW DC Fast Chargers do not require liquid cooling components within the charger or the charging cables, which reduces complexity, cost and maintenance while improving reliability.

Powering Business Worldwide

Product highlights

- **Save space** with an all-in-one design (no separate power module cabinets), with models designed for private fleet and public charging applications*
- **Enjoy fast charging** with high current 300 Amp cables in 100–150 kW models that allow for faster real-world charge times of many of todays vehicles using ~400 Vdc battery architectures
  – ~400 Vdc architecture vehicles include Ford Mustang Mach-E and F-150 lightning, Audi E-tron (SUV), Nissan Leaf, Rivian R1T/R1S, and many others
- **Designed for compatibility** with a variety of charge management platforms through the use of OCPP 1.6J+ as well as future Eaton charge network management software (expected 2023)
- **Supports simultaneous charging** of two connected vehicles and OCPP-enabled load management to reduce installation cost per port while powering more vehicles
- **UL-listed and tested** for electrical safety and includes ground fault protection**

*Public charging models will be released after launch of private fleet charging models
**UL certification will be obtained before launch

Eaton Green Motion 50–150 kW DC Fast Charger

The perfect fit for a wide-range of fast-charging applications, including:

Fleets that support customers to perform their core business

Delivery trucks or customer-owned fleets

Fleet operations for business owners

MD/HD trucks may require charging beyond 20 kW to support fleets that may have short dwell times to charge charge overnight and may have large battery capacities, including:

- Package delivery
- Regional trucking
- Rental car agencies
- Buses
- Municipality and government fleet vehicles

Charging stations

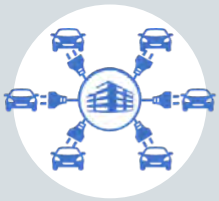
DC fast charging for personal, business and industrial use along a travelers' route, including:

- Rest areas
- Interstate dining and gas areas
- Truck stops

Site-level deployment

This includes:

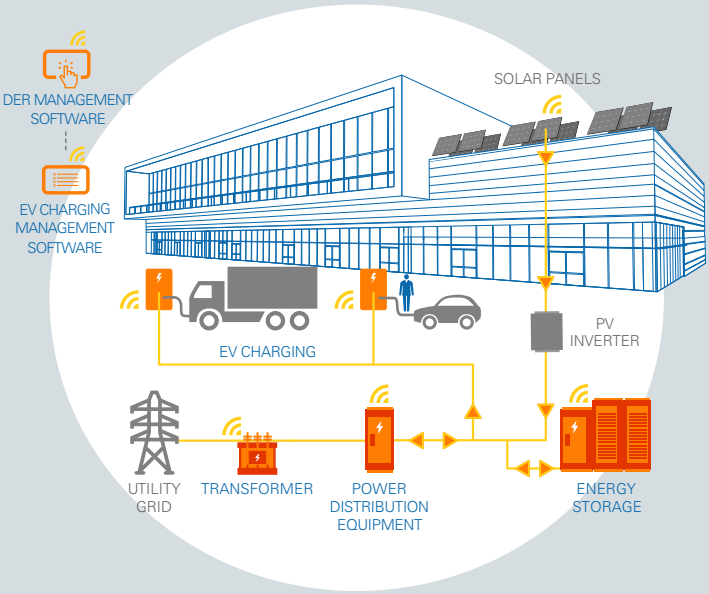
- Major shopping centers, outlet malls, and retail locations
- Stadiums and event arenas
- Race tracks



Parking as a business

- DC fast charging for temporary parking in cities and parking in cities and parking decks, where people may spend 1–3 hours at their destination and need to charge their vehicle

Eaton's comprehensive EV charging infrastructure offerings will include, equipment, software and engineering services solutions to meet EV charging project requirements.



As the demand for EV charging rapidly increases, Eaton can satisfy electric vehicle charging infrastructure needs of today and tomorrow.

EATON GREEN MOTION 50–150 kW DC FAST CHARGER SPECIFICATIONS

Description	
5PX G2 extended battery module options	
Available max kW rating (in kW)	50, 75, 100, 125, 150
150 kW model max power rating	120 kW @ 400 Vdc 150 kW @ 500–1000 Vdc
Cable cooling type	Air-cooled (passively cooled)
Plug/nozzle options (2x CCS1, or CCS1 and CHAdeMO)	CCS1 (125 A, 200 A or 300 A) CHAdeMO (125 A)
Number of ports per charger	1 or 2 per charger
Elevation range	<2000 m (<6500 feet)
Temperature range	-35 to 55°C (-31 to 131°F)
Input voltage (AC)	480 Vac Delta (3-Phase)
DC output voltage range	200–1000 Vdc
Cable management	Hook for cable management
User access	RFID, ISO 15118 "Plug and Charge" (future)
Display	7" touch screen
Network Support	3G/4G cellular, Ethernet
EVSE communication protocol	OCPP 1.6J (supports future upgrades to OCPP 2.x)
Enclosure rating for environment	IP54 for environment, enclosure designed to IK10 for impact
Safety certifications	UL 2202, UL 2231 CSA C22.2 No. 107.1, No 281.1-12, No 281.2-12
FCC rating	CFR 47 Part 15 Subpart B, Class A
Size (height x width x depth)	1685 x 530 x 750 mm 66.4" x 20.9" x 29.6"
Surge protection	ANSI C62.41 Cat B3/C1
Standard warranty	1 year

Due to the continuing product improvement programs, specifications are subject to change without notice.

EATON GREEN MOTION 50–150 kW DC FAST CHARGERS

Description	Catalog number	Maximum power rating (kW)
Private fleet charging — single cable models		
DC50 CCS1 125A	GMDC50-CCS	50
DC150 CCS1 300A	GMDC150-CCS	150
Private fleet charging — dual cable models		
DC50 CCS1x2 125A	GMDC50-CCSX2	50
DC75 CCS1x2 200A	GMDC75-CCSX2	75
DC100 CCS1x2 300A	GMDC100-CCSX2	100
DC125 CCS1x2 300A	GMDC125-CCSX2	125
DC150 CCS1x2 300A	GMDC150-CCSX2	150
Public charging — dual cable models		
DC50 CCS1x2 125A w/credit card reader	GMDC50-CCSX2-P	50
DC50 CCS1 125A and CHAdeMO 125A w/credit card reader	GMDC50-CCSCDM-P	50
DC75 CCS1x2 200A w/credit card reader	GMDC75-CCSX2-P	75
DC75 CCS1 200A and CHAdeMO 125A w/credit card reader	GMDC75-CCSCDM-P	75
DC100 CCS1x2 300A w/credit card reader	GMDC100-CCSX2-P	100
DC100 CCS1 300A and CHAdeMO 125A w/ credit card reader	GMDC100-CCSCDM-P	100
DC125 CCS1x2 300A w/credit card reader	GMDC125-CCSX2-P	125
DC125 CCS1 300A and CHAdeMO 125A w/credit card reader	GMDC125-CCSCDM-P	125
DC150 CCS1x2 300A w/credit card reader	GMDC150-CCSX2-P	150
DC150 CCS1 300A and CHAdeMO 125A w/credit card reader	GMDC150-CCSCDM-P	150

Note: Private charging models anticipated Q4 2022, public charging models available 2023

For more information, visit **Eaton.com/EVCI**

Follow us on social media to get the latest product and support information.

Powering Business Worldwide

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

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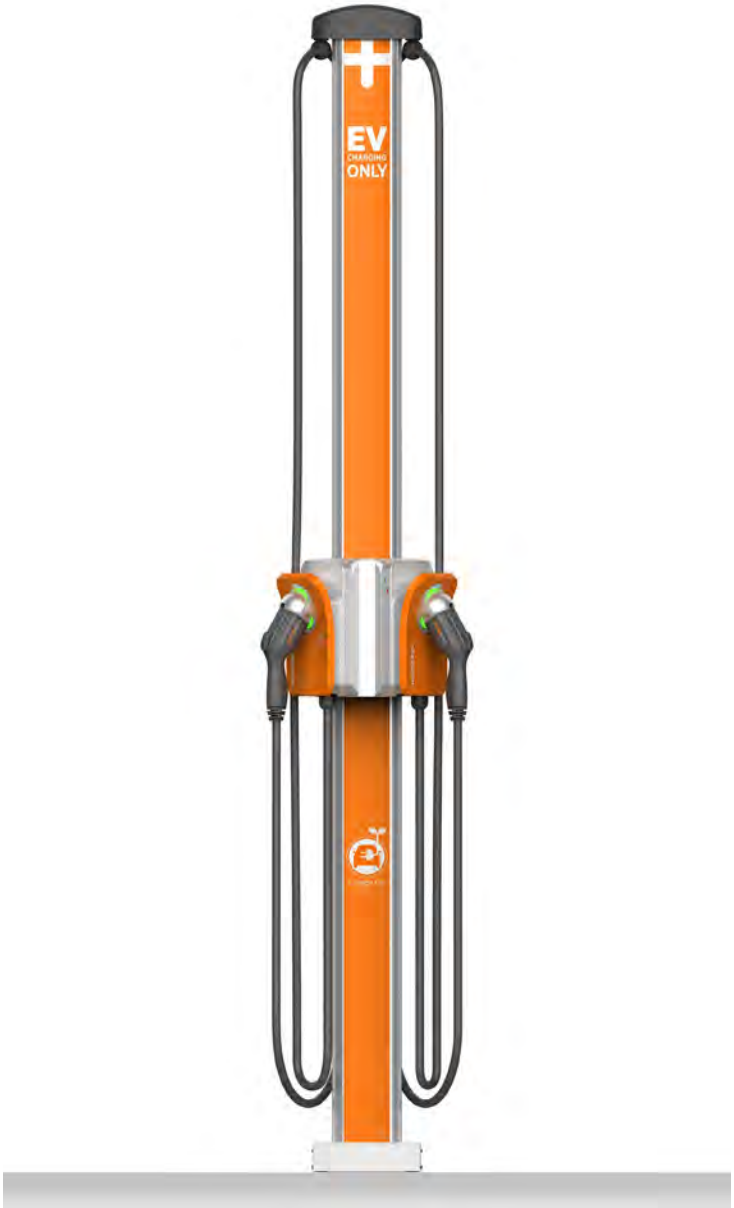
CHARGEPOINT

CiorbaGroup
CONSULTING ENGINEERS

ChargePoint® CPF50 Level 2 Charging Stations for Multifamily

Specifications and Ordering Information



Ordering Information

The order codes below represent specific product configurations. Other product options are available. Please contact ChargePoint Sales for information and order codes.

Hardware

Description		Order Code
Model	Single Port, Pedestal 5.4m (18’) Cable with 6' Cable Management Kit	CPF50-L18-PEDMNT-CMK6
	Dual Port, Pedestal, 5.4m (18’) Cable with 6' Cable Management Kit	CPF50-L18-PEDMNT-CMK-Dual
	Single Port, Wall, 5.4m (18’) Cable with 6' Cable Management Kit	CPF50-L18-WALLMNT-CMK6
	Single Port, Pedestal, 7.0m (23’) Cable with 8' Cable Management Kit	CPF50-L23-PEDMNT-CMK8
	Dual Port, Pedestal, 7.0m (23’) Cable with 8' Cable Management Kit	CPF50-L23-PEDMNT-CMK8-Dual
	Single Port, Wall, 7.0m (23’) Cable with 8' Cable Management Kit	CPF50-L23-WALLMNT-CMK8
Replacement Cable	5.4m (18’). 50A, Charging Cable, CMK version 7.0m (23’), 50A, Charging Cable, CMK version	CPFCABLE-T1-50A-L18-CMK-F CPFCABLE-T1-50A-L23-CMK-F

Required Companion Products

Description	Order Code
ChargePoint Cloud Plan	Please contact ChargePoint sales
Station Initial Activation*	CPMFHS-ACTIVE
ChargePoint Gateway* (1 required for every 9 stations)	CPGW1-LTE

*Includes a 3 year parts exchange warranty (“Parts Warranty”). Additionally, for as long as the resident subscribes to Multi-Family Home Service Plan, ChargePoint will provide on-site labor to maintain the stations (“Maintenance Service”). The Maintenance service

does not provide coverage for abuse, vandalism, damage or other problems caused by accidents or negligence.

**ChargePoint Gateway is required for all CPF50 installations. ChargePoint certified installers will do a site validation and order the ChargePoint Gateway as needed. In addition, the site host is responsible for providing power and cell coverage to the gateway.

The Gateway should be located where cellular signal levels are optimal for LTE. Each Gateway must be located within 150 feet line-of-sight to as many as nine (9) CPF50 charging stations. Each CPF50 charging station has built-in WiFi capability to communicate via the Gateway for ChargePoint network services.

The Gateway is a UL Class 2 device and requires less than 4 watts power (33 mA@120V or 19 mA@208V). ChargePoint recommends hardwire electrical termination to the power source for the Gateway. The Gateway dimensions are 280 mm (11 in) wide by 340 mm (13 3/8 in) long by 137 mm (5 3/8 in) deep.

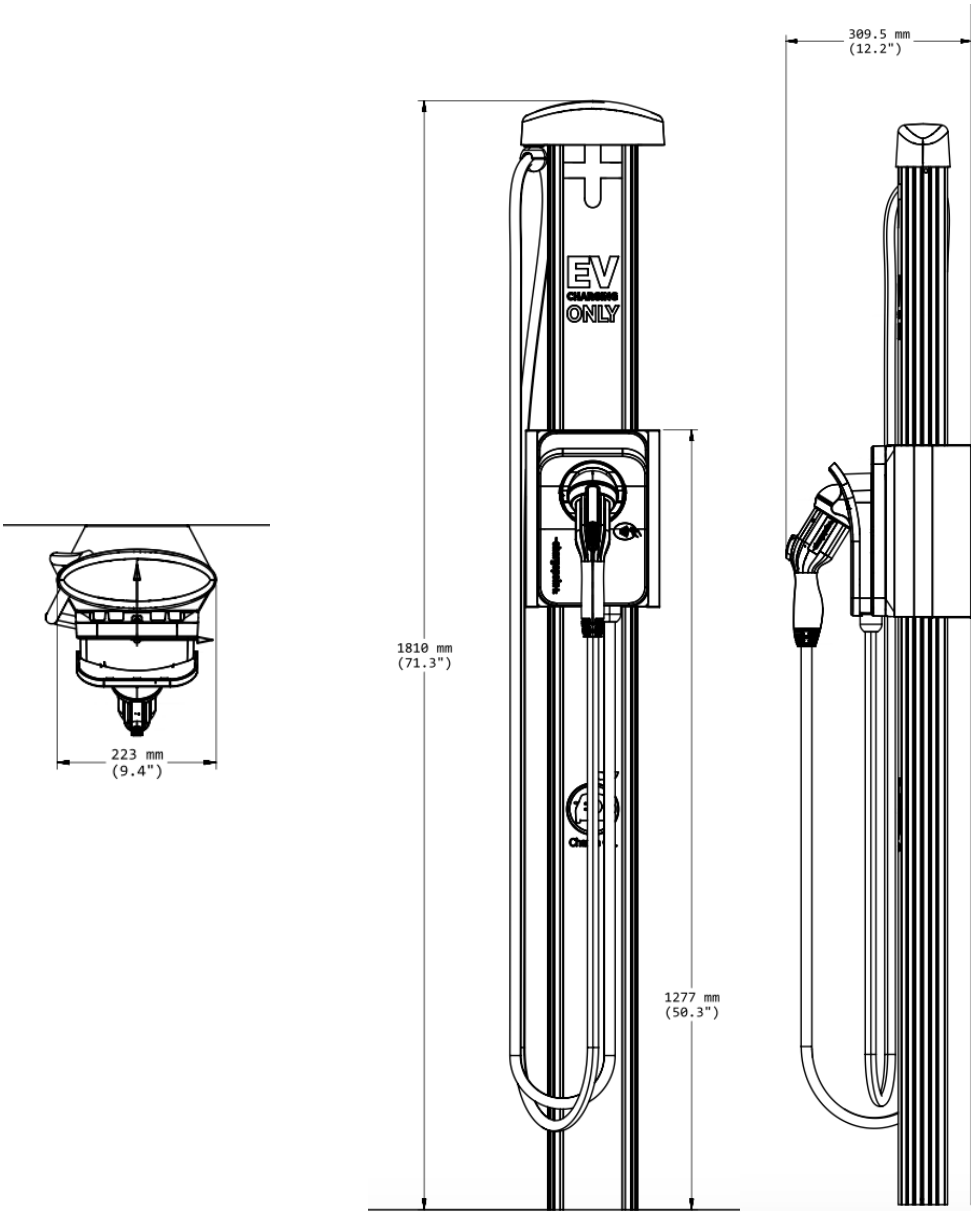
Recommended Companion Products for Multifamily Applications

Description	Order Code
ChargePoint Installation and Site Validation	CPF-INSTALLVALID or CPF-SITEVALID

Architectural Drawings (Dimensions)

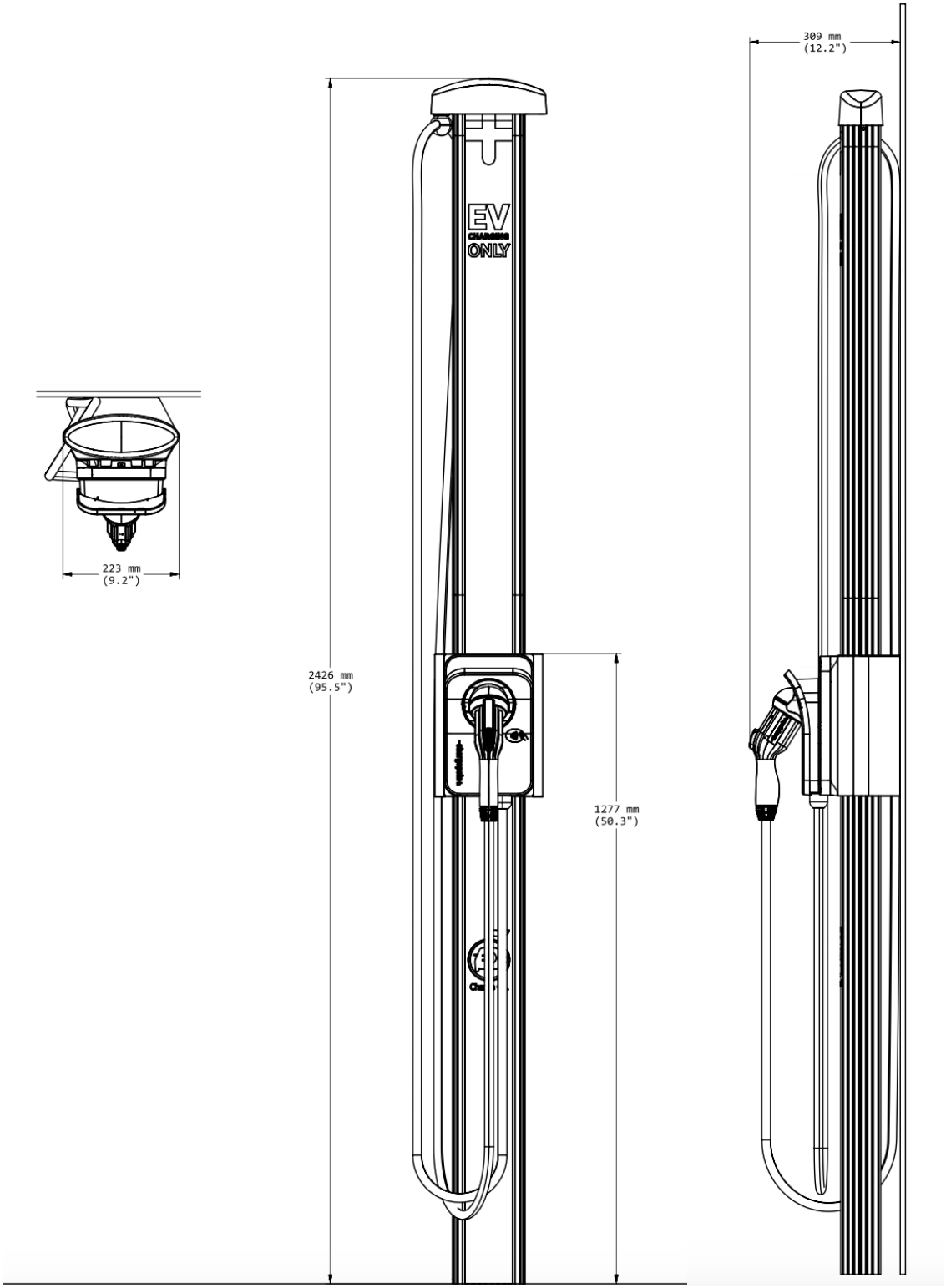
Single Wall Mount with Cable Management Kit

CPF50-L18-WALLMNT-CMK6ft (6 ft)



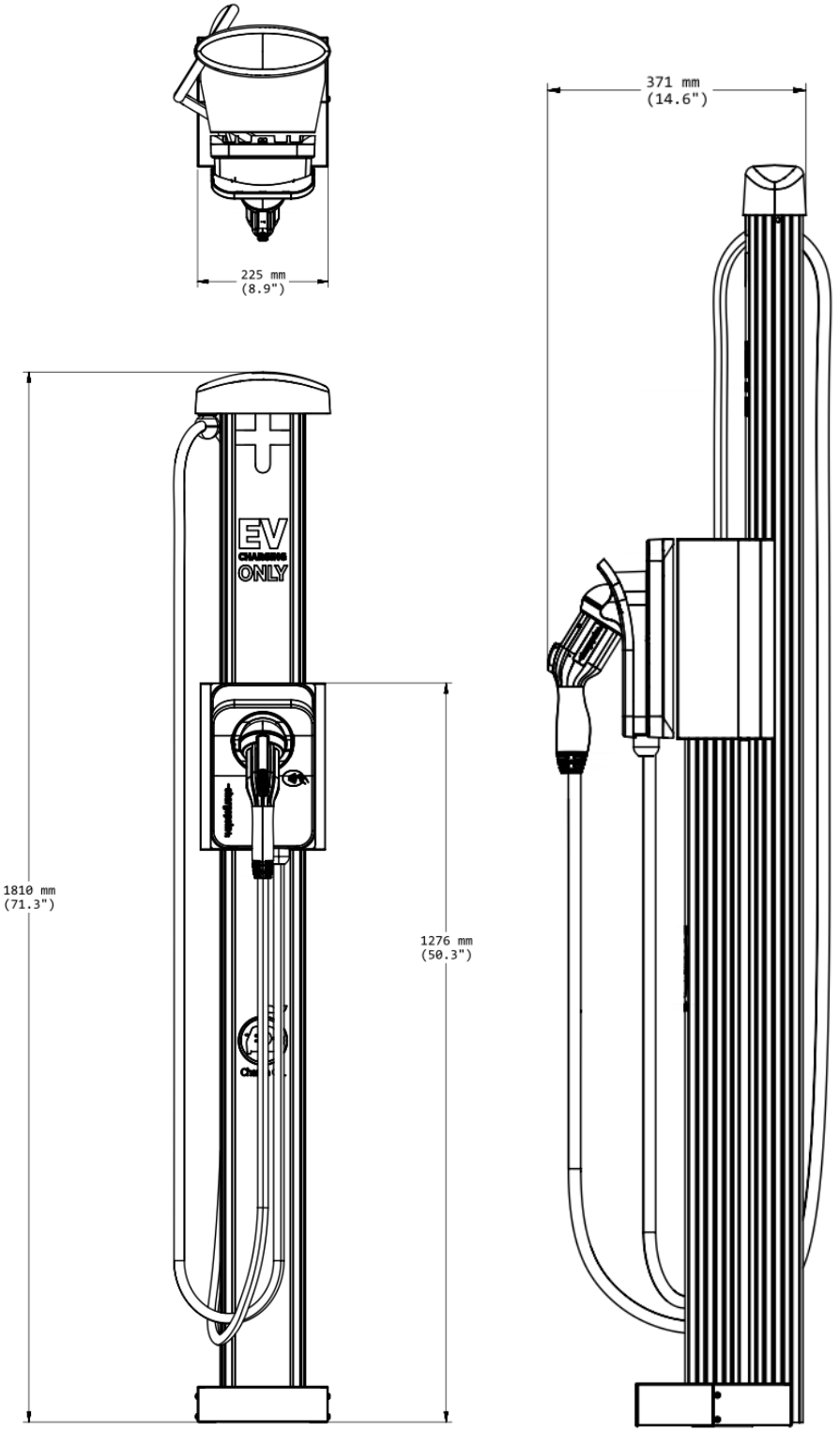
Single Wall Mount with Cable Management Kit

CPF50-L23-WALLMNT-CMK8ft (8 ft)



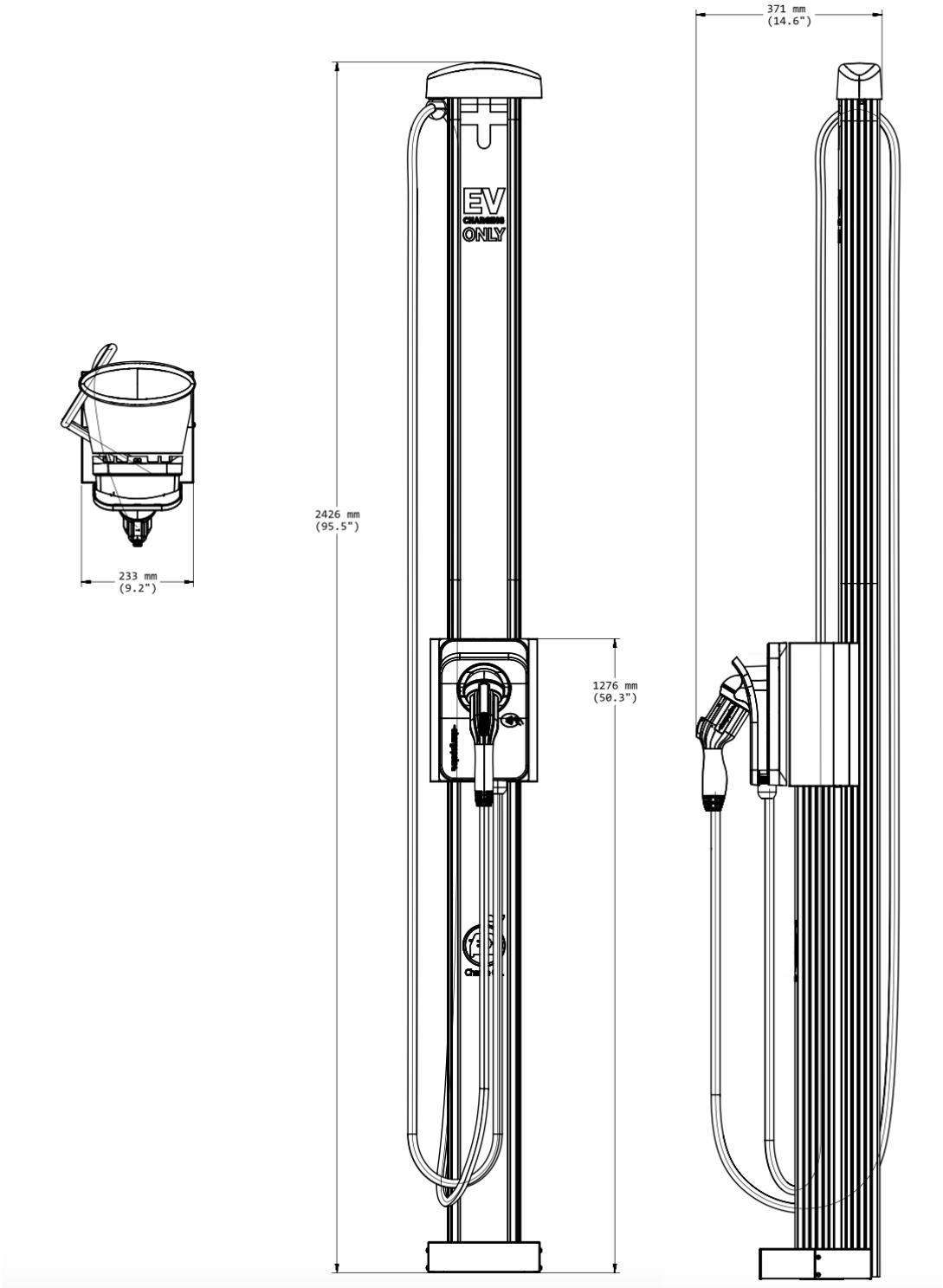
Single Pedestal Mount with Cable Management Kit

CPF50-L18-PEDMNT-CMK6 (6 ft)



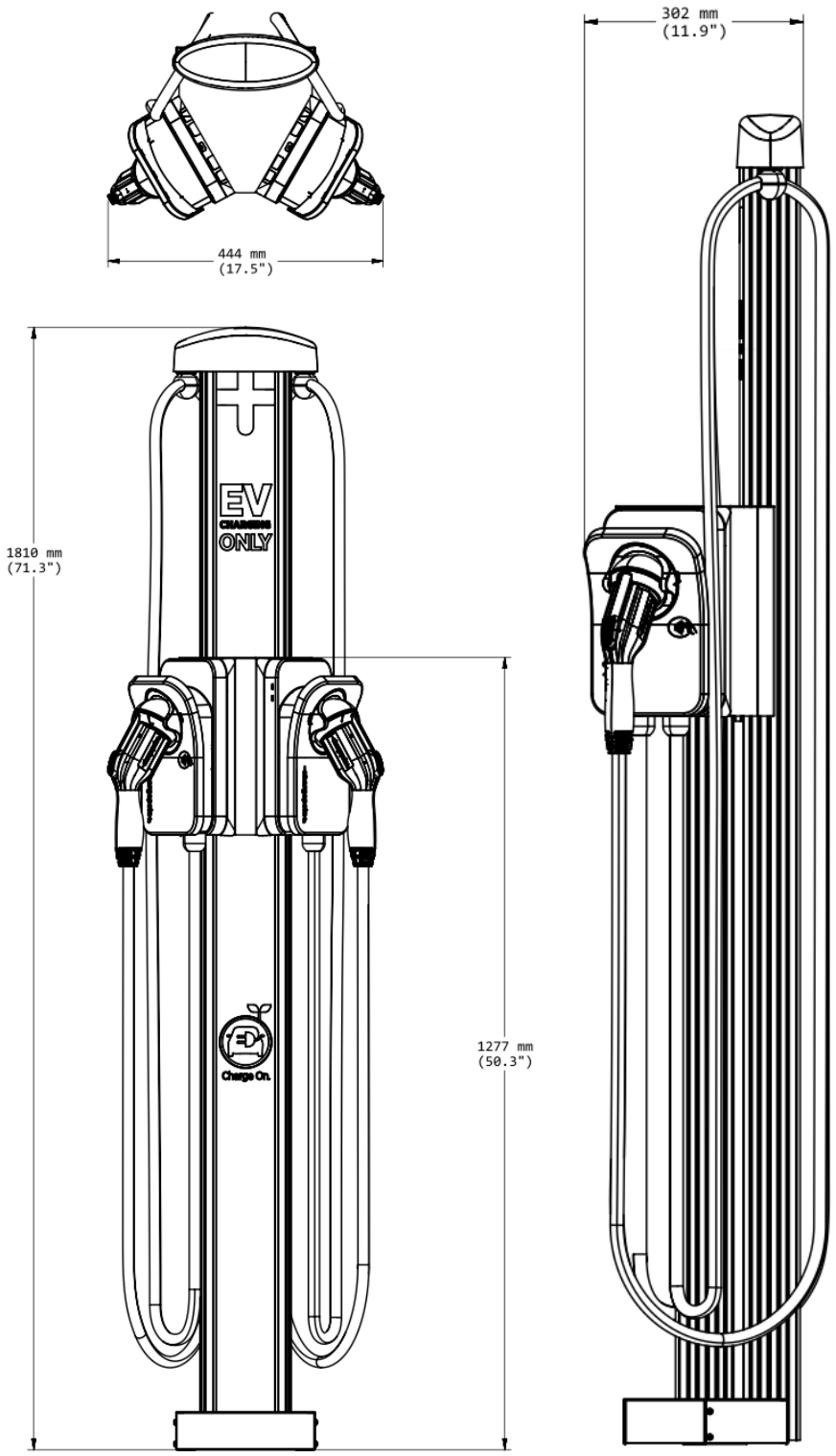
Single Pedestal Mount with Cable Management Kit

CPF50-L23-PEDMNT-CMK8 (8 ft)



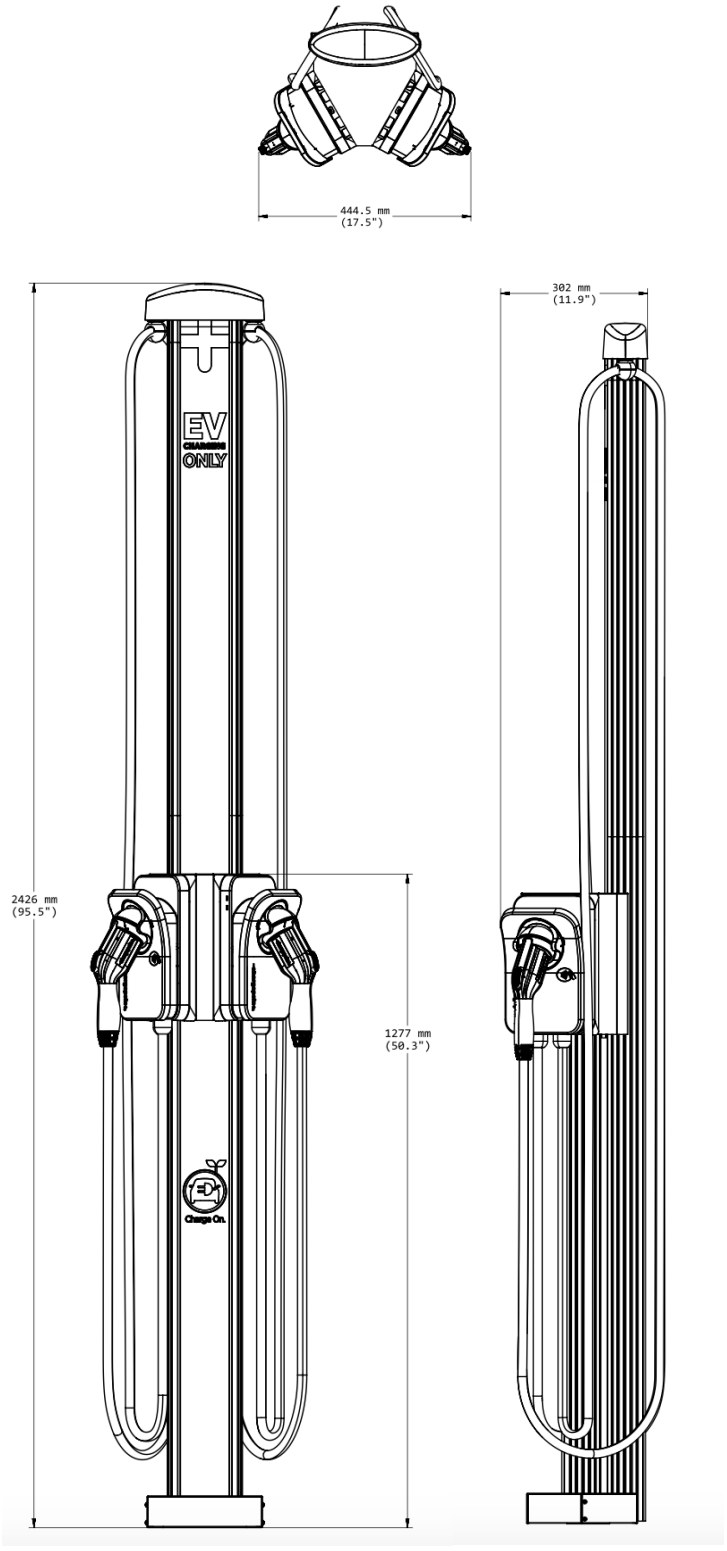
Dual Pedestal Mount with Cable Management Kit

CPF50-L18-PEDMNT-CMK6-Dual (6 ft)



Dual Pedestal Mount with Cable Management Kit

CPF50-L23-PEDMNT-CMK8-Dual (8 ft)



General Specifications

Electrical Input

CPF50 supports flexible current settings up to 50A to fit your needs.

Power Select allows CPF50 stations to be installed and software-configured for current input/output lower than the maximum 50A rating depending on your electrical and charging requirements. CPF50 Power Select current input/output options include 16A, 24A, 32A, 40A, and 48A.

Power Share allows two stations to share power from a single circuit dynamically across the stations, adjusting each station's power output depending on whether one or both are actively charging. Standard wiring uses an independent circuit for each station. Power Share can be used in combination with Power Select.

Electrical Input	One Station (AC Voltage 208 / 240V AC)			Two Stations (AC Voltage 208 / 240V AC)		
	Input Current	Input Power Connection	Required Service Panel Breaker	Input Current	Input Power Connection	Required Service Panel Breaker
Maximum 50A (Standard)	50A	One 70A/80A branch circuit	70A/80A dual pole (non-GFCI)	50A x 2	Two independent 70A/80A branch circuits	70A/80A dual pole (non GFCI) x 2
Maximum 50A (Power Share)	N/A	N/A	N/A	50A	One 70A/80A branch circuit split to two	70A/80A dual pole (non GFCI)
Power Select 16A - 48A (Standard)	16A - 48A	One branch circuit rated 125% of input current (20A - 60A)	Dual pole (non-GFCI) rated 125% of input current (20A-60A)	16A - 48A x 2	Two independent branch circuits rated 125% of input current (20A - 60A)	Dual pole (non-GFCI) rated 125% of input current x 2
Power Select 16A - 48A (Power Share)	N/A	N/A	N/A	16A - 48A	One branch circuit rated 125% of input current (20A to 60A) split to two	Dual pole (non-GFCI) rated 125% of input current (20A- 60A)

Service Panel/Breaker GFCI	Do not provide external GFCI as it may conflict with internal GFCI (CCID)	
Wiring – Standard	3-wire (L1, L2, Earth) No neutral	3-wire (L1, L2, Earth) x 2 No neutral
Wiring – Power Share	N/A	3-wire (L1, L2, Earth) split to 3-wire (L1, L2, Earth) x 2
Station Power	2.5W typical (standby), 4W maximum (operation)	5W typical (standby), 8W maximum (operation)
Line to Ground Voltage	120V +/- 10%	

Electrical Output

Electrical Output	Single Port (AC Voltage 208 / 240V AC)	Dual Port (AC Voltage 208 / 240V AC)
Maximum 50A (Standard)	12 kW (240V AC @ 50A)	12 kW (240V AC @ 50A)
Maximum 50A (Power Share)	N/A	12 kW (240V AC @ 50A) x 1 or 6 kW (240V AC @ 25A) x 2
Power Select 16A - 48A (Standard)	3.8 kW – 11.5 kW (240V AC @ 16A - 48A)	3.8 kW – 11.5 kW (240V AC @ 16A - 48A) x 2
Power Select 16A - 48A (Power Share)	N/A	3.8 kW – 11.5 kW (240V AC @ 16A - 48A) x 1 or 1.9 kW – 5.8 kW (240V AC @ 8A - 24A) x 2

Functional Interfaces

Connector Types	SAE J1772™
Cable Length – 1.8 m (6’) Cable Management	5.4 m (18’)

Cable Length – 2.4 m (8') Cable Management	7.0 m (23')
Overhead Cable Management System	Yes
Card Reader	ISO 15693 and ISO 14443

Indicators

WiFi LED	Yes
Fault Indicator per UL	Yes
Status LED	Yes

Safety and Connectivity Features

Ground Fault Detection	20mA CCID with auto retry
Open Safety Ground Detection	Continuously monitors presence of safety (green wire) ground connection
Plug-Out Detection	Power terminated per SAE J1772™ specifications
Power Measurement Accuracy	+/- 2% from 2% to full scale (50A)
Power Report/Store Interval	15 minute, aligned to hour
Local Area Network	2.4/5 GHz Wi-Fi (802.11 a/b/g/n)
Wide Area Network	4G LTE provided by the ChargePoint Gateway CPGWx

Safety and Operational Ratings

Station Enclosure Rating	Type 3R per UL 50E
Safety and Compliance	UL and C-UL listed; complies with UL2594, UL2231-1, UL 2231-2. NEC Article 625 compliant. For Canada CSA C22.2, No. 280, 281.1, 281.2, CED UL and C-UL listed per UL916 Energy Management Equipment

Station Surge Protection	6 kV @ 3000A. In geographic areas subject to frequent thunder storms, supplemental surge protection at the service panel is recommended
EMC Compliance	FCC Part 15 Class B
Storage Temperature	-40ºC to +60ºC (-40ºF to 140ºF)
Operating Temperature	-40ºC to +50ºC (-40ºF to 122ºF)
Operating Humidity	Up to 95% @+50ºC (122ºF) non-condensing
Non-Operating Humidity	Up to 95% @+50ºC (122ºF) non-condensing
Maximum Charging Stations per 802.11 Radio Group	9 maximum. Each station must be located within 46 m (150') "line of sight" of a CPGW gateway

ChargePoint, Inc. reserves the right to alter product offerings and specifications at any time without notice, and is not responsible for typographical or graphical errors that may appear in this document

ChargePoint, Inc.
240 East Hacienda Avenue
Campbell, CA 95008-6617 USA

Contact Us

Visit chargepoint.com

Call +1.408.370.3802 or +1.877.370.3802
US and Canada toll-free

Email sales@chargepoint.com

ENERGY STAR certified. Listed by Underwriters Laboratories Inc.

ChargePoint ® CP6000 Series — Fleet

Specifications and Ordering Information

Dual port, pedestal mount, 23 ft cable

Ordering Information

The order codes below represent specific product configurations. Please contact ChargePoint Sales for additional information.

Specify model number followed by the applicable code(s).

The order code sequence is: **Model-Options. Software, Services** and **Other** are ordered as separate line items.

Hardware

Description		Order Code
Model	80A Dual port, pedestal mount, 23 ft cable	CP6021X-80A-L7
	80A Single port, pedestal mount, 23 ft cable	CP6011X-80A-L7
	80A Dual port, wall mount, 23 ft cable	CP6023X-80A-L7
	80A Single port, wall mount, 23 ft cable	CP6013X-80A-L7
Other	Bollard Concrete Mounting Kit	CP6K-CMT-NA

Software and Services

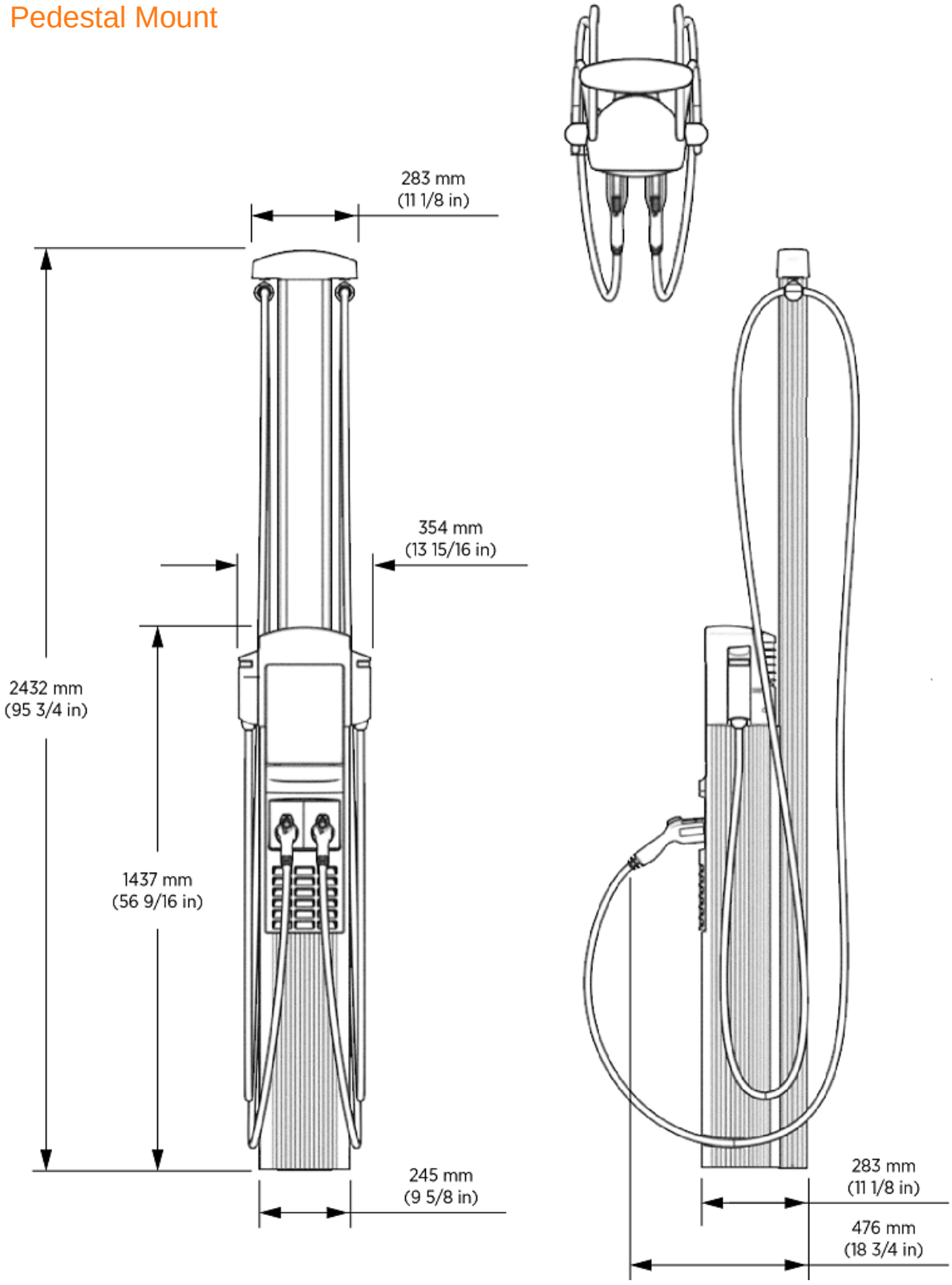
Description	Order Code
ChargePoint Power Plan	CPCLD-POWER-*n**
ChargePoint Enterprise Plan	CPCLD-FLEETENT-*n**
ChargePoint Fleet Commercial	CPCLD-FLEETCOMM-*n**
ChargePoint Assure	CP6000-ASSURE-n*
Station Activation and Configuration	CPSUPPORT-ACTIVE
ChargePoint Site Validation	CPSUPPORT-SITEVALID
ChargePoint Installation and Validation	CP6000-INSTALLVALID

Note: All CP6000 stations require a network service plan per port.

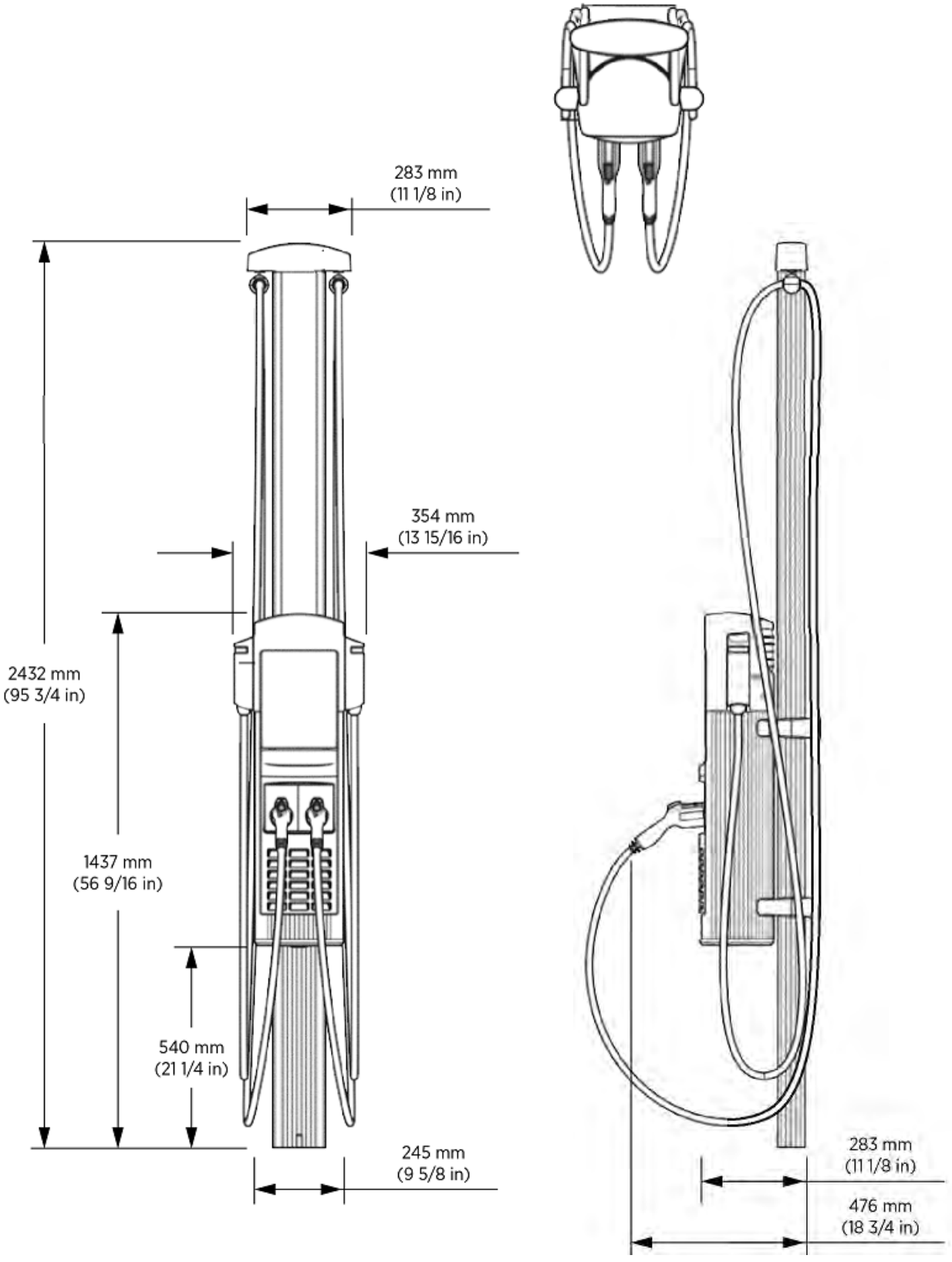
*Substitute *n* for desired years (1, 2, 3, 4 or 5 years)

Architectural Drawings and Dimensions

Pedestal Mount



Wall Mount


283 mm
(11 1/8 in)
354 mm
(13 15/16 in)
2432 mm
(95 3/4 in)
1437 mm
(56 9/16 in)
540 mm
(21 1/4 in)
245 mm
(9 5/8 in)
283 mm
(11 1/8 in)
476 mm
(18 3/4 in)

General Specifications

Electrical Input

The CP6000 supports flexible wiring and power settings up to 80A. Power Select allows stations to be installed and configured for current lower than the maximum 80A. Power Select current options include 40A, 48A, 56A, and 64A.

Power Share allows a dual-port station to share power from a single circuit across two ports, adjusting power depending on whether one or both are charging. Standard wiring uses an independent circuit for each port. Power Share can be used in combination with Power Select.

Electrical Input	Single Port (AC Voltage 208 / 240V AC)			Dual Port (AC Voltage 208 / 240V AC)		
	Input Current	Input Power Connection	Required Service Panel Breaker	Input Current	Input Power Connection	Required Service Panel Breaker
Maximum 80A (Standard)	80A	One 100A branch circuit	100A dual pole (non-GFCI)	80A x 2	Two independent 100A branch circuits	100A dual pole (non GFCI) x 2
Maximum 80A (Power Share*)	N/A	N/A	N/A	80A	One 100A branch circuit	100A dual pole (non GFCI)
Power Select** 40A - 64A (Standard)	40A - 64A	One branch circuit rated 125% of input current (50A - 80A)	Dual pole (non-GFCI) rated 125% of input current (50A-80A)	40A - 64A x 2	Two independent branch circuits rated 125% of input current (50A - 80A)	Dual pole (non-GFCI) rated 125% of input current x 2
Power Select 40A - 64A (Power Share)	N/A	N/A	N/A	40A - 64A	One branch circuit rated 125% of input current (50A - 80A)	Dual pole (non-GFCI) rated 125% of input current (50A - 80A)
Service Panel/Breaker GFCI	Do not provide external GFCI as it may conflict with internal GFCI (CCID)					
Wiring – Standard	3-wire (L1, L2, Earth) No neutral			5-wire (L1, L1, L2, L2, Earth)		
Wiring – Power Share	N/A			3-wire (L1, L2, Earth)		
Line to Ground Voltage	120V +/- 10%					

Electrical Output

Electrical Output	Single Port (AC Voltage 208 / 240V AC)	Dual Port (AC Voltage 208 / 240V AC)
Maximum 80A (Standard)	19.2 kW (240V AC @ 80A)	19.2 kW (240V AC @ 80A)
Maximum 80A (Power Share)	N/A	19.2 kW (240V AC @ 80A) x 1 or 9.6 kW (240V AC @ 40A) x 2
Power Select 40A - 64A (Standard)	9.6 kW – 15.4 kW (240V AC @ 40A - 64A)	9.6 kW - 15.4 kW (240V AC @ 40A - 64A) x 2
Power Select 40A - 64A (Power Share)	N/A	9.6 kW - 15.4 kW (240V AC @ 40A - 64A) x 1 or 4.8 kW – 7.7 kW (240V AC @ 20A - 32A) x 2

Mounting and Functional Interfaces

Connector Type	SAE J1772™
Number of Ports	Single, dual
Mounting	Pedestal, wall
Cable Length	23 ft (7 m)
Cable Management	Yes
Authentication	RFID: ISO 15693, ISO 14443, NEMA EVSE 1.2-2015 (UR) NFC (Tap to Charge) Remote: mobile and in vehicle (if supported by vehicle)
Locking Holster	Yes
ISO 15118	Supported by hardware

Safety and Connectivity Features

Ground Fault Detection	20 mA CCID with auto retry
Open Safety Ground Detection	Continuously monitors presence of safety (green wire) ground connection
Plug-Out Detection	Power terminated per SAE J1772™ specifications

Power Measurement Accuracy	+/- 2% from 2% to full scale
Power Report/Store Interval	15-minute interval aligned to hour. Responsive to load management signals.
Local Area Network	Wi-Fi 2.4 GHz and 5GHz (802.11 a/n/b/g)
Wide Area Network	LTE Category 4
Network Communication Protocol	OCPP 2.0.1
Ethernet connection	Capable with accessory

Safety and Operational Ratings

Station Enclosure Rating	Type 3R
Station Surge Protection	6 kV @ 3,000A. In geographic areas subject to frequent thunderstorms, supplemental surge protection at the service panel is recommended.
EMC Compliance	FCC Part 15 Class B
Operating Temperature	-40°C to 50°C (-40°F to 122°F)
Non-Operating Temperature	-40°C to 60°C (-40°F to 140°F)
Terminal Block Temperature Rating	105°C (221°F)
Operating Humidity	Up to 85% @ 50°C (122°F) non-condensing
Non-Operating Humidity	Up to 95% @ 50°C (122°F) non-condensing

ChargePoint, Inc.
240 East Hacienda Avenue
Campbell, CA 95008-6617 USA

Contact Us

Visit chargepoint.com

Express 250

Specifications and Ordering Information

High Power in a Small Footprint

Ordering Information

The order codes below represent specific product configurations. Other product options are available. Please contact ChargePoint Sales for information and order codes.

Hardware

Description		Order Code
Model	Express 250 Station includes 2x Power Modules, 1x CCS1 cable, 1x CHAdeMO cable (NA)	CPE250C-625-CCS1-CHD
	Express 250 Station includes 2x Power Modules, 1x CCS2 cable, 1x CHAdeMO cable (EU)	CPE250C-625-CCS2-CHD
Connector Options	Cable connectors available include CCS1, CCS2, and/or CHAdeMO. Cables can be ordered with a single connector or a combination.	Please contact ChargePoint Sales
Buy America	The Express 250 is compliant with the Federal Transportation Authority (FTA) and Federal Highway Administration (FHWA) Buy America Options.	Please contact ChargePoint Sales

Software & Services

Description	Order Code
ChargePoint Enterprise Cloud Plan *Note: Station activation is included in this plan.*	CPCLD-ENTERPRISE-DC-n*
ChargePoint Assure® — Prepaid Assure Plan for one Express 250 station. Includes Parts and Labor Warranty, Remote Technical Support, On-Site Repairs when needed, Unlimited Configuration Changes, and Reporting.	CPE250-ASSURE-n*
ChargePoint Assure® — Assure Plan for one Express 250 and invoiced annually. Includes Parts and Labor Warranty, Remote Technical Support, On-Site Repairs when needed, Unlimited Configuration Changes, and Reporting.	CPE250-ASSURE-n-COMMIT*

Commissioning Service: includes on-site validation and inspection of electrical, mechanical, installation, wiring and civil parameters for the Express 250 station.	CPE250-COMMISSIONING
Commissioning Service: includes both the installation and commissioning of the Express 250 station.	CPE250-INSTALL-COMMISSIONING

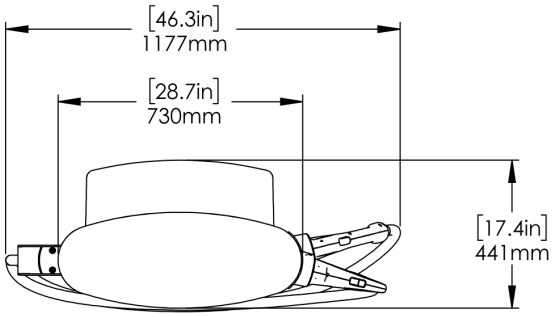
Note: All Express 250 stations require a cloud plan.

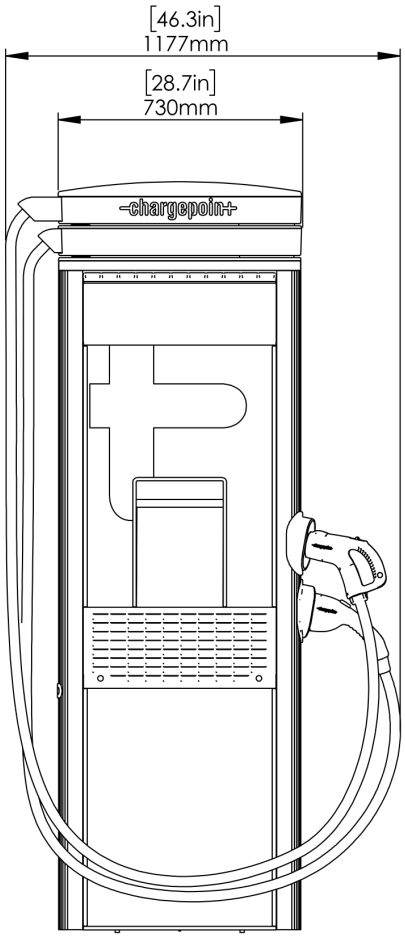
*Substitute *n* for desired years of service (1, 2, 3, 4 or 5 years).

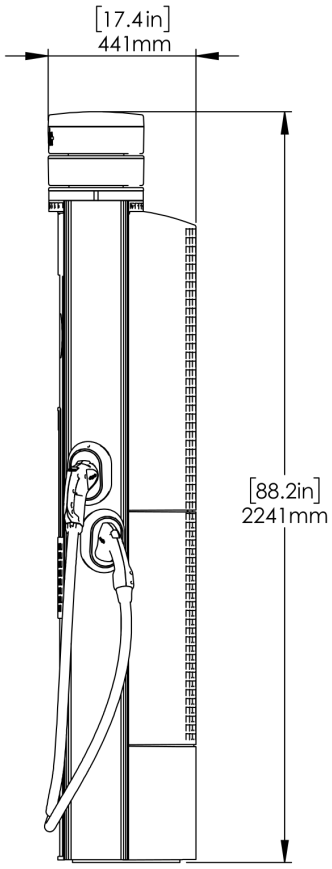
Order Code Information

If ordering this…	…the order code is
Express 250 Station includes 2x Power Modules, 1x CCS1 cable, 1x CHAdeMO cable (NA)	CPE250C-625-CCS1-CHD

Architectural Drawings (Dimensions)







General Specifications

Station Electrical Input

Input Rating	400V AC, 3-phase, 96A, 50 Hz 480Y/277V AC, 3-phase, 80A, 60 Hz
Wiring	L1, L2, L3, Neutral & Earth

Station Electrical Output

Max Output Power	62.5 kW
Output Voltage, Charging	200–1,000V DC
Max Output Current	156A
Max Modules per Station	2

Paired Station Electrical Output

Paired Max Output Power	125 kW
Paired Max Output Current	CCS1: 174A or 200A CCS2: 200A CHAdeMO; US: 140A, EU: 125A

Power Module

Max Output Power	31.25 kW
Max Output Current	78 A
Power Conversion Efficiency	> 95%
Power Factor	0.99 at full load
Harmonics	iTHD < 5% (Complies with IEEE 519 Requirements)
Power Module Cooling	Liquid Cooling Technology

Functional Interfaces

Max Connector Types per Station	Up to two different connector types per station
Supported Connector Types	CHAdeMO, CCS1 (SAE J1772™ Combo), CCS2 (IEC 61851-23)
Cable Length with Swing Arm*	Full Horizontal Reach: 4.27m (14’)
LCD Display	Full-color 254 mm (10 in) display for driver interaction
Top Display	Full-color 508 mm (20 in) LED display for notifications
Authentication	RFID: ISO 15693, ISO 14443, NEMA EVSE 1.2-2015 (UR) Tap to Charge (NFC on Apple & Android): 15118-2 (EIM) Remote: Mobile and in vehicle (if supported by vehicle)

*Horizontal reach to typical vehicle charging port: 3.76 (12’4”)

Connectivity Features

Vehicle Safety Communication	CHAdeMO – JEVS G104 over CAN, CCS1 – SAE J1772 over PLC and CCS2 — IEC 61851-23
Plug-Out Detection	Power terminated per JEVS G104 (CHAdeMO), SAE J2931 (CCS1) and IEC 61851-23 (CCS2)
Local Area Network	2.4 GHz and 5 GHz WiFi (802.11 b/g/n)
Wide Area Network	4G LTE (fall back to 3G GSM)
Supported Communication Protocols	OCPP
Service and Maintenance	Remote system monitoring, diagnostic, and proactive maintenance

Safety and Operational Ratings

Station Enclosure Rating	Type 3R, IP54
Station Impact Rating	IK10
Safety and Compliance	UL and cUL listed: complies with UL 2202, UL 2231-1, UL 2231-2, CSA 107.1 CE marking: complies with IEC 62196, IEC 61851

Station Surge Protection	Tested to IEC 6100-4-5, Level 5 (6 kV @ 3,000A). In geographic areas subject to frequent thunder storms, supplemental surge protection at the service panel is recommended.
EMC Compliance	U.S.: FCC part 15 Class A; EU: EN55011, EN55022 and IEC61000-4
Storage Temperature	-40°C to 50°C (-40°F to 122°F)
Operating Temperature	-40°C to 50°C (-40°F to 122°F)
Operational Altitude	<3,000 m (<9,800 ft)
Operating Humidity	Up to 95% @ 50°C (122°F) non-condensing

Generic Specifications

Station Enclosure Dimensions	2,241 mm H x 730 mm W x 441 mm D (7'4" x 2'5" x 1'5")
Power Module Dimensions	760 mm H x 430 mm W x 130 mm D (2'6" x 1'5" x 5")
Station Weight (without Power Modules)	250 kg (551 lb)
Power Module Weight	45 kg (98.5 lb)

Energy Management Features

Dynamic Power Management	Allows a fixed maximum power output per station or lets the system dynamically manage the power distribution per station
Remote Energy Management	Manage output power via the ChargePoint Admin Portal, API, and Open ADR 2.0b VEN

ChargePoint, Inc.
240 East Hacienda Avenue
Campbell, CA 95008-6617 USA

+1.408.841.4500 or
+1.877.370.3802 US and Canada toll-free

chargepoint.com

Contact Us

Visit chargepoint.com

Call +1.408.705.1992

Email sales@chargepoint.com

* Listed by Underwriters Laboratories Inc.

TESLA

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CONSULTING ENGINEERS

Support

Wall Connector

Tesla Wall Connector is an efficient and convenient home charging solution that lets you plug your vehicle in overnight and start your day charged. To purchase a Wall Connector, visit the Tesla online store.

Wall Connector Features

Speed

Wall Connector is compatible with Model S, Model 3, Model X and Model Y and is capable of providing up to 44 miles of range per hour of charge, with up to 11.5 kW / 48 amp output, depending on model.

Convenience

Wall Connector can adapt to most home electrical systems, with customizable power levels on a range of circuit breakers. This versatility allows installation in most homes, apartments, condos and workplaces. The lightweight 24-foot (7.3 meter) cable allows the Mobile Connector to be left in the car.

Connectivity

Connecting the Wall Connector to a local Wi-Fi network enables it to receive over-the-air firmware updates, remote diagnostics access and usage data tracking capability. Firmware updates will be automatically sent to the Wall Connector to improve the user experience and introduce new features.

Power Sharing

Power sharing is ideal for households that need to charge more than one Tesla at the same time, but may not have enough power for multiple electrical circuits. This functionality allows up to six Wall Connectors to share power from one circuit while still allowing your vehicles to receive a sufficient charge.

Access Control

Charging Access Control gives you full control over which cars are allowed to charge with your Wall Connector. You can restrict charging access directly through the commissioning wizard without having to resort to a physical locking device.

Indoor/Outdoor Compatible

Wall Connector's lightweight design allows for versatile, indoor or outdoor mounting.

Order Now

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Vehicle Charging Speeds

For the fastest home charging, install Wall Connector with a circuit breaker that matches your vehicle's onboard charger capabilities. To view the max amperage of your Tesla, tap the lightning bolt icon on the touchscreen.

For unique power situations or when power may be limited, Wall Connector can also be installed with lower amperage circuit breakers to support almost any existing electrical system.

Please refer to the table below for charging speeds for each power level option.

Wall Connector Technical details			**Charge Speed** Max miles of range per hour of charge*			
Circuit breaker (amps)	Maximum output (amps)	Power at 240 volts (kilowatt)	Model S (mph)	Model 3† (mph)	Model X (mph)	Model Y (mph)
60	48	11.5 kW	41	44	35	44
50	40	9.6 kW	34	37	29	37
40	32	7.7 kW	27	30	23	30
30	24	5.7 kW	21	22	17	22
20	16	3.8 kW	14	15	12	15
15	12	2.8 kW	10	11	9	11

**All charge speeds are approximate.*
†Maximum charge rate for Model 3 Rear-Wheel Drive is 32A (7.7kW) - up to 30 miles of range per hour.

Installation Walkthrough

Process

We recommend installing your Wall Connector prior to taking delivery of your vehicle. Most installations will take a few hours, but finding and scheduling an electrician can take up to two weeks.

Follow these steps to successfully install a Wall Connector in your home:

1. Find an Electrician
   Enter your zip code in the Find an Electrician tool to locate an installer in your area.
2. Request a Quote
   We recommend installing the Wall Connector on a 60 amp circuit in the parking space closest to your existing electrical infrastructure. Many electricians now offer quotes online and by email, making it easy to obtain multiple quotes.
3. Order Your Wall Connector
   Once you have a quote from an electrician, order your Wall Connector online.
4. Schedule Your Installation
   Forward the Wall Connector Order Shipment Confirmation email to your electrician and schedule your installation date directly.

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Cost

Installation pricing can vary depending on your electrical system.

A straightforward installation can range from $750 - $1,500. However, if there are additional items needed to complete your installation, the price will be adjusted accordingly.

Typically included:

- Professional installation service and materials
- Permit
- Inspection
- Installation warranty

Typically additional:

- Long wire run (distance from electrical panel to installation site)
- Additional sub panel
- Trench (underground wires)
- Main panel upgrade
- Pedestal installation
- Hiding cables behind walls

Installation Resources

Your electrician can visit the Wall Connector Support page for further information on how to install a Wall Connector.

Installation manuals and troubleshooting information for Tesla charging products can also be found on the Charging and Adapter Product Guides page.

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Support

Order Support

For questions about an existing Wall Connector order (tracking, cancelation or updates), reach out to OnlineOrders@tesla.com.

Post-Installation Support

If you are experiencing problems with a Wall Connector, contact the Customer Support team.

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Additional Resources

- Home Charging Installation
- Wall Connector FAQs
- Charging & Adapter Product Guides
- Gen 3 Wall Connector Power Sharing
- Gen 2 Wall Connector
- Installing a Wall Connector
- Commissioning Procedure

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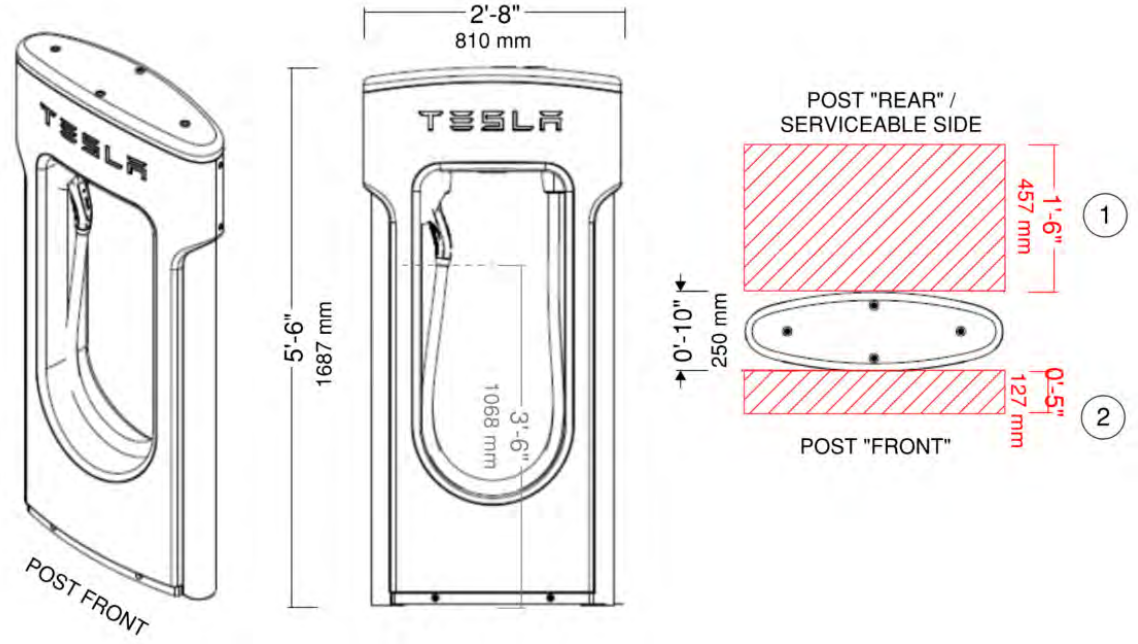
Tags: Owners

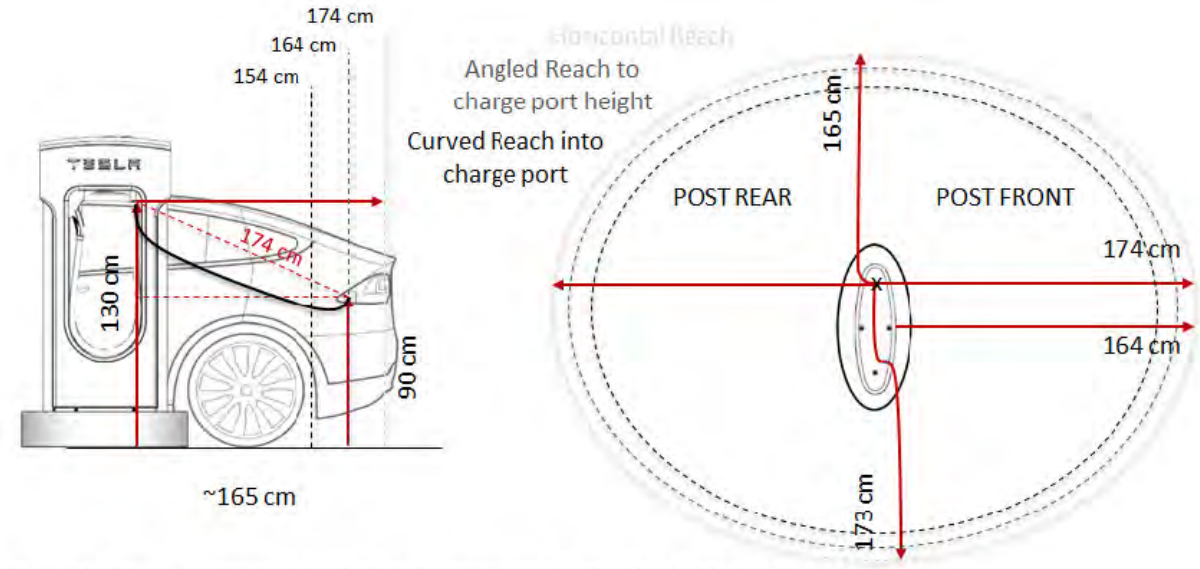
V3 Charge Post Clearances

Table 7. Charge Post Clearances

Diagram Label	Description	Metric (mm)	Imperial
1	Rear	457	1′-6″
2	Front	305	0′-5″



V3 North America Cable Reach



All values here are experimentally determined by measuring installed V3 posts and Model X dimensions

ABB

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PRODUCT DATA SHEET

ABB E-mobility
Terra DC Wallbox UL

The Terra DC Wallbox is a compact DC fast charger rated up to 24 kW, perfect for auto dealerships, retail parking lots, fleets, workplace facilities, and retail parking.

With its low-power, high-voltage architecture, the Terra DC Wallbox can be installed at sites with defined or limited available power service – while offering 920 VDC charging capability for every EV model.

Future-proof "Destination DC" charging
The Terra DC Wallbox is a compact 24 kW DC fast charger with one or two outlets supporting CCS and CHAdeMO protocols.

Operating the Terra DC Wallbox is easy thanks to a full color, daylight readable touchscreen display. This includes starting and stopping of charge sessions, progress indication during charging, help menus, language selection, and PIN code access control.

As connectivity is the key to successful EV charging installations, the Terra DC Wallbox features ABB Ability Connected Services to enable authentication, payment, monitoring, remote diagnostics and repair, as well as over-the-air updates and upgrades.

Applications
- Commercial, retail parking
- Automotive dealers
- Right-of-way parking
- Office, workplace, campus
- Delivery fleets
- High voltage battery EV fleets
- Sites with sensitive load concerns

Benefits of low power DC solutions
Low power DC is an ideal solution for use cases demanding shorter charging times and higher charging asset utilization than can be provided by AC charging solutions. With a 24 kW compact DC solution, charging needs can be met in balance with load demands and infrastructure costs.

In AC charging solutions, the EV's onboard converter is usually the limiting factor on the charging power that can be supplied to the car. With typical onboard ratings ranging from 3 kW to 11 kW, any additional power the AC charger could provide is left unused. With the Terra DC Wallbox, 24 kW peak DC power is provided directly to the battery, bypassing the limitations of an EV's onboard converter.

High voltage charging capabilities
As electric vehicles and their use cases grow, high voltage DC charging has become more important to increase charging power while ensuring the highest safety, usability and utilization from charging assets. The Terra DC Wallbox can meet EV battery capabilities up to 920 VDC to enhance power output across a wider range of today's and tomorrow's EVs, including both passenger and fleet vehicles.

Main features

- Future-proof DC output voltage range from 150 to 920 VDC supporting EVs today and in the future
- Enables CCS1 only or CCS1 and CHAdeMO
- Daylight readable 7” full color touchscreen display
- Future proof connectivity:
  - OCPP 1.6 and Smart Charging Profiles
  - Capability for remote services and updates
- Compact design
- Robust all-weather enclosure for indoor and outdoor use
- RFID reader
- ENERGY STAR® Certified

Key optional features

- On-screen PIN code authorization
- Input current limiting software to match site requirements
- Web tools for statistics, configuration, access management, remote diagnostics and repair
- Integration with back offices and payment platforms
- Customized branding possibilities
- Pedestal mounted option available

Configurations

The Terra DC Wallbox is available in the following configurations:

- Single outlet CCS1
- Dual outlet CCS1 + CHAdeMO
- Single-phase, 208-240 VAC
- Three-phase, 480 VAC

Specifications	
Electrical	
AC Input voltage range	(1) 208-240 VAC +/- 10% (60 Hz) (2) 480Y / 277 VAC +/- 10% (60 Hz)
AC input power connection	(1) 1-phase: L1, L2, GND (2) 3-phase: L1, L2, L3, N, GND
AC input current* and max power	(1) 100 A; 20.8-24 kVA (2) 32 A; 26.6 kVA 35 A; 26.6 kVA at 432 VAC (-10% dip) Current limiting options available
Recommended upstream circuit breaker	(1) 125 A (2) 50 A
Power Factor*	>0.96
Current THD*	IEEE 519 Compliant; 5%
DC output power	(1) 19.5 kW at 208 V (1) 22.5 kW at 240 V (2) 24 kW peak; 22.5 kW continuous
DC output voltage	CCS1: 150 - 920 VDC CHAdeMO: 150 - 500 VDC
DC output current	60 A
Efficiency*	94%
Interface and Control	
Charging protocols	CCS1-only and CCS1+CHAdeMO
User interface	7” full color touchscreen display
RFID system	ISO/IEC14443A/B, ISO/IEC15693, NFC reader mode, Mifare, Calypso
Network connection	GSM / 4G modem 10/100 Base-T Ethernet
Communication	OCPP 1.6 Core and Smart Charging Profiles; Autocharge via OCPP
Support languages	English (others available on request)
Environment	
Operating temperature	-35 °C to +45 °C (+45 °C to +55 °C with linear derating)
Recommended storage conditions	-10 °C to +70 °C / 14 °F to +158 °C (dry environment)
Protection	IP54, NEMA 3S; indoor and outdoor
Humidity	5% to 95%, non-condensing
Altitude	2500 m (8200 ft)
General	
Charge cable	7 m (23 ft)
Dimensions (H x W x D)	770 x 584 x 300 mm / 30.3 x 23 x 11.8 in
Weight	60kg / 132 lbs excluding backplate (10 kg / 22 lbs) and cables
ENERGY STAR Certification	Yes
Compliance and safety	UL 2202, CSA No. 107.1-16, NEC Article 625, EN 61851, EN 62196; CHAdeMO 1.2; DIN 70121, ISO 15118; IEC 61000-6-3, (2) EMC Class B

(1) Single phase configuration
(2) Three phase configuration

* Data shown at nominal output power

ABB E-mobility Inc.
950 W Elliott Road, Suite 101
Tempe, AZ 85284
United States
Phone: 800-435-7365
E-mail: US-evci@abb.com

ABB E-mobility Inc.
800 Hymus Boulevard
Saint-Laurent, QC H4S 0B5
Canada
Phone: 800-435-7365
E-mail: CA-evci@abb.com

e-mobility.abb.com

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