MEMORANDUM

DATE: December 6, 2022

TO: Marty Paulins
Director of Parking
University of Illinois

FROM: Gerald Salzman
Maria Berg

RE: University of Illinois Urbana-Champaign Electric Vehicle Charging Research

INTRODUCTION

The purpose of this memorandum is to summarize the results of a parking study conducted by DESMAN. The study was commissioned by the University of Illinois Urbana-Champaign (UIUC) to develop a policy for the installation of electric vehicle (EV) charging stations. The university anticipates an increased presence of electric vehicles among students, staff, and visitors, resulting in an increased demand for EV charging stations on campus. The demand, placement, technology, policy, and costs associated with EV charging have been identified by this study.

DESMAN is a national specialist in parking planning, design, and restoration. We offer a full range of services including Master Planning, Economic Feasibility Studies, Site/Size Selection Analysis, Cost Estimating, Parking Functional Design, Architectural Design, Structural Engineering, Revenue/Access Control System Design, Condition Survey/Due Diligence Studies, and Restoration Engineering. We have been in existence since 1973 and currently operate on a national basis out of nine principal offices. We have a total staff of more than 70 people, comprised mostly of Parking Planners, Architects, and Structural Engineers. We have been involved in the planning, design, and restoration of over 5,000 parking projects throughout the United States and abroad. We have a range of projects involving electric vehicles, with recent and past project experience at UIUC.

BACKGROUND

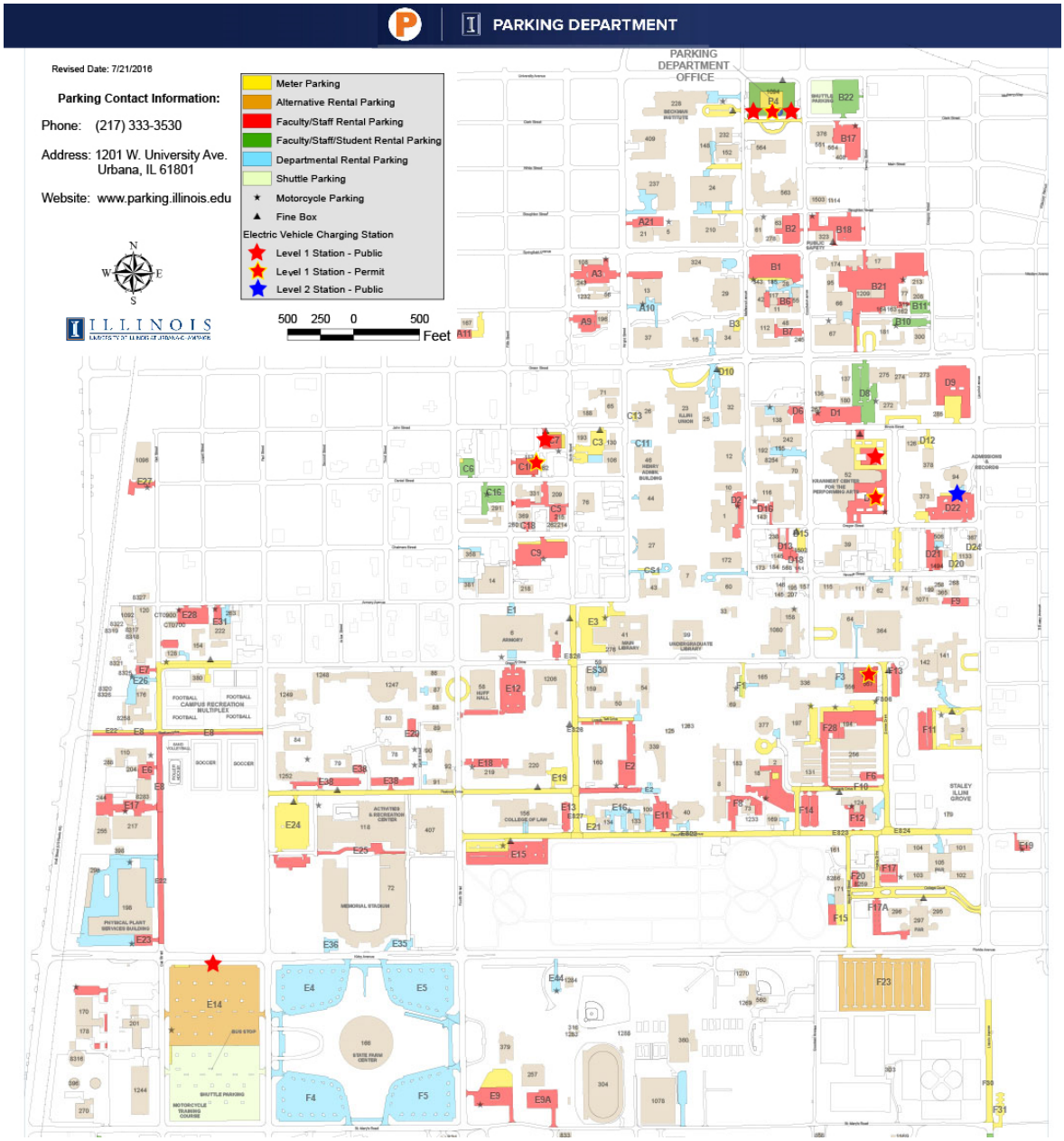
The UIUC campus is located in the twin cities of Urbana and Champaign, Illinois. The boundaries of the university district stretch approximately 2,295 acres. As a public land-grant university, there are over 40,000 students enrolled annually with a support staff of over 13,000 employees. The majority of academic classes are taught in-person on campus. Many employees continue to work in-person, or on a hybrid schedule, meaning that the five-day work week is split between in-person days and remote days.

The 2022-2023 academic year had 7,580 active employee parking permits—a decrease of about 800 permits from the previous year—as well as 1,876 active student parking permits. In addition, there are approximately 3,000 daily transient parkers on campus. We looked to national data and statistics to determine the current and future percentage of electric vehicle owners. In general, the National Parking

Association (NPA) estimates that 2.00% of the total number of vehicles in the U.S. are electric. That number is expected to grow considerably in the next thirty years.

With a growing number of electric vehicles, the UIUC Parking Department is committed to implementing EV charging stations on campus. The charging stations will be strategically placed to provide the campus community with sustainable driving options. This will further the university's commitment to sustainability, helping to meet the carbon emissions reduction goals for transportation established in the Illinois Climate Action Plan (iCAP). **Figure 1** identifies the locations of the existing EV charging supply on campus.

Figure 1: Existing UIUC EV Charging Locations



Source: UIUC Parking Division

DEMAND

The auto industry is transitioning to electric vehicles as consumer acceptance grows in the United States. With an increasing market share, the NPA estimates the percentage of EVs on the road to be 7.00% by 2030, 23.40% by 2040, and 42.20% by 2050.

State of Illinois Demand

According to the Alternative Fuels Data Center through the US Department of Energy website, the state of Illinois had 36,520 EV registrations in 2021—approximately 2.51% of the total EVs in the United States. The state's year-over-year growth was estimated to be 40.50%. This percentage is slightly below average in comparison to the rest of the country.

UIUC Campus Demand

We anticipate EV demand at the UIUC campus to remain consistent with the projections published by the NPA. Since students are seen as early adopters of renewable energy despite the upfront costs in purchasing EVs, we maintain that the distribution of EVs should be weighted equally among students, employees, and the general public.

Charging station demand at the UIUC campus is determined by the existing number of permit and transient parkers multiplied by the percentage of EV owners and percentage of EVs charging simultaneously. The number of permit and transient parkers remains constant year-to-year as there is no data or master plan to suggest an increase or decrease in parking demand. In the report published by the NPA, it is stated that no more than 25% of EVs need to be charged simultaneously at Level 2 power load for residential parking. Destination parking has an even lower need. Since the UIUC campus is a destination for the majority of EV owners, a factor of 20% is applied to the total number of EVs to project the charging station need. **Table 1** presents the 30-year EV demand and charging projections at UIUC using the principles stated above.

Table 1: UIUC EV Charging Demand

Parking	2020		2025		2030		2035		2040		2045		2050	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Student Permits	1,876	15.1%	1,876	15.1%	1,876	15.1%	1,876	15.1%	1,876	15.1%	1,876	15.1%	1,876	15.1%
Employee Permits	7,580	60.9%	7,580	60.9%	7,580	60.9%	7,580	60.9%	7,580	60.9%	7,580	60.9%	7,580	60.9%
Daily Parkers	3,000	24.1%	3,000	24.1%	3,000	24.1%	3,000	24.1%	3,000	24.1%	3,000	24.1%	3,000	24.1%
Total Parkers	12,456	100.0%	12,456	100.0%	12,456	100.0%	12,456	100.0%	12,456	100.0%	12,456	100.0%	12,456	100.0%
Absentee Reduction	1,891	20.0%	1,891	20.0%	1,891	20.0%	1,891	20.0%	1,891	20.0%	1,891	20.0%	1,891	20.0%
EV Parkers	211	2.0%	264	2.5%	740	7.0%	1,500	14.2%	2,472	23.4%	3,381	32.0%	4,458	42.2%
EV Charging Stalls	**42**	**0.3%**	**53**	**0.4%**	**148**	**1.2%**	**300**	**2.4%**	**494**	**4.0%**	**676**	**5.4%**	**892**	**7.2%**

Represents no change in values

Represents total charging stalls required on campus

Source: UIUC Parking Division, National Parking Association

As presented in Table 1, the current demand for EV charging requires 42 charging stalls. By 2025, the demand will rise to 53. The charging demand escalates at a greater rate in the following years as EV demand and acceptance becomes more prevalent. By 2050, 42.2% of all vehicles will be electric, requiring 892 charging stalls on the UIUC campus. The number of stalls varies from the number of charging stations,

since charging stations can cover two stalls at once. The total number of charging stations will depend on the specific design at each location. Table 1 uses the following assumptions:

- Student permit data is based on the 2022-2023 academic year
- Employee permit data is based on the 2022 fiscal year
- An absentee reduction of 20% is applied to permit holders, which assumes the percentage of permit holders that are absent from campus on a given day
- Daily parking data is gathered from Passport and adjusted for additional payment methods and vehicle turnover
- Number of student permits, employee permits, and daily parkers remain constant
- Percentage of vehicles that are electric is based on NPA projections
- Percentage of EVs requiring charging simultaneously is based on NPA data
- Charging stations are Level 2

It is important to note that the current demand of 42 charging stalls produced in the calculations may not reflect the actual demand on campus today. A variety of factors, such as hybrid work or the rural environment of Urbana-Champaign, are a few examples of what might be conflicting with the current day estimates. EV usage is difficult to predict as acceptance grows rapidly, but it is expected that the demand will be an accurate reflection by 2025.

TECHNOLOGY

Installation of EV charging technology involves a number of considerations in order to be effective and profitable. For review, an EV Charging Station (EVCS) is a self-contained unit that combines all required equipment for charging electric vehicle batteries. Some units even provide a means of payment for charging—a feature that UIUC will need on campus. The technical name for the complete vehicle charging system is the EV Supply Equipment (EVSE). This includes the EV charging equipment and conductors, both ungrounded and grounded, EV cables, and attachment plugs. An Automatic Load Management Systems (ALMS) is a control system which allows multiple chargers to share a circuit or panel and automatically reduce power at each charger. This provides the opportunity to reduce electrical infrastructure costs and/or provide demand-responsive capability—another desirable feature for UIUC.

The following provides a list of design considerations for EV charging stations on the UIUC campus:

- Charger Level
- Location
- Unit and Stall Size
- Encroachment Issues
- Protection of Equipment
- Cord Length and Management
- Accessibility Standards

Charger Levels

There are three types of chargers used for EVs: Level 1, Level 2, and Fast Chargers. The charging stations differ in power output, primary use, circuit types, charging rates, and amount of time for vehicles to reach full charge. **Table 2** presents the characteristics for each charger.

Table 2: Types of EV Charging

Type	Maximum Power Output	Use	Circuit Type	Charging Rate	Time for Full Charge
Level 1	<1.92 kW	Residential	120 V 15 A	2-5 miles per hour of charge	20 hours
Level 2	<1.92 kW	Residential Commercial	208 V/240 V 40A-80A	10-20 miles per hour of charge	7 hours
Fast Charger	<400 kW	Commercial Highway Fleet	480 V AC input 100+ A DC output	>100 miles per hour of charge	<1 hour

Source: National Parking Association

As presented in Table 2, the chargers have vastly different primary uses. Level 1 chargers are only feasible for residential charging due to the low power output and the amount of time for vehicles to reach full charge. Level 1 chargers are not recommended for the UIUC campus for this reason. Level 2, however, is ideal for destination or commercial uses, as most EV models can accept an average of 7.5 kW from a Level 2 charger. Most EVs cannot handle the power output of Fast Chargers, which are only appropriate for large commercial, transit, or maintenance vehicle use. It is recommended that Level 2 chargers are installed throughout the UIUC campus, with Fast Chargers installed only at the university's discretion when appropriate for large commercial, transit, or maintenance vehicles.

Future batteries will improve to handle higher kW at faster charging rates, used first for trucks and buses, and then for personal vehicles. Rapid technological advancements make it difficult to plan for EV infrastructure today. According to the NPA, it is not appropriate to assume that all EV charging at Level 2 will be at today's 7.5 kW average per vehicle charger port through the life of the structure. Continuous review of the campus' charging infrastructure is recommended to ensure that the provided technology meets the needs of its customers. Level 2 chargers are most appropriate for current EV models, but the university should be aware of the rapid changes in charging technology as EV demand grows.

Location

The first step in planning strategic placement of EV charging stations is to identify EV-Capable and EV-Ready locations. EV-Capable locations require the installation of an electrical service and electrical room for the expected total EV charging volume. For new construction, it is strongly recommended that raceways are provided, particularly below slab grade, to minimize unsightly surface conduits in future EV stall locations. EV-Capable locations require more effort to prepare the stalls than EV-Ready locations, EV-Capable locations involve installing an electrical panel capacity and raceways with conductors to terminate in junction boxes at the point of service. Charging stations are plugged in when added. Continuous installation of EVCS in response to demand is recommended as EV demand grows over time.

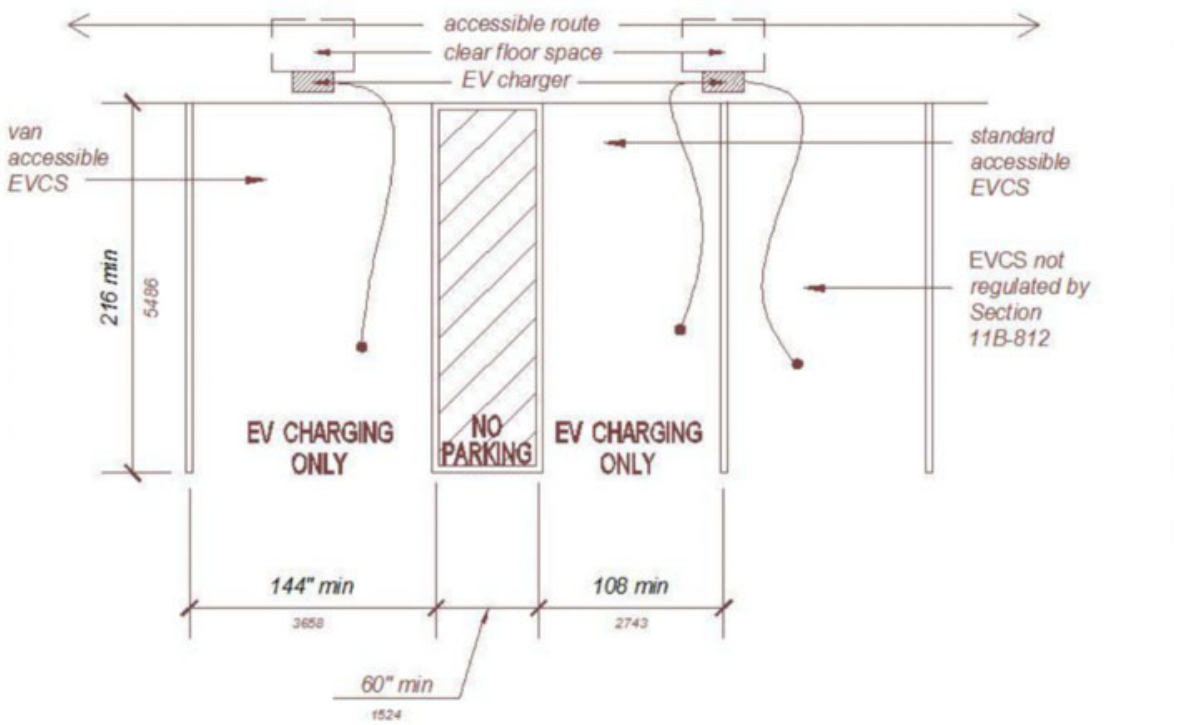
Placing EV stalls on the perimeters of surface lots or on the grade level of a parking structure simplifies many of the design considerations. Charging stations on parking ramps are not desirable, although it can be done if several charging stations are required. It is also recommended by LEED that charging stations be adjacent to pedestrian portals after ADA stalls. This may encourage sales of EVs. Placing them closer to electrical rooms will also minimize costs significantly.

It is recommended that UIUC distribute EVCS equally throughout each parking facility. The number of charging stalls should reflect a percentage of the total number of stalls in the facility. For example, if a facility has 100 standard parking stalls in the year 2025, there should be three EV charging stalls since the EV demand makes up 2.5% of the total number of vehicles. By 2030, that number should rise to seven EV stalls, representing a 7% EV demand.

Unit and Stall Size

EV charging stalls have no special stall size requirements. Similar to standard parking stalls at UIUC, EV charging stalls must have a minimum length and width of 18’-0” by 8’-6”. Although there is no additional width required for charging station operation, a stall size of 18’-0” by 9’-0” eases the access and operations of the space. ADA van stall width requirements must be a minimum of 18’-0” by 10’-0” with a 3’-0” access aisle on either side. However, It is recommended that ADA van spaces be 18’-0” by 11’-0” with a 5’-0” access aisle on the right side to maximize accessibility. **Figure 2** presents a diagram of functional design for EV charging stalls.

Figure 2: EVCS Stall Design



Source: California EVCS Code

It is recommended that UIUC add the EV charging stalls to the existing parking facility design—ideally a 9'-0" width for standard stalls, and an 11'-0" for van accessible stalls. Access aisles should be 3'-0" to 5'-0" wide.

Encroachment Considerations

Encroachment occurs when a column, wall, or equipment such as EVCS extends into the required parking space dimensions. A *module* is the dimension of two rows of stalls and the aisle between. The NPA standard allows up to 2'-0" of encroachment into the module, at up to one-third of stalls. This can occur at any point in the stall width. Placing EVCS on stall lines may overcome the encroachment issue. There is an incentive to accept encroachment for EVCS charging units given many jurisdictions' goals to encourage EVs. Encroachment is more of an issue with DC Fast Charging as the units are larger, and an even more critical issue with ADA stalls as it is not permitted. Encroachment and obstructions can range from columns, to bollards, to curb ramps, and more.

Protection of Equipment

The NPA recommends protecting EVCS with protection equipment, such as bollards or pipe guards. Some units have a base that is reinforced to act as a bollard, eliminating the need for additional protection. However, in most designs, bollards or pipe guards are typically provided in addition to EVCS. This creates a challenge for encroachment issues, but is necessary to the design.

The most common design is the placement of two pipe guards in front of the unit, roughly aligned with the edges of the device to minimize encroachment into the stalls with 6" clear from the face of the unit to the centerline of the bollard. The variation in unit dimensions typically requires installing the bollards after the unit is installed. The photo on the right shows an example of this pipe guard placement.

Protection equipment makes encroachment a critical issue. It is difficult to accurately measure the encroachment at the time of design if a vendor has not been preselected. It is recommended that the university pre-selects a vendor prior to the design of the stalls so that protection equipment and encroachment can be accurately predicted.

Cord Length and Management

There is no standard location on EVs for charging ports. Unlike gasoline-powered vehicles, charging ports may be located on the front, back, left, or right of the vehicle. For this reason, the cord lengths—the length required to stretch from the charging unit to the vehicle charging port—are critical. The length for standard EV stalls is approximately 23'-0". Longer lengths may be required for accessible stalls, which only exacerbates cord management issues, such as cords lying on the pavement and violating accessible routes.

Cord management is an issue that has not yet been resolved with EVCS design. Cords lying on the pavement within the required clear space makes the charging station inaccessible and creates tripping hazards. Units with retractable cords, such as overhead units, may be a solution for ADA stalls. Coiling cords are also a solution for standard stalls to keep cords off the pavement, but are not within reach range to meet ADA standards.

Accessibility Standards

The following is a list of considerations developed by the NPA for installing EV chargers with accessible mobility features to existing parking facilities:

- Can the chargers be connected by a compliant accessible route to the accessible entrance of the building or facility?
- Is the slope and cross slope of the vehicle charging space less than 1:48? Can the floor or ground surface be altered to achieve slopes less than 1:48?
- Is there sufficient space for an 11-foot-wide, 20-foot-long vehicle space and 5-foot-wide access aisle?
- Can the chargers be placed at the same level as the vehicle charging space? Will existing curbs and landscaping need to be removed or altered to place chargers at the same level as the vehicle charging space?
- Can a clear floor or ground space positioned for a parallel approach with an unobstructed side reach be provided?
- Is the clear floor or ground space firm, stable, and slip resistant?
- If EV chargers must be mounted on a curb, are operable parts of the chargers still within an unobstructed side reach and no farther than 10 inches and no higher than 48 inches above the clear floor or ground space?
- What existing site constraints are there, and would locating chargers elsewhere on the site make them more accessible?

EV charging stations that are added to existing parking facilities must connect to an accessible route. A reasonable number of EV chargers must comply with ADA standards and have a clear floor or ground space and operable parts within reach range. Converting ADA parking spaces to EV charging spaces is not recommended, especially when use will be restricted to electrical vehicle charging only. The ADA standards prohibit an alteration that decreases accessibility below the requirements for new construction. If an existing ADA space is converted to an EV charging space, the minimum number of ADA parking spaces must be recalculated based on the total number of parking spaces provided in the facility. As a result, ADA parking spaces may need to be added elsewhere. **Table 3** presents the ADA EV stall requirements relative to the total number of stalls.

Table 3: ADA EV Stall Requirement

EV Charging Stalls	Minimum Requirement of ADA EV Charging Stalls		
	Van Accessible	Standard Accessible	Ambulatory
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 200, 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

Accessible EVCS designed for accessibility but not reserved for exclusive use by people with disabilities

Source: California Division of the State Architect

Electrical Requirements

Each Level 2 charging port requires a dedicated single-phase electrical circuit (32A @ 208/240V) with 40A circuit breaker at the electrical panel. A certified electrician must install all electrical circuits in accordance with local and National Electric Code requirements. The following is a list of general EVCS electrical guidelines provided by ChargePoint:

- Evaluation of existing electrical infrastructure to determine if there is sufficient existing utility service and electrical panel capacity and to identify costs for necessary upgrades and electrical panels.
- For installation of dedicated EV electrical panel, choose panel location in close proximity to existing electrical supply.
- Identify station locations for EV charging that are in close proximity to an electrical room with common area electrical panel; reduce distance for conduit runs and electrical wiring from electrical panel to all proposed EV parking spaces.
- Determine the appropriate mounting location.
- Ensure the wiring, circuit protection, and metering is in place at the station installation location by reviewing the specification, wiring diagram, and grounding requirements.
- Use a 6- or 8-gauge wire to station. If feeding the station with a larger wire, such as 4 gauge, then splice the wire for 6 or 8 gauge.
- Avoid or minimize trenching requirements, especially more costly trenching to run conduit under asphalt surfaces.
- Choose adjacent parking spaces in an area with adequate lighting and identify suitable locations with flat surface for wall mount stations or suitable floor surface for pedestal mount stations (no asphalt surfaces).

- Use dual-port pedestal mount stations where possible in open areas for adjacent or tandem parking spaces.
- Determine optimum conduit layout to minimize linear conduit costs to multiply EV parking spaces and size all conduit and electrical wiring in accordance with National Electrical Code requirements.
- Measure cellular signal levels and identify optimum location for placement of gateway devices.
- Ensure that adequate cellular coverage is available at the station installation location. To ensure adequate signal strength in underground or enclosed parking structures, cellular repeaters may be required.
- For below ground-level or enclosed parking garages, installation of a cellular signal booster often is required with indoor antenna located near gateway device and EV parking spaces and outdoor antenna typically located at the garage entrance ceiling or on the rooftop where cellular signal levels are optimum.
- Determine cost budget options for make-ready electrical infrastructure to satisfy current needs and future needs. Prioritize locations for installation of charging stations based upon immediate and future needs, construction timelines, and costs.

FINANCING

The financial analysis is a calculation for near term utilization, such as 2025. By 2030, the batteries and charging may improve, impacting the calculations shown below. Charging is assumed to be at Level 2 with an average draw of 7.5kW, unless noted otherwise. 7.5kW is the average rate for EVs in the present day, but it is likely this will increase in the future.

Costs

The university should charge permit holders and transient parkers for EV charging. The cost analysis in this document is intended to facilitate an understanding of the costs of owning and operating EVCS and facilitate a decision to require payment.

Installation Costs for New Construction:

- AC Level 1: less than $5,000
- AC Level 2: up to $15,000
- DC Fast Charge: $28,000 (50kW) to $140,000 (350kW)

Many variables in subsidies, tax credits, depreciation, and accounting factors make it difficult to provide a definitive analysis regarding the cost to own and operate an EVCS. However, a simplified analysis for AC Level 2 and DCFC chargers (150 and 350 kW) is provided that is useful to understanding the comparison between the two types of chargers. The most important factor is utilization: how many hours charging at the device will occur per day, month or year which is then converted to estimated kW-h with some assumptions on the average length of charge, including a 30% credit for the initial cost of installation and a 7% cost of funds over 10 years for the remaining 70% cost installed. These are incremental costs to own and operate the EVCS. The cost for public charging at Level 2 is calculated assuming a charger is used once per weekday with 7.5 kW average per charge session. **Table 4** presents the cost recovery analysis for each individual station.

Table 4: EVCS Recovery Cost Analysis

Financing Factors	Level 2	Fast Charger (150kW)	Fast Charger (350kW)
Installation Costs	$ 10,000.00	$ 73,900.00	$ 206,000.00
Less Tax Credit Received	$ (3,000.00)	$ (22,170.00)	$ (30,000.00)
Net Cost Installed	**$ 7,000.00**	**$ 51,730.00**	**$ 176,000.00**
Annual Cost to Own	**$ 997.00**	**$ 7,365.00**	**$ 25,058.00**
Charge Rate	7.50	150.00	350.00
Hours Per Charge	1.00	0.40	0.20
kW-h Rate	$ 0.13	$ 0.13	$ 0.13
Cost Per Charge	**$ 0.98**	**$ 7.80**	**$ 9.10**
Capital Cost Per Month	$ 83.00	$ 614.00	$ 2,088.00
Data Fees	$ 50.00	$ 50.00	$ 50.00
Power Per Month	$ 2.06	$ 18.15	$ 18.15
Total Cost Per Month	$ 135.00	$ 682.00	$ 2,156.00
Uses Per Month	20	20	20
Cost Recovery Required	**$ 6.75**	**$ 34.10**	**$ 107.80**

Source: National Parking Association

As presented in Table 4, with just 20 uses per month for each charger, the cost per one hour of Level 2 charge is $0.98. The cost for a full charge at Level 2 is $6.75. Fast chargers are far more expensive, and personal vehicles cannot handle the power output. They are not feasible for commercial operations without very high utilization and/or heavy rebates and incentives. The cost per charge is $34.10 at 150 kW and $107.80 for 350 kW chargers. As utilization increases, the charge per user will drop significantly.

This analysis is useful for an understanding of the economics and decisions involved in EV charging. The assumptions in this analysis are general and are expected to change by location. Technological advancements will also yield different results.

Fees to Consumers

UIUC Permit holders who cannot charge at their residence and can only charge on campus need a standard of 366 kW/month. Although they may not charge an equal amount every day, they will need to charge that amount over the course of one month. As of 2022, the average rate is $0.13/kWh in Urbana-Champaign. The average power cost will likely be $47.50 per month for EV owners. The recommendations for fees to consumers are provided in the Policy section of the report.

Comparable University Programs

For benchmarking, UIUC provided the following analysis of comparable universities to examine their EV permitting programs.

Table 5: Comparable University Programs

Institution	EV Permit	Location	Payment	Level 1	Owner	Notes
University of Illinois	No	4 Garages 3 Surface Lots	Charge Point <4 hours: $1.25 >4 hours: $2.50	Yes	Parking Department	-
Purdue University	$50 in addition to regular permit	Garages	Permit	No	Transportation and Parking	-
Indiana University	$3 in addition to regular permit	5 Garages 1 Surface Lot	None	No	Traffic and Parking	The state institution is not allowed to generate revenue from the sale of electricty nor provide electricity at no cost.
University of Wisconsin	No	Garages	Charge Point $0	No	Transportation	Vehicle must be in "paid" status to use charging stalls. This includes employee and student permits. A charging fee is implemented during hours of no enforcement.
University of Nebraska	No	Surface Lots	Charge Point <4 hours: $1.50 >4 hours: $3.00 50% discount for employees and students	No	Transportation and Parking	Employees and students must have a univeristy associated email to receive the discount. Units are funded by two $21,500 grants from the Nebraska Department of Environment and Education, and the Lincoln Electric System.
University of Michigan	No	5 Garages 4 Surface Lots	Charge Point	No	Transportation	The Univeristy owns 7 units. The City of Ann Arbor owns 18 units. There is no charge to university permit holders.
Ohio State University	No	5 Garages 4 Surface Lots	Charge Point <4 hours: $1.00 >4 hours: $2.50	No	Transportation	-

Source: UIUC Parking Department

The examination of comparable universities and their EV policies revealed that a standard for EV charging policy has not yet been established. Most schools do not offer a singular EV permit yet but instead offer a price reduction for students and employees. Some universities do have public EVCS that people without university permits and not associated with the university can utilize. Since the UIUC chargers will only be placed in parking permit facilities, this feature will not be necessary. Overall, the policies are specific to each school and there are few consistencies throughout. The following section will attempt to set a precedent for EV charging at UIUC that the Parking Department can effectively implement.

POLICY

The information provided is a summary of the report and a general policy outline for EV charging at UIUC.

Demand

UIUC should continue to increase the number of charging stations as the demand for EVs increase. New chargers should be proportionally distributed across campus parking facilities as much as possible. The university is already akin to this idea as new parking facilities, such as the UIUC Lot E15 parking garage,

will add five Level 2 chargers and five EV-Ready locations. This is consistent with the 2025 demand projections of 2.50%.

To track EV demand, the parking department should record EV ownership by adding registration information to permit applications. This will help the parking department to better monitor demand of EV chargers.

Table 6 presents the estimates for EV presence and EVCS demand at UIUC. The number of charging stalls will differ from the number of charging stations provided since many stations can service two stalls at a time.

Table 6: UIUC EVCS Demand

	2020		2025		2030		2035		2040		2045		2050	
EV Parkers	211	2%	264	3%	740	7%	1,500	14%	2,472	23%	3,381	32%	4,458	42%
EV Charging Stalls	42	0.3%	53	0.4%	148	1%	300	2%	494	4%	676	5%	892	7%

Source: National Parking Association

As presented in Table 6, "EV Parkers" represents the number of parkers with electric vehicles, while "EV Charging Stalls" represents the number of EVs charging simultaneously on campus. The percentages in the table reflect the number of EV parkers or charging stalls out of the total number of parking permits, EV or not. For example, in the year 2025, the number of charging stalls should reflect 0.4% of the total number of parking permits. If there are 100 total permits, four charging stalls should be provided to meet the charging demand.

Charger Level

Charging station implemented by the UIUC Parking Department should be Level 2 chargers. Level 2 chargers are the most economically feasible option for a destination such as the university.

Fast Chargers will be necessary for university fleet vehicles. The Parking Department should monitor the number of university electric fleet vehicles and provide Fast Charging stations as needed. Fast Charging stations are to be restricted for university fleet vehicle use only, and prohibited for use by regular EVs.

Location

The locations of EVCS should be proportional to the total number of vehicles in a facility. For example, if a parking facility has 100 permit parkers, and the EV charging demand is 0.4% of that number, the parking facility should offer four charging stalls. If an adjacent parking facility has 50 total vehicles, it should offer two charging stalls. Within the facility, chargers should be located as close to the electrical supply as possible.

Special Requests

For any staff, department, or organization that requests the installation of a charging unit that would not be installed by the university in the immediate future or be available to campus permit parkers, the following is proposed:

- The requesting entity should cover costs of purchasing and installation.
- Basic electric infrastructure should remain the responsibility of the university.

- If the charger is not readily available to the general campus population, the requesting entity should cover annual operating costs.

Costs to the University

Detailed capital costs for purchasing a Level 2 ChargePoint charging unit were provided by the UIUC Parking Department. The capital costs do not include installation costs, which vary based on the port's distance from the power supply. Costs associated with purchasing, installing, operating, and maintaining the units will be incurred by the university, aside from special requests by departments for charging unit. **Table 7** presents a break-down of capital costs for a Level 2, one-unit, two-port charging unit.

Table 7: Level 2 ChargePoint Charging Unit Capital Cost

Order Code	USD	Product Description
CT4021-GW1	$ 9,190	Dual Output Gateway North America, Bollard Unit - 208/240V @30A with Cord Management
CT4001-CCM	$ 125	CT4000 Bollard Concrete Mounting Kit. Bolts: 5/8 - 11 x 9? F1554 Grade 55 hot-dipped galvanized threaded bolts - 3 ea. Nuts: 5/8 - Heavy Galvanized Hex Nuts (DH Rated) - 12 ea. Washers: Galvanized Washers (ASTM F436) - 9 ea. Plastic Template - 1 ea.
CT4000-PMGMT	$ 65	CT4000 Power Management Kit. Allows both ports on a dual port station to share a single 40A circuit (Power Share). Also allows a CT4000 to be set up to operate at a lower current (Power Select).
CPCLD-COMMERCIAL-1	$ 690	Prepaid Commercial Cloud Plan subscription with station management features such as: Custom Video uploads and Automatic Software Updates, driver and fleet management with Access Control, Pricing, and Automatic Payment Collection, as well as energy and power management with Power Sharing. Real-time dashboards and reports provided for applicable features. Station Activation purchase required. Priced per port.
CP-SUPPORT-ACTIVE	$ 350	Initial Station Activation & Configuration Service includes activation of cloud services and configuration of radio groups, custom groups, connections, access control, visibility control, pricing, reports, and alerts. One time initial service per station.
CT4000-ASSURE1	$ 775	1 prepaid year of ChargePoint Assure for CT4000 stations. Includes Parts and Labor Warranty, Remote Technical Support, On-Site Repairs when needed, Unlimited Configuration Changes, and Reporting. Priced Per Station.
CPSUPPORT-SITEVALID	$ 600	Customer works with their own contractor to perform all construction and station installation services. ChargePoint then engages with an authorized ChargePoint Partner to perform Site Validation of electrical capacity, transformers, panels, breakers, wiring, cellular coverage, and to ensure the station installation meets all ChargePoint published requirements and local codes. Upon successful Site Validation, the customer will be eligible to obtain warranty coverage under a ChargePoint Maintenance plan sold separately. Note, a failed Site Validation will incur a second validation fee to repeat the validation after the site deficiencies are corrected. Priced per every 5 on the site.
Total 2 Port / 1 Unit with all options	**$ 11,795**	

Source: UIUC Parking Department

As presented in Table 7, the capital costs for a Level 2 ChargePoint charging unit is approximately $11,800. This does not include installation costs, which vary based upon the port's distance from the power supply. If a specific department requests a charging station, the department must incur the costs associated with purchasing and installing the unit, as well as annual operating costs.

Fees to Consumers

As presented in Table 4, the cost recovery with conservative utilization assumptions for one hour of charge is $0.98. The cost recovery for a full charge is $6.75 per hour. EVCS users will have two options for payment.

Option 1: EV Charging Permits

An EV charging add-on to the annual parking permits will be offered to all permit holders at a price of $50. This offer will be available to annual permit holders only, and remain equal across the salary brackets.

Students will also be offered the add-on for $50 in addition to regular student permits. This option will not be available to hybrid or monthly permit holders.

Option 2: Pay by the Hour
Permit holders can pay on demand at the charging station at a rate of $1.50/hour. As the demand and utilization of chargers increase, the rate per hour will decrease.

Refer to *Appendix A* for a list of sources that were used in this report.

APPENDIX

Appendix A: Sources

1. ChargePoint CT4000 Make-Ready Specifications
2. Current EV Registrations in the U.S. - Electrek
3. Illinois Climate Action Plan
4. National Park Association White Paper on EV Charging
5. Understanding Charging Levels
6. U.S. Access Board Design Recommendations for Accessible Electric Vehicle Charging Stations