Camp Lejeune Federal Fleet Tiger Team EVSE Site Assessment

Cabell Hodge, Ranjit R. Desai, and Leidy Boyce

National Renewable Energy Laboratory

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Errata

This report, originally published in October 2022 has been revised in September 2023 to update Figure 35, identify one of the models used as EVI-Ratio, and properly accredit one of the authors.

Table of Contents

1 Introduction ... 1
1.1 EVSE Installation Planning at Camp Lejeune ... 1
1.2 Camp Lejeune Overview ... 1
1.3 EVSE Installation Design Guidelines ... 2
1.4 Pedestal Charging Arrangement ... 3
1.5 EVSE Reporting ... 4
1.6 Networked EVSE ... 5
1.7 Assumptions for Cost Estimates ... 6
2 Privately Owned Vehicle Charging ... 8
2.1 EVSE Requirements to Support POV Charging Policies ... 8
2.2 Americans With Disabilities Act Considerations ... 8
3 MCB Lejeune Sites ... 10
3.1 Building 1005 ... 11
3.2 Building 1110 Ash ... 15
3.3 Building 1308 Cedar ... 19
3.4 Building 1407 Dogwood Bus Lot ... 24
3.5 Lot 200 Holcomb Boulevard ... 29
3.6 Building 25 Cross Street ... 32
3.7 Building 773 ... 34
3.8 Building AS-302 Police Station ... 36
4 USCG Lejeune Sites ... 39
4.1 Analyzing the Number of EVSE Ports Required ... 39
4.2 Building B-328 ... 42
4.3 Building B-329 ... 44
4.4 Barracks Parking Locations ... 48
5 Marine Corps Community Service Lejeune Sites ... 51
5.1 Building 895 ... 51
5.2 Building 88 ... 54
6 Summary of Tiger Team Assessment ... 58
6.1 Next Steps ... 59

List of Figures

Figure 1. Camp Lejeune base map (Maslia 2005) ... 2
Figure 2. Dual-port pedestal EVSE unit ... 3
Figure 3. Example dual-port EVSE wiring diagram ... 4
Figure 4. Camp Lejeune Campus Snapshot 1 ... 10
Figure 5. Camp Lejeune Campus Snapshot 2 ... 11
Figure 6. Building 1005 Parking lot with the Beam Charger ... 12
Figure 7. Recommended configuration for Building 1005 EVSE and electrical service ... 13
Figure 8. Cost estimate for Building 1005 in incremental costs format ... 15
Figure 9. Transformer, generator, meter, and panel at the north corner of 1110 Ash Street ... 16
Figure 10. Recommended EVSE locations in 1110 Ash Street parking ... 17
Figure 11. Overhead plan for EVSE installation at 1110 Ash Street ... 17
Figure 12. Cost Estimate for 1110 Ash Street in incremental costs format ... 18
Figure 13. Sam Seaman checking power readings on Building 1308 utility pole ... 19
Figure 14. Craig Frank standing near the location of prospective new utility pole and transformer ... 20
Figure 15. Location for EVSE behind Building 1308 ... 21
Figure 16. Recommended configuration for Building 1308 EVSE, new pole, and electrical service ... 22
Figure 17. Cost estimate for 1308 Cedar Street in incremental costs format ... 24
Figure 18. Utility pole at the north corner of the Dogwood Bus Lot ... 25
Figure 19. Building 1407 Dogwood parking lot ... 26
Figure 20. Recommended configuration for 1407 Dogwood EVSE and electrical service ... 27
Figure 21. Cost Estimate for 1407 Dogwood Bus Lot in incremental costs format ... 28
Figure 22. Lot 200 parking structure ... 29
Figure 23. Recommended configuration for Lot 200 EVSE and electrical service ... 30
Figure 24. The backside of Lot 200 parking structure ... 30
Figure 26. Recommended configuration for Building 25 EVSE and electrical service ... 32
Figure 27. Cost Estimate for Building 25 Cross Street in incremental costs format ... 33
Figure 29. Recommended configuration for Building 773 EVSE and electrical service ... 34
Figure 30. Cost Estimate for Building 773 in incremental costs format ... 35
Figure 31. Transformer, panels, and generator behind AS-302 ... 36
Figure 32. Recommended configuration for AS-302 EVSE and electrical service ... 37
Figure 33. Cost estimate for Building AS-302 in incremental costs format ... 38
Figure 34. Coincident charging considerations, for an example garage ... 40
Figure 35. Frequency of daily distance traveled by USCG vehicles ... 41
Figure 36. Schematic for Building B-328. ... 43
Figure 37. Cost estimate for Building B-328 in incremental costs format ... 44
Figure 38. Ranjit Desai and Dale Swink by an existing transformer in Building B-329 parking lot ... 45
Figure 39. Recommended configuration for B-329 EVSE and electrical service ... 46
Figure 40. Cost estimate for Building B-329 in incremental costs format ... 47
Figure 41. USCG barracks parking lots A and B ... 48
Figure 42. Recommended configuration for USCG Barracks EVSE and electrical service ... 49
Figure 43. Cost estimate for Parking Lot A in incremental costs format ... 50
Figure 44. Building 895 parking lot and transformer ... 51
Figure 45. Recommended configuration for Building 895 EVSE and electrical service ... 52
Figure 46. Cost estimate for Building B-895 in incremental costs format ... 53
Figure 47. 112.5-kVA transformer behind Building 88 ... 54
Figure 48. Recommended configuration for Building 88 EVSE and electrical service ... 55
Figure 49. Cost estimate for Building B-88 in incremental costs format ... 57

List of Tables

Table 1. SAE J1772 AC Charging Options 3
Table 2. Assumptions for the Project Costs Included in the Cost Estimates 7
Table 3. Minimum Number of Accessible Charging Ports 9
Table 4. Cost Estimate for Building 1005 14
Table 5. Cost Estimate for 1110 Ash Street 18
Table 6. Cost Estimate for 1308 Cedar Street 23
Table 7. Cost Estimate for 1407 Dogwood Bus Lot 28
Table 8. Cost Estimate for Lot 200 Holcomb Blvd. 31
Table 9. Cost Estimate for Building 25 Cross Street 33
Table 10. Cost Estimate for Building 773 35
Table 11. Cost Estimate for Building AS-302 38
Table 12. Ratio of EV:EVSE for Vehicles Analyzed 41
Table 13. Cost Estimate for Building B-328 43
Table 14. Cost Estimate for Building B-329 47
Table 15. Cost Estimate for USCG Barracks Parking Lot A 50
Table 16. Cost Estimate for Building 895 53
Table 17. Cost Estimate for Building 88 56
Table 18. Summary of Cost Estimates 58

List of Acronyms

ADA	Americans with Disabilities Act
DoD	Department of Defense
DOE	Department of Energy
EV	electric vehicle
EVSE	electric vehicle supply equipment
FEMP	Federal Energy Management Program
GOV	government-owned vehicle
GSA	General Services Administration
MCB	Marine Corps Base
MCCS	Marine Corps Community Service
NEC	National Electric Code
NREL	National Renewable Energy Laboratory
POV	privately owned vehicle
SAE	Society of Automotive Engineers
USCG	U.S. Coast Guard

1 Introduction

The National Renewable Energy Laboratory (NREL) was contracted by the U.S. Department of Defense (DoD) Environmental Security Technology Certification Program and the U.S. Department of Energy's (DOE's) Federal Energy Management Program (FEMP) to develop a web tool and complete pilot assessments for the installation of electric vehicle supply equipment (EVSE). NREL has deployed Tiger Teams comprising engineers and fleet experts to support DoD and DOE on several EVSE site assessments since 2015. However, the advancements developed in support of this report, including a cost-estimation tool and geospatial mapping tool, will enable a user-driven path to assess EVSE needs.

1.1 EVSE Installation Planning at Camp Lejeune

The Tiger Team evaluated 14 parking areas at Camp Lejeune, North Carolina, eight for fleet vehicles operated by the Marine Corps Base (MCB) Lejeune, four for fleet vehicles operated by the US Coast Guard (USCG), and two for fleet vehicles operated by Marine Corps Community (MCCS) Lejeune. This report details the site design recommendations and cost estimates for these parking areas.

1.2 Camp Lejeune Overview

Military operations at Camp Lejeune take place on the military reservation and surrounding areas indicated in Figure 1, including the Holcomb Boulevard area and Courthouse Bay locations examined by the EVSE Tiger Team. NREL worked with three different fleets situated on Camp Lejeune: the MCB fleet, MCCS fleet, and USCG fleet.

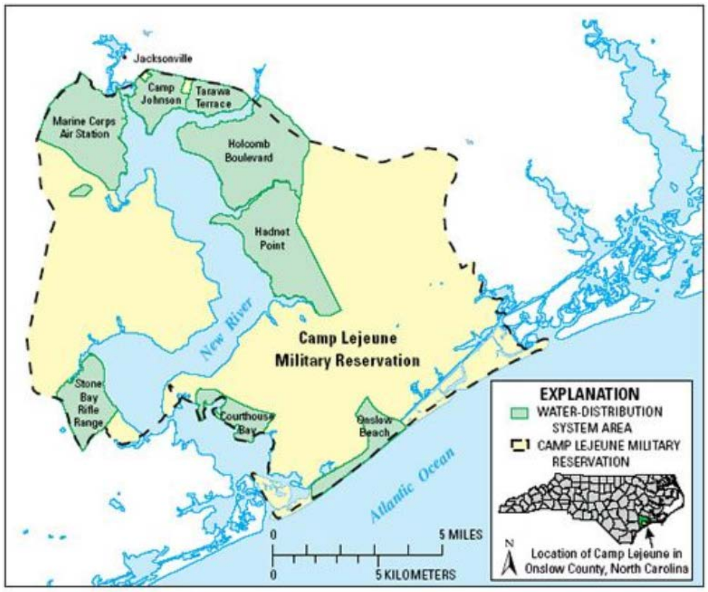

Figure 1. Camp Lejeune base map (Maslia 2005[1])

1.3 EVSE Installation Design Guidelines

In order to provide the energy that zero-emission vehicles require, EVSE must be installed to provide sufficient charging power. Due to the significant energy demand from fleet mobility needs, the power ratings of these devices are higher than most other electrical devices. This requires specific installation considerations as per the National Fire Protection Association's Standard 70, known as the National Electric Code (NEC), and as outlined in the FEMP Electric Vehicle (EV) Champion Training Series[2].

Most zero-emission vehicles available in the United States are capable of charging from the Society of Automotive Engineers (SAE) Standard J1772 EVSE charge coupler. This standard provides two typical charging levels—AC Level 1 and 2—which provide AC power directly to the vehicle, which is then converted to DC power for the battery through the vehicle's onboard charger. Level 1 charging provides a maximum of 1.9 kW of power and is typically plugged into a standard 120-V receptacle, which is best served through a dedicated 20-A circuit breaker to provide a maximum 16 A (ampere) of current to the vehicle. These chargers are best suited for plug-in hybrid EVs or battery EVs with a low number of daily vehicle miles traveled. However, for most battery EVs, the higher-power Level 2 charging option is preferred to ensure the vehicle can always receive a full charge after each day of driving. These chargers are typically hard-wired dual-port pedestal units and can supply either 208 V or 240 V to the vehicle, depending on whether the building is receiving a three-phase (3Φ) or single-phase (1Φ) electric service from the utility. They also require a double-pole breaker that is typically rated at 40 A. These chargers'

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[1] https://www.atsdr.cdc.gov/sites/lejeune/panel_report_groundwater.html.

[2] FEMP Fleet EV Webpage: https://www.energy.gov/eere/femp/electric-vehicles-federal-fleets.

power capabilities depend on the service voltage and 32 A of charging current, with 208 V and 240 V providing 6.7 kW and 7.7 kW, respectively. These options and requirements are outlined in Table 1. This report focused on the installation of AC Level 2 EVSE.

Table 1. SAE J1772 AC Charging Options

EVSE	Typical Charging Power	Typical Service Type	Typical Installation Requirements
AC Level 1	1.9 kW (16 A @ 120 V 1F)	120/240 V 1F or 208Y/120V 3F	Portable EVSE, 120-V receptacle, 20-A single-pole circuit breaker
AC Level 2	6.7 kW (32 A @ 208 V 1F) 7.7 kW (32 A @ 240 V 1F)	208Y/120V 3F 120/240 V 1F	Hard-wired EVSE, 40-A double-pole circuit breaker

1.4 Pedestal Charging Arrangement

All the parking assessed at Camp Lejeune was located in outdoor parking lots, away from buildings. Without a wall or ceiling to support the EVSE, pedestal units are required. Generally, there are significant economies of scale to installing dual-port EVSE when the pedestal is already needed, including a less expensive charging unit, shared ground between the two ports, and a single conduit run. Figure 2 shows an example of a dual-port pedestal EVSE unit, and Figure 3 is an example of a wiring diagram for a dual-port Level 2 EVSE serviced by a 208-V 3Φ service panel.

Figure 2. Dual-port pedestal EVSE unit

Source: Argonne National Laboratory

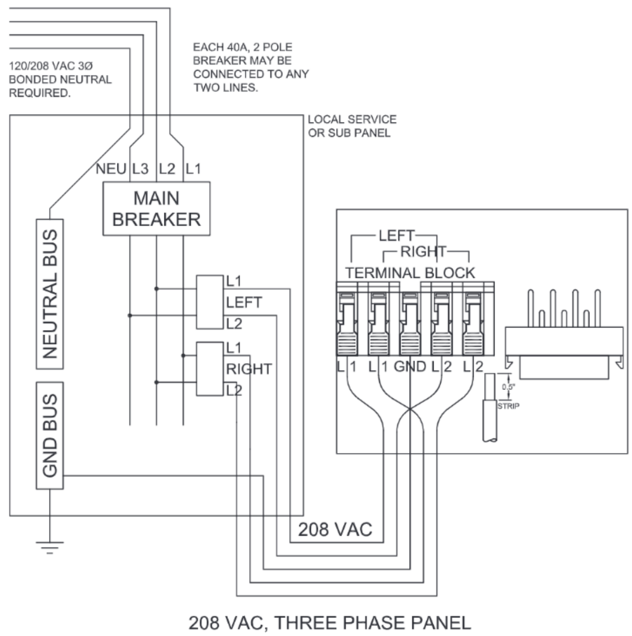

Figure 3. Example dual-port EVSE wiring diagram

Source: ChargePoint[3]

Note: Electricians must consult an installation guide for EVSE procured.

1.5 EVSE Reporting

There are multiple reporting requirements for EVSE and multiple ways to meet them. The primary concern of facility management staff reporting is often energy usage intensity (EUI), a metric that accounts for the total energy consumed by a building and campus and square footage. EUI can be addressed by metering EVSE separately from the building load. This is simple when EVSE is installed on a separate secondary tap from the building transformer and metered independently. If EVSE draws power from a building service panel or anywhere else downstream of the building meter, then the EVSE needs to be metered separately and the energy consumed by the EVSE subtracted from the building load for EUI purposes.

The Executive Order 14057 Implementing Instructions state, “Agencies must separately track energy used for vehicle charging and overall facility energy consumption.”[4] This can similarly be accomplished by metering EVSE separately from the building load as described above. The Implementing Instructions also note that networked EVSE can track vehicle charging energy

[3] https://www.chargepoint.com/files/CT4000_Install_Guide.pdf.

[4] https://www.whitehouse.gov/briefing-room/presidential-actions/2021/12/08/executive-order-on-catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability/.

consumption, although without separate electricity meters, the EVSE load must be subtracted from the building load, as with EUI measurements.

Federal vehicle reporting does not require measuring electricity at the EVSE. Instead, the EV's energy consumption must be reported to the Federal Automotive Statistical Tool. There are multiple ways to capture energy consumption from the vehicle:

1. Telematics should capture energy consumption in kWh from EVs. This accounts for all the energy consumed by battery EVs and the electrical energy, as well as gasoline energy consumed by plug-in hybrid electric vehicles.

2. Networked EVSE using FOBs or other cards associated with individual EVs can track electricity consumed by the vehicles. This must be supplemented by electricity from public charging stations.

3. NREL and FEMP developed an electricity estimation calculator where electricity consumption data is not available.[5]

1.6 Networked EVSE

In addition to reporting purposes, networked EVSE can serve other purposes. Networked dual-port EVSE units can often be configured to share power between multiple EVs. This can reduce the power requirements for EVSE units, and the electrical upgrades required for that EVSE (sometimes it can be used to avoid installing a new transformer). Many networked solutions can also be programmed to charge only at off-peak hours, and some can even ramp down power delivery during peak times to achieve multiple objectives (e.g., avoid peak demand charges while ensuring that EVs are sufficiently charged by a specific time).

Networked EVSE greatly simplifies charging commuter vehicles as well. Commuters can pay for the EVSE with a mobile application or card from the EVSE network provider, and the network provider can deposit the funds into a U.S. Department of Treasury account.[6]

Although networked EVSE has multiple advantages, it is less reliable than unnetworked EVSE. As explained in *Considerations for Department of Defense Implementation of Zero-Emission Vehicles and Charging Infrastructure*[7]:

> "Networked EVSE require ongoing sustainment, including paying the charging service provider an annual network fee. There are firmware and software updates that must occur

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[5] This calculator can be accessed at: https://www.energy.gov/sites/default/files/2020/12/f81/ev-electricity-in-gge-calculator.xlsx.

[6] For more details, FEMP and NREL developed a Workplace Charging Program Guide, which can be accessed at https://www.energy.gov/eere/femp/electric-vehicle-workplace-charging.

[7] https://doi.org/10.2172/1861409.

as well. Because of these complexities, a study found that nonresidential networked EVSE in its sample size performed at 68% to 83% uptime, while simple EVSE performed above 99% uptime during the study period (Avista Corp. 2019). The study authors noted that this was because nonresidential networked EVSE would not charge vehicles without user authentication through a mobile application or RFID card, and that could not take place if the network was disturbed. It is critical that a sustainment plan be included for networked EVSE and that the units function without a requirement for authentication."

An alternative to the common approach of networked charging ports is to use a central controller that sits between the service panel and EVSE and controls the power flow to each EVSE. This can minimize EVSE unit, network, maintenance, and cellular connection costs.

For the purposes of this report, the Tiger Team is assuming that all EVSE will be networked. Ongoing sustainment costs are not included in this report, but the costs on the U.S. General Services Administration's (GSA's) blanket purchase agreement[8] are summarized here:

- Network costs range from $250 to $1,250 per year per port.
- Maintenance service plans range from $200 to over $1,000 per year (port/station coverage varies).
- Cellular connection plans are not available through GSA; they may be negotiated with mobile phone and internet carriers.

Telematics subscriptions are also available through GSA for $156 per year per vehicle.[9]

1.7 Assumptions for Cost Estimates

The main components of the costs of installing EVSEs are charging equipment, electrical equipment, construction costs, and project costs. As the federal agencies mainly purchase the required equipment at the GSA,[10] the EVSE costs are sourced from the GSA. The electrical components are designed as per the NEC.[11] Once the EVSEs and electrical components are

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[8] EVSE BPA information can be found at https://www.gsa.gov/buying-selling/products-services/transportation-logistics-services/fleet-management/vehicle-leasing/alternative-fuel-vehicles/electric-vehicle-charging-stations?gsaredirect=.

[9] GSA telematics plan details can be found at https://www.gsa.gov/buying-selling/products-services/transportation-logistics-services/fleet-management/vehicle-leasing/telematics.

[10] Source: https://www.gsa.gov.

[11] Source: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70.

assigned for each site, the costs are estimated using the RSMeans costs.[12] Apart from the component costs and construction costs, one of the main components of the cost estimates is the project costs. These costs include contingency costs, taxes, overhead, and profit. However, they do not include additional costs for design. These costs vary significantly as per the location and contractor/installer. Therefore, to simplify, these project costs are assumed as fixed percentages as per the RSMeans.

Table 2. Assumptions for the Project Costs Included in the Cost Estimates

Component	Assumed Fixed Percentage	Referred RSMeans Line Number
Contingency Costs	20%	01 21 16 50 0020
Taxes (Sales, State, Average)	7%	01 21 63 10 0020
Overhead	15%	01 31 13 80 0020 & 01 31 13 80 0350
Profit	10%	01 31 13 80 0020 & 01 31 13 80 0350
Bond	2.50%	01 31 13 80 0350
Permits	2.00%	01 31 13 90 0100

The RSMeans, however, contains the costs for a national average estimate. Therefore, another critical component in the cost estimates is the DoD Area Cost Factor,[13] which is used to appropriate the national average costs to the particular location and the agency. In this case, the cost factor is 1.01 for both materials and labor.

[12] Source: https://www.rsmeansonline.com.

[13] Source: https://www.usace.army.mil/Cost-Engineering/Area-Cost-Factors/.

2 Privately Owned Vehicle Charging

MCB and MCCS have determined that they will not allow privately owned vehicles (POVs) to access the EVSE evaluated by the NREL Tiger Team in this report. MCB and MCCS may offer POV charging at a later time on other EVSE units.

The USCG has a separate charging policy. USCG would like to allow POVs to charge at EVSE installed for government-owned vehicles (GOVs), provided it does not interfere with fleet operations. This approach will require networked EVSE, access management, and payment processing.

2.1 EVSE Requirements to Support POV Charging Policies

All EVSE installed for the MCB and MCCS fleet vehicles should be configured for access without authentication to minimize downtime. If authentication is required, then any network interruptions will disable the EVSE, creating a fleet resilience issue by sidelining EVs. POVs will not be permitted to use MCB or MCCS fleet EVSE. The fleet EVSE parking lot spaces should be marked "GOV" to ensure access control. If POVs use the EVSE contrary to policy, the Tiger Team recommends instituting a parking enforcement policy (e.g., parking tickets). This approach does not require networked EVSE for access management. However, networked EVSE may be helpful in reporting and data points on charger utilization that can inform the Marine Corps whether a new EVSE is required.

The USCG approach will require networked EVSE, access management, and payment processing. USCG must continue to fund the network provider for this EVSE, or the payment processing will no longer be available, and the likelihood of EVSE downtime will significantly increase.

2.2 Americans With Disabilities Act Considerations

The Americans With Disabilities Act (ADA) applies to publicly available EVSE, including employee POV charging[14]. The authors could not locate specific ADA EVSE regulations in North Carolina. However, the state of California (which significantly leads the country in EV adoption) has promulgated regulations with specific requirements for ADA compliance (California Building Code 11B-812). These requirements include minimum numbers of EV charging ports required to be ADA-accessible based on the total number of EVSE ports in a particular location. The ratios in Table 3 apply to the number of existing publicly available EVSE ports plus new public ports. The California regulations do not apply to fleet EVSE[15].

[14] DOE. 2014. "ADA Requirements for Workplace Charging Installation." DOE/GO-102014-4563. https://afdc.energy.gov/files/u/publication/WPCC_complyingwithADArequirements_1114.pdf.

[15] Clair, Ida. 2017. "Access California New Accessibility Regulations for Electric Vehicle Charging Stations (EVCS)." California Department of General Services. https://slidetodoc.com/access-california-new-accessibility-regulations-for-electric-vehicle/.

Table 3. Minimum Number of Accessible Charging Ports

Source: Clair 2017[16]

Total Number of EVCS at a Facility	Minimum Number (by type of EVCS Required to Comply with Section 11B-812:1 Van Accessible	Minimum Number (by type of EVCS Required to Comply with Section 11B-812:1 Standard Accessible	Minimum Number (by type of EVCS Required to Comply with Section 11B-812:1 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

The California Building Code[17] has specific requirements for the size of the parking spaces designed to serve van-accessible, standard accessible, and ambulatory parking spots, signage, access aisles, and accessible routes with clear floor space.

[16] Clair, Ida. 2017. "Access California New Accessibility Regulations for Electric Vehicle Charging Stations (EVCS)." California Department of General Services. https://slidetodoc.com/access-california-new-accessibility-regulations-for-electric-vehicle/.

[17] https://up.codes/viewer/california/ca-building-code-2022

3 MCB Lejeune Sites

The EVSE Tiger Team assessed eight parking locations for EVSE needs for MCB Lejeune, marked with orange and white pins in Figure 4 and Figure 5.

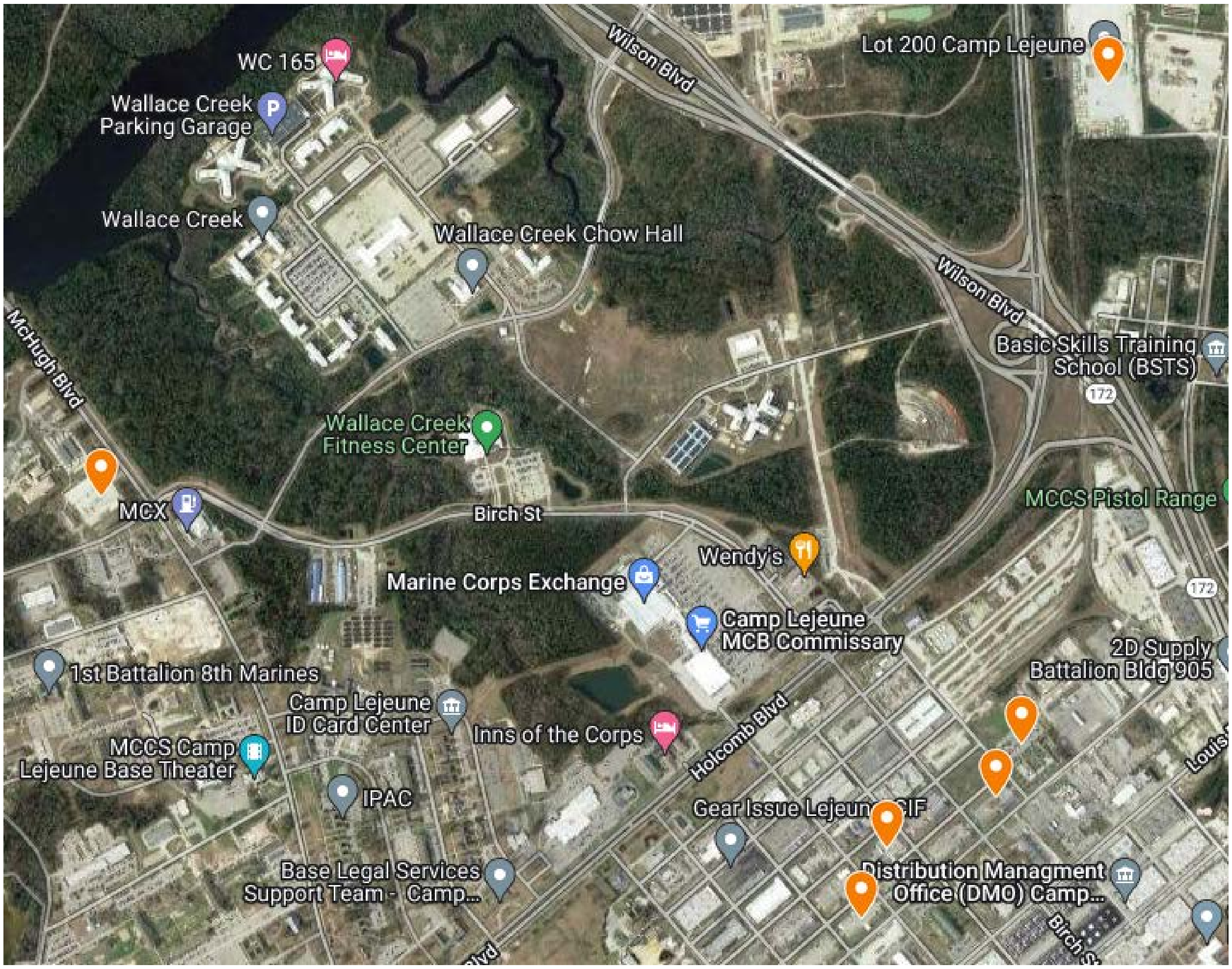

Figure 4. Camp Lejeune Campus Snapshot 1

Source: © 2022 Google

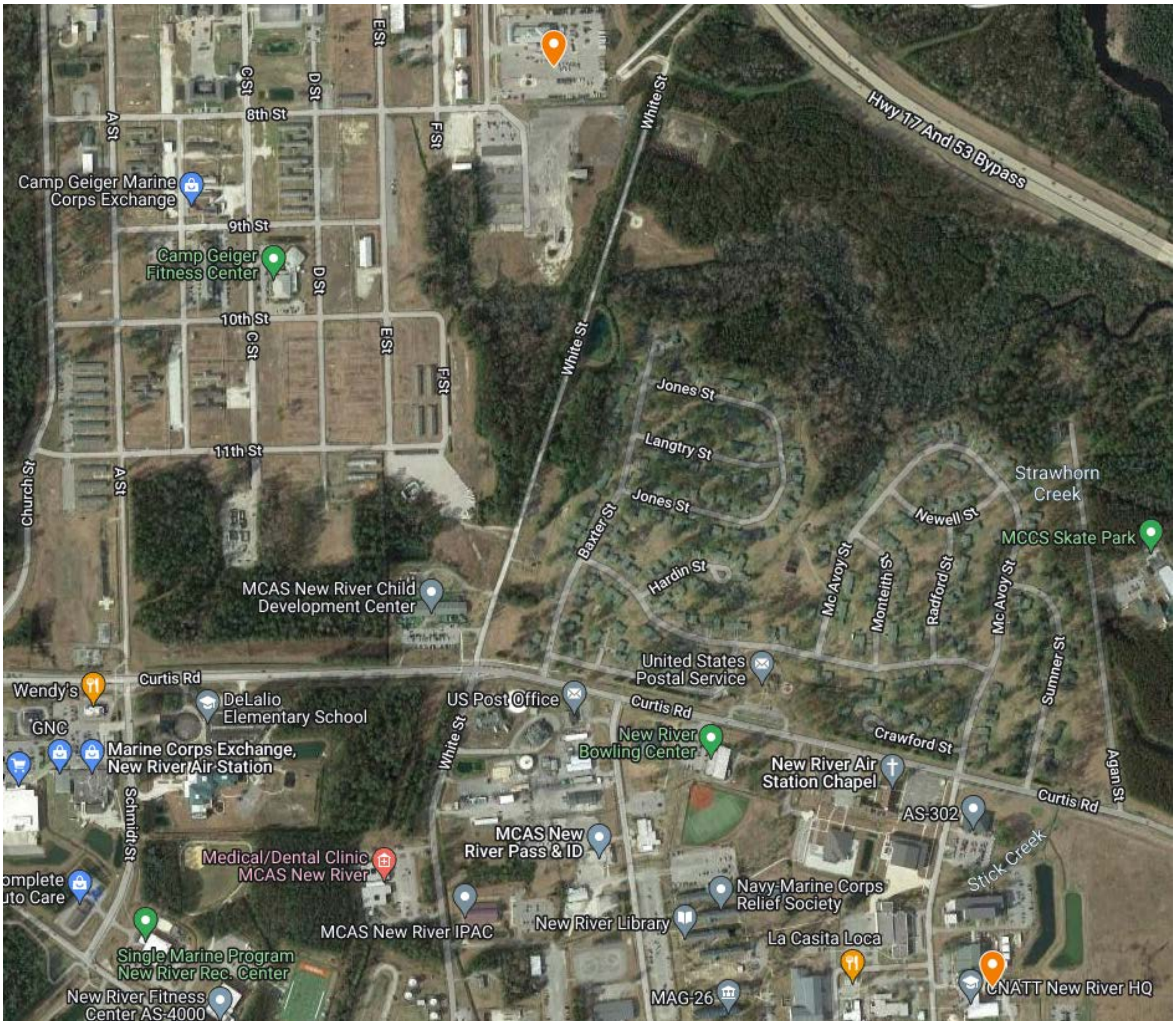

Figure 5. Camp Lejeune Campus Snapshot 2

Source: © 2022 Google

3.1 Building 1005

There are 24 light-duty vehicles based in the Building 1005 parking lot. The MCB Lejeune fleet was considering acquiring 10 plug-in hybrid EVs in FY22 at this location, but has since downgraded its estimate based on budget limitations and a slower replacement cycle.

There is currently a Beam EV ARC skid-mount, dual-port Level 2 EVSE unit with a 4.3-kW solar array and 43-kWh[18] energy storage system installed outside Building 1005. The EV ARC

[18] https://beamforall.com/wp-content/uploads/2021/06/BEAM-EV-ARC-2020-Info-Sheet-v1.1.pdf.

could be moved to another location with an appropriate trailer. Therefore, the Tiger Team planned for EVSE numbers as though the EV ARC were not currently located in this lot.

To accommodate the EVs eventually deployed at Building 1005, the MCB fleet management team and the Tiger Team discussed installing 12 EVSE ports. Daily vehicle utilization data from telematics would enable a better understanding of the number of EVSE ports required at the location.

The Tiger Team recommended installing six Level 2 dual-port pedestal-mount EVSE along the grass outskirts in the parking lot behind Building 1005. The existing parking spaces are about 10 feet across. The EVSE should be equipped with the extended length cord-set (e.g., 23 feet) to reach parking spots beyond those immediately adjacent. With this arrangement, 24 vehicles can be parked within charging proximity to the 12 EVSE ports.

Figure 6. Building 1005 Parking lot with the Beam Charger

Photo by [Ranjit Desai], NREL

Assuming a 95% power factor, 12 ports, 32-A/240-V EVSE, and the 15% capacity cushion required by UFC 3-501-01, transformer capacity must be at least 112 kVA. The next-largest standard single-phase transformer size listed by Schneider Electric is 167 kVA.[19]

The Tiger Team recommends installing a 167-kVA single-phase, pad-mounted transformer, a 100-A single-phase service panel (minimum 24 circuit breakers), and a separate meter. The transformer will be fed by pole number 67177 – 33105, with a primary line running down the pole and underneath the grass directly toward the parking lot.

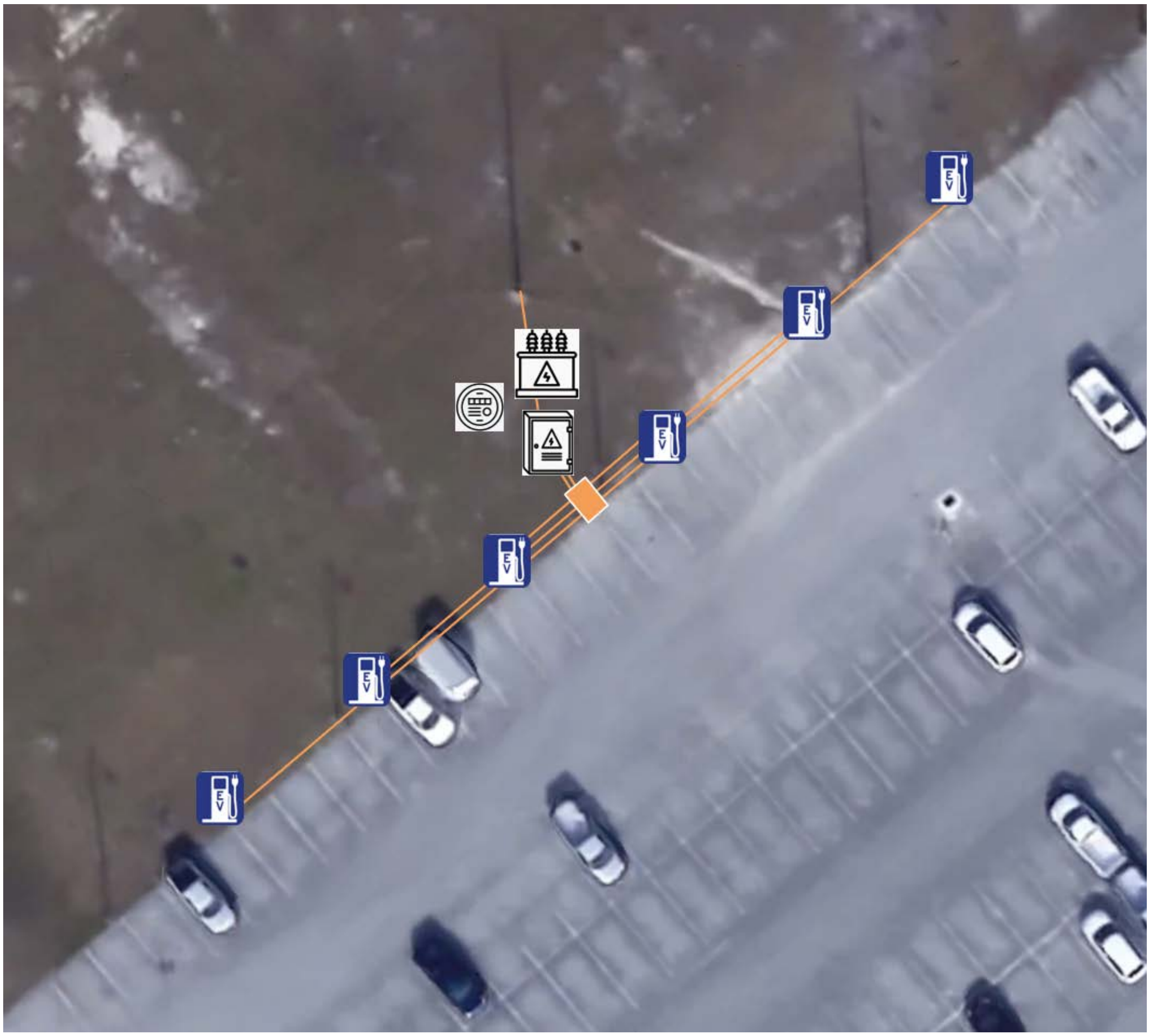

Figure 7. Recommended configuration for Building 1005 EVSE and electrical service

[19] https://www.se.com/us/en/faqs/FA91532/.

Cost Estimate:

The cost estimate is generated using the site assessment conducted by the Tiger Team and the discussions with the stakeholders at Camp Lejeune. Once the number of EVSE ports and type of charger (pedestal or wall-mounted) are decided, the Tiger Team evaluates the site for potential location to install EVSE ports. Further, the transformer capacity is assessed for the potential increase in the electric load as a result of installed EVSEs. After the decision on location of transformer and EVSEs is made, the Tiger Team follows up with calculating the distances. Following these steps, the NEC code is incorporated in the site assessment to finalize the technical specifications like material, AWG (or kcmil), and trade size for conductors and conduits.

Once the quantities and technical specifications are decided, the RSMeans is used along with the DoD Area Cost Factor to estimate the total costs. Lastly, to complete the cost estimate for the site, the project costs are estimated (as described in the Section 1.4). Table 4 and Figure 8 show the cost estimate for the Building 1005. Table 4 shows the costs for each entity, while Figure 8 shows the cost estimate in the incremental cost format.

For each site at Camp Lejeune, the Tiger Team followed the same process and completed the cost estimates.

Table 4. Cost Estimate for Building 1005

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSE: 6 Units	$42,400
Additional Components	$-
Transformer	$10,200
Service Panel	$7,800
Main Circuit Breaker	$7,200
Circuit Breakers	$12,100
Pull Boxes	$1,800
Conduit	$4,600
Conductors	$5,100
Bollards	$-
Wheel Stops	$1,400
Signage Posts	$700
Painting	$-
Others	$10,100
Trenching	$6,000
Project Costs	$71,600
Total	**$181,000**

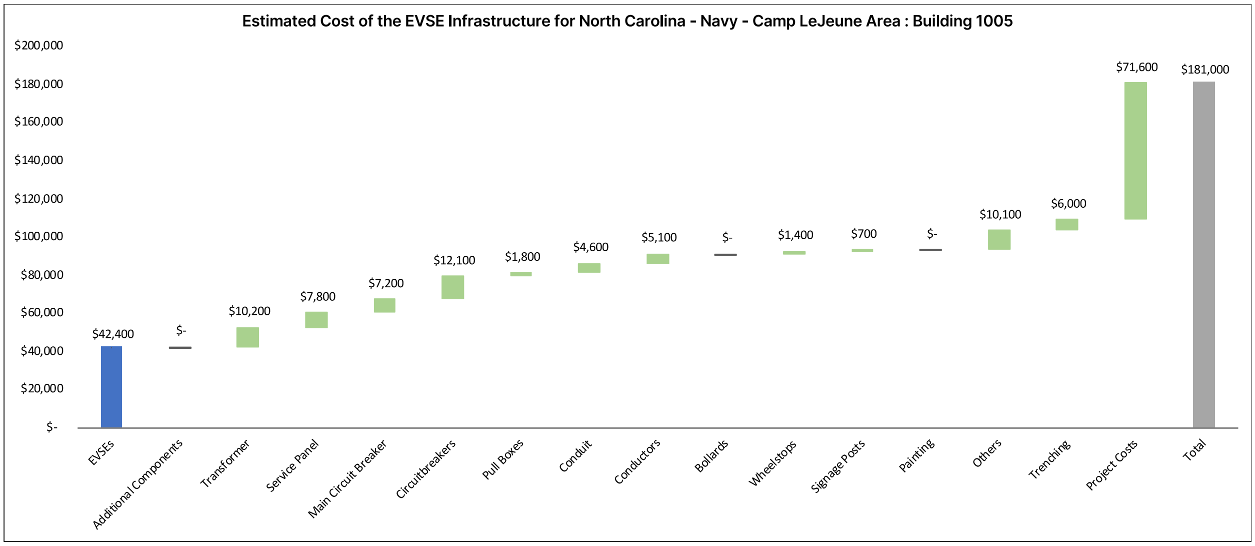

Figure 8. Cost estimate for Building 1005 in incremental costs format

3.2 Building 1110 Ash

There are 14 light-duty vehicles currently parked at 1110 Ash Street along the side of the building (Figure 9). The MCB fleet would like to install a minimum of six EVSE ports.

There is a 100-kVA single-phase transformer and a backup generator next to the north corner of the building (Figure 9). The highest recorded load from the meter reading of the transformer is 21.9 kW, but the reading does not include the summer months and likely higher air conditioning loads. If the air conditioning load patterns mirror the impacts on buildings 1005, 1308, AS302, and 895, then the summer load should be as high as 27 kW. The EVSE power needs for six Level 2 ports at 208-V single-phase should not exceed 42 kW. Accounting for power factors and a 15% capacity cushion, the transformer could still easily supply power to six EVSE ports. Therefore, the Tiger Team recommends tapping the existing transformer, installing a new meter, and a three-phase service panel with a minimum capacity of 240 A to account for the NFPA 70 continuous load requirements and the possibility that all EVSE will charge simultaneously.

Figure 9. Transformer, generator, meter, and panel at the north corner of 1110 Ash Street

Photo by [Ranjit Desai], NREL

The run from the transformer to the first parking spot is approximately 150 feet. The EVSE can be installed in the same arrangement as at Building 1005, where they could serve 12 parking spaces by leaving extra spaces between the EVSE. To keep the EVSE cords from stretching across the concrete walking path, the farther EVSE unit should be installed, as shown in Figure 10. This would lead to a long run to the final spot, totaling 270 feet from the transformer. The required wire gauge would be AWG 8, and the conduit trade size would be 2 inches. However, the Tiger Team recommends that professional engineers be engaged to finalize the designs. The entire distance can be trenched through softscape with minimal boring under the concrete walking path.

Figure 10. Recommended EVSE locations in 1110 Ash Street parking

Photo by [Ranjit Desai], NREL

Figure 11 displays an overhead schematic of the EVSE installation recommended at 1110 Ash Street. The 1110 Ash Street building has been rebuilt since the aerial image was uploaded to Google Earth, so the Figure 11 aerial image does not reflect the current parking lot. The transformer shown is existing, but a new service panel, meter, conduit, and junction box would need to be installed.

Figure 11. Overhead plan for EVSE installation at 1110 Ash Street

Cost Estimate:

Table 5. Cost Estimate for 1110 Ash Street

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSE: 3 Units	$21,200
Additional Components	$-
Transformer	$-
Service Panel	$3,200
Main Circuit Breaker	$1,400
Circuit Breakers	$6,100
Pull Boxes	$5,400
Conduit	$12,000
Conductors	$12,600
Bollards	$-
Wheel Stops	$700
Signage Posts	$400
Painting	$
Others	$9,500
Trenching	$6,100
Project Costs	$51,300
Total	**$129,900**

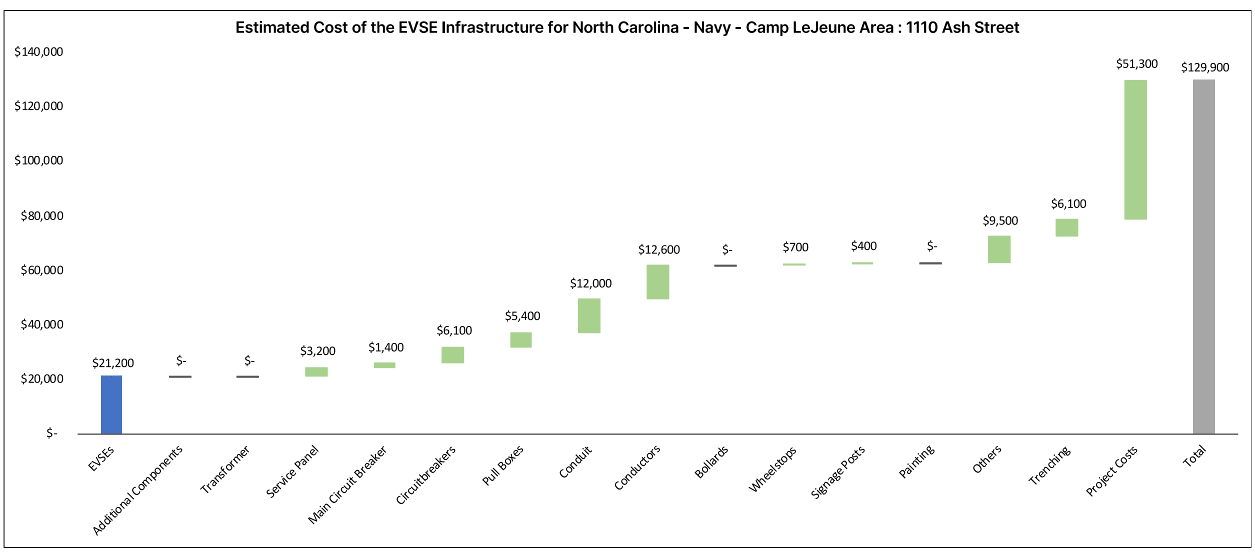

Figure 12. Cost Estimate for 1110 Ash Street in incremental costs format

3.3 Building 1308 Cedar

There are seven light-duty vehicles parked outside Building 1308. The MCB fleet would like to install four EVSE ports to charge those vehicles once transitioned to EVs.

The 75-kVA pole transformer at the corner of Cedar Street and Hammond Street serves Buildings 1308 and the building across the way, identified inconsistently as 1310 and 1204. In either case, Lejeune electrical engineers checked the transformer capacity and deemed it insufficient to accommodate the installation of new EVSE units (Figure 13). The 1310-meter report confirmed that assessment, showing a maximum 2021 capacity of 51.45 kW with a significant load (>20 kW) likely at the adjacent building based on square footage calculations.

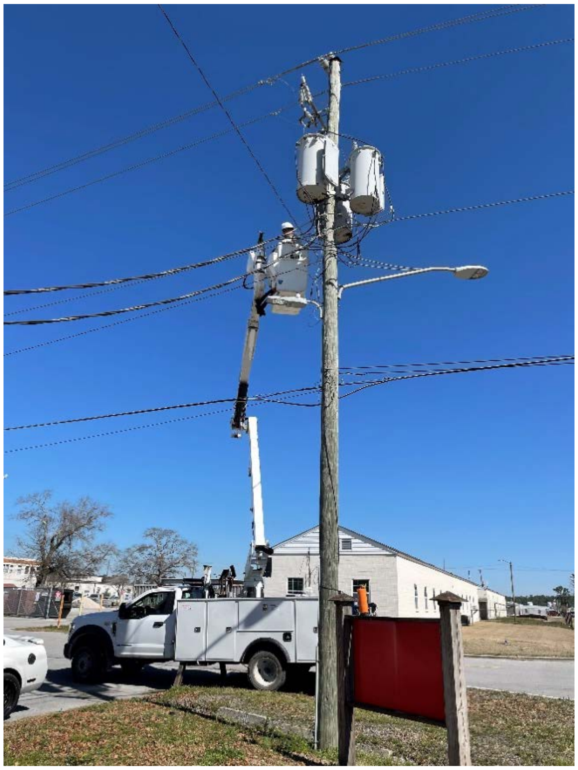

Figure 13. Sam Seaman checking power readings on Building 1308 utility pole

Photo by [Ranjit Desai], NREL

Therefore, the Tiger Team recommends installing a new 37.5-kVA single-phase pole-mounted transformer as close to the 1308 parking lot as possible. A new utility pole with a guy-wire will be necessary as well. Electricity can be pulled from pole 66941 – 33482 and run across E Street to the location where Craig Frank is standing in Figure 14.

Figure 14. Craig Frank standing near the location of prospective new utility pole and transformer

Photo by [Ranjit Desai], NREL

Then the EVSE would be installed along the fence line marked with the orange line in Figure 15. The new primary run will be about 90 feet, and the new secondary run will be 110 feet, including 100 feet of asphalt trenching along the fence line.

Figure 15. Location for EVSE behind Building 1308

Photo by [Ranjit Desai], NREL

In order to accommodate the maximum number of EVs in the 1308 parking lot, the EVSE should be spaced apart like at Building 1005. Dual-port pedestal EVSE units with extended-length cord-sets should be installed. There appears to be a small structure in the middle of the parking lot, in which case two EVSE units would need to be installed on the near side in Figure 15 and one on the far side of the structure. Considering the crowded lot behind Building 1308, the Tiger Team recommends installing protection bollards in addition to the concrete EVSE pads.

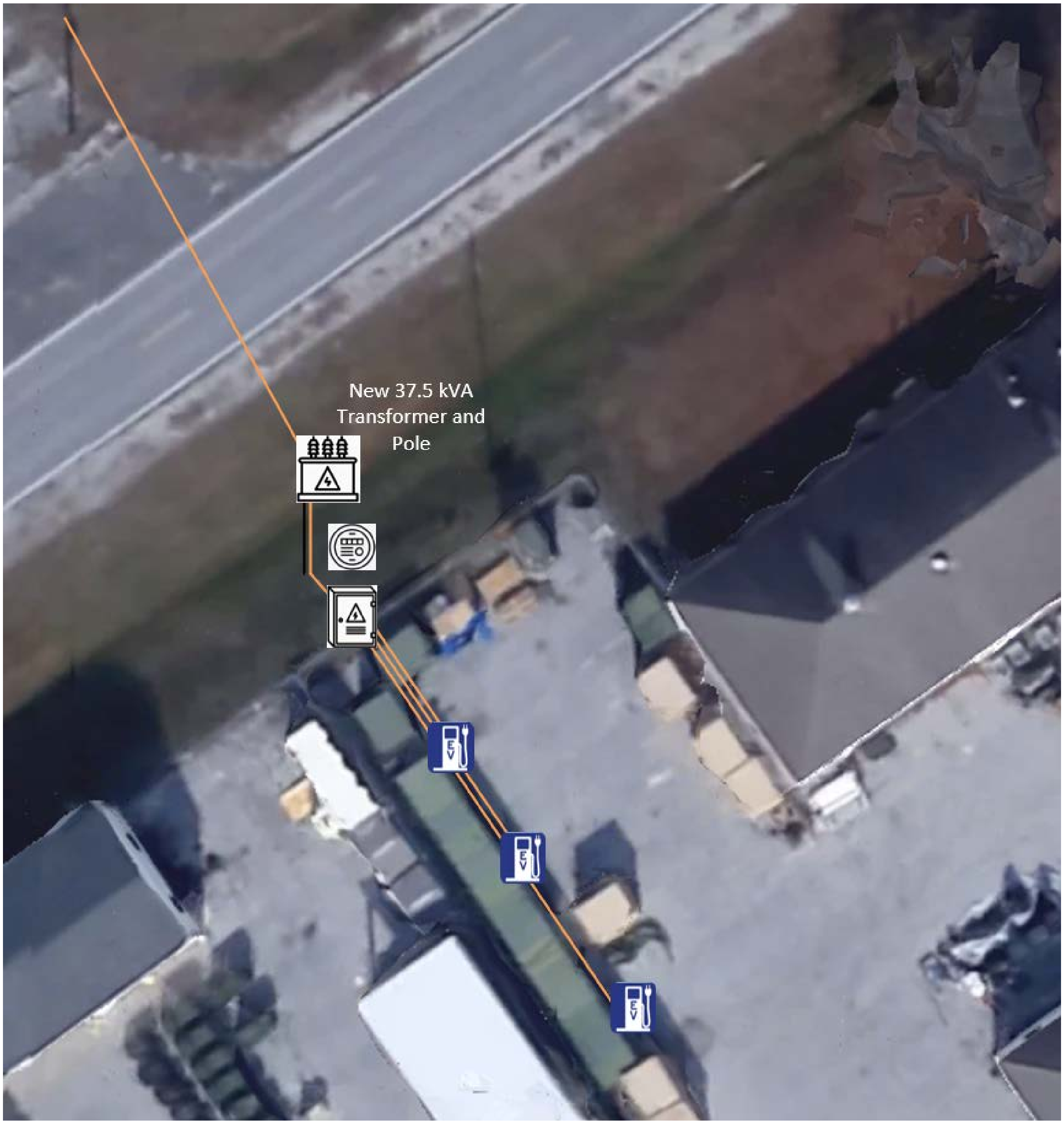

Figure 16. Recommended configuration for Building 1308 EVSE, new pole, and electrical service

Cost Estimate:

This cost estimate does not include the cost to run primary from pole 66941 – 33482 across E Street to the new utility pole. However, the cost estimate includes costs for a wooden utility pole.

Table 6. Cost Estimate for 1308 Cedar Street

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSE: 3 Units	$21,200
Additional Components (Utility Pole)	$18,300
Transformer	$6,200
Service Panel	$3,200
Main Circuit Breaker	$1,400
Circuit Breakers	$6,100
Pull Boxes	$3,600
Conduit	$6,000
Conductors	$7,300
Bollards	$1,300
Wheel Stops	$-
Signage Posts	$400
Painting	$-
Others	$9,500
Trenching	$6,100
Project Costs	$59,200
Total	**$149,700**

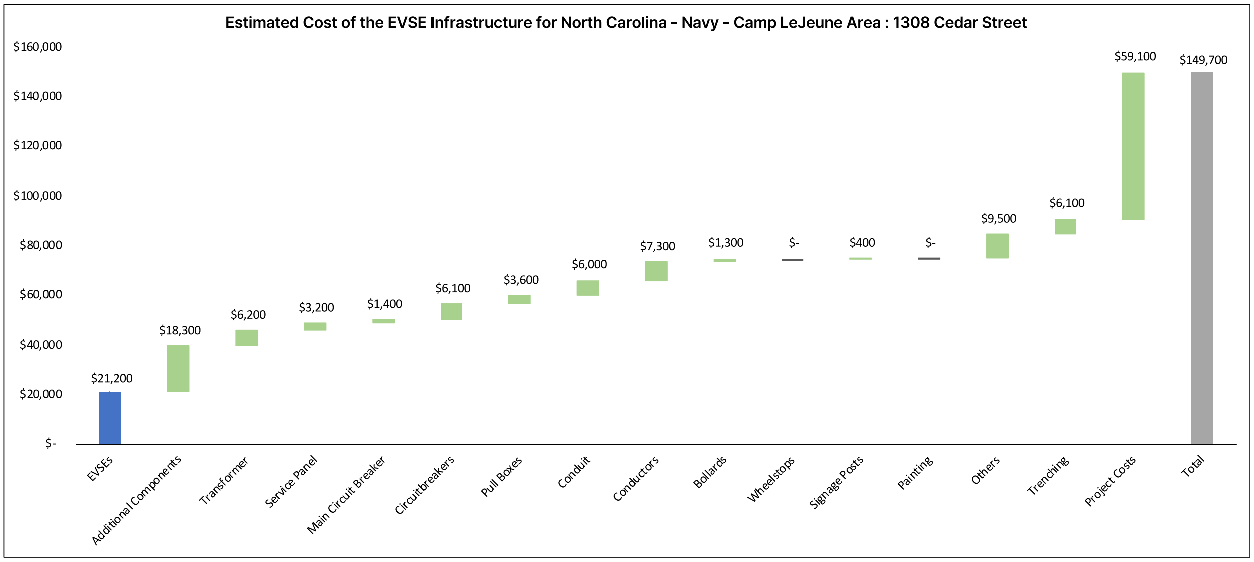

Figure 17. Cost estimate for 1308 Cedar Street in incremental costs format

3.4 Building 1407 Dogwood Bus Lot

There are approximately 35 light-duty vehicles parked in the Building 1407 Dogwood Bus Lot. There are additional medium and heavy-duty vehicles parked in the lot that may eventually transition to EVs, although there are no plans to electrify these vehicles in the near future. There is currently a portable solar-powered EVSE unit in the Dogwood lot. However, the Tiger Team was instructed to analyze the lot as though the EVSE did not exist because it could be moved to another location where no new charging stations would be installed.

The MCB fleet team expressed interest in 18 EVSE ports to support an electric fleet at that location. They hoped that telematics data would be available to make that determination, but currently, the MCB telematics reports do not contain a sufficient degree of specificity for the NREL team to make an assessment. Therefore, the Tiger Team recommends installing sufficient power capacity to service 32 EVSE ports in the future but only installing 18 ports through the upcoming project.

The existing service is not sufficient for 18 or 32 EVSE ports. In order to accommodate that large load, a new 300 kVA single-phase transformer should be installed at the north corner of the parking lot at the intersection of Dogwood Street and Hammond Road, pulling primary power off of the utility pole 66799 - 33471, shown in Figure 18.

Figure 18. Utility pole at the north corner of the Dogwood Bus Lot

Photo by [Ranjit Desai], NREL

The parking lot is large, with a significant amount of parking in the middle and at the edges. The Tiger Team recommends prioritizing EVSE installation along the grass edges of the lot to eliminate asphalt trenching and reduce the risk of drivers crashing into EVSE. The lot is approximately 350 feet deep along the path of the orange line shown on the right side of Figure 19. As many as 32 EVSE ports (16 pedestals) could be installed along that line, although it would not provide space for empty parking spots between the EVSE. While only 18 EVSE ports (9 pedestals) will being installed in the near future, they should be spaced to accommodate additional EVSE in the future along the grass shown in Figure 19. Dual-pedestal EVSE with the typical length cords would suffice in this case. That way, more EVSE ports could be installed along the northeast edge of the parking lot before any need to be installed in the middle of the lot.

Figure 19. Building 1407 Dogwood parking lot

Photo by [Ranjit Desai], NREL

Figure 20 illustrates the recommended locations for installing the new service transformer, meter, two 400-A three-phase panels, and one 600-A three-phase panels, along with 16 dual-port EVSE units providing 32 charging ports. The Google Earth imagery does not reflect the current parking configuration in the 1407 Dogwood parking lot. As shown in Figure 19, light-duty vehicles are now parked along the northwest side of the lot abutting the grass in a single lane, and other light-duty vehicles are now parked in the middle of the lot that had formerly served as a bus driving lane.

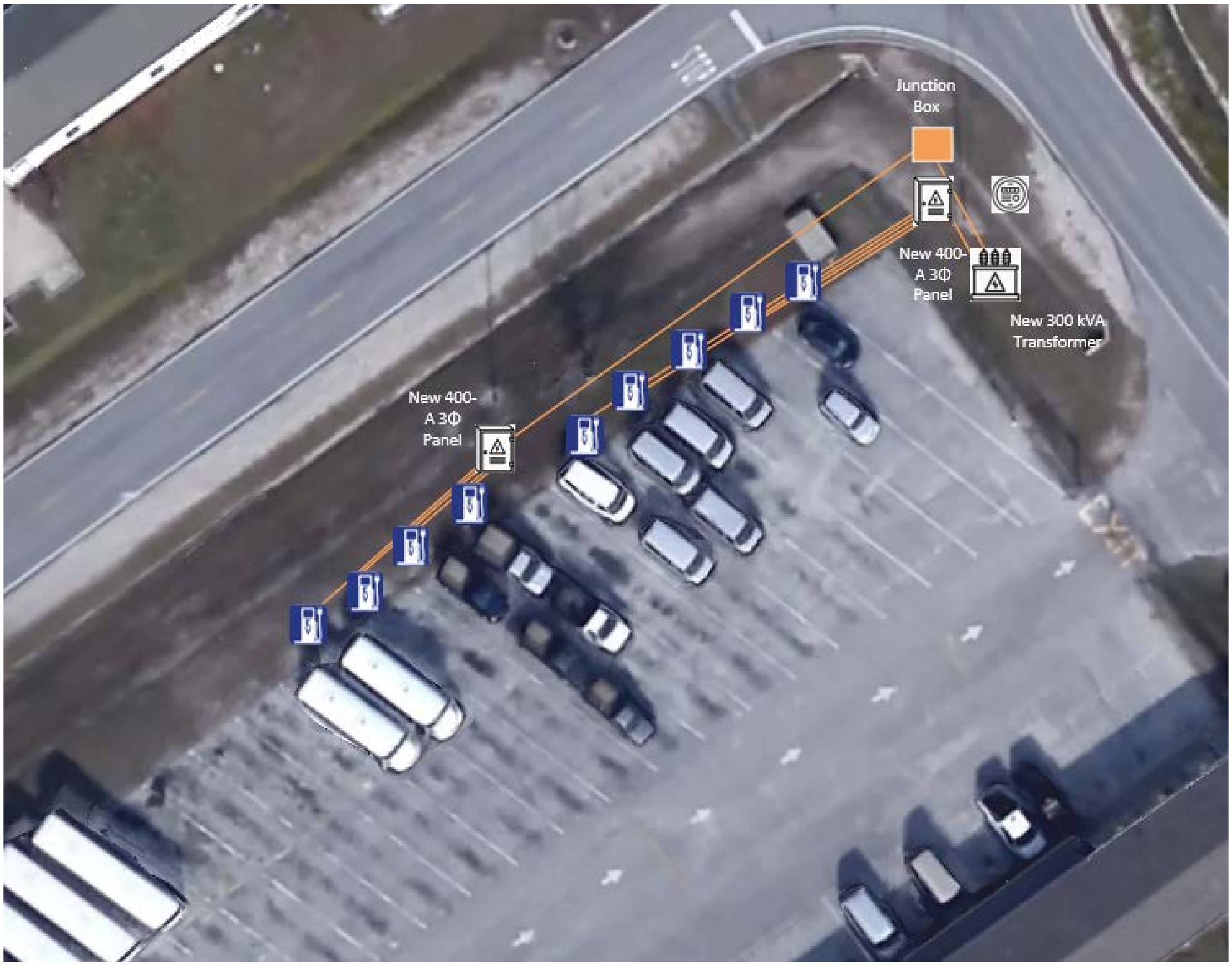

Figure 20. Recommended configuration for 1407 Dogwood EVSE and electrical service

Cost Estimate:

Table 7. Cost Estimate for 1407 Dogwood Bus Lot

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSE: 9 Units	$63,600
Additional Components	$-
Transformer	$43,900
Service Panel	$7,800
Main Circuit Breaker	$14,400
Circuit Breakers	$18,100
Pull Boxes	$17,800
Conduit	$54,000
Conductors	$55,900
Bollards	$-
Wheel Stops	$2,100
Signage Posts	$1,000
Painting	$600
Others	$11,200
Trenching	$6,100
Project Costs	$194,000
Total	**$490,100**

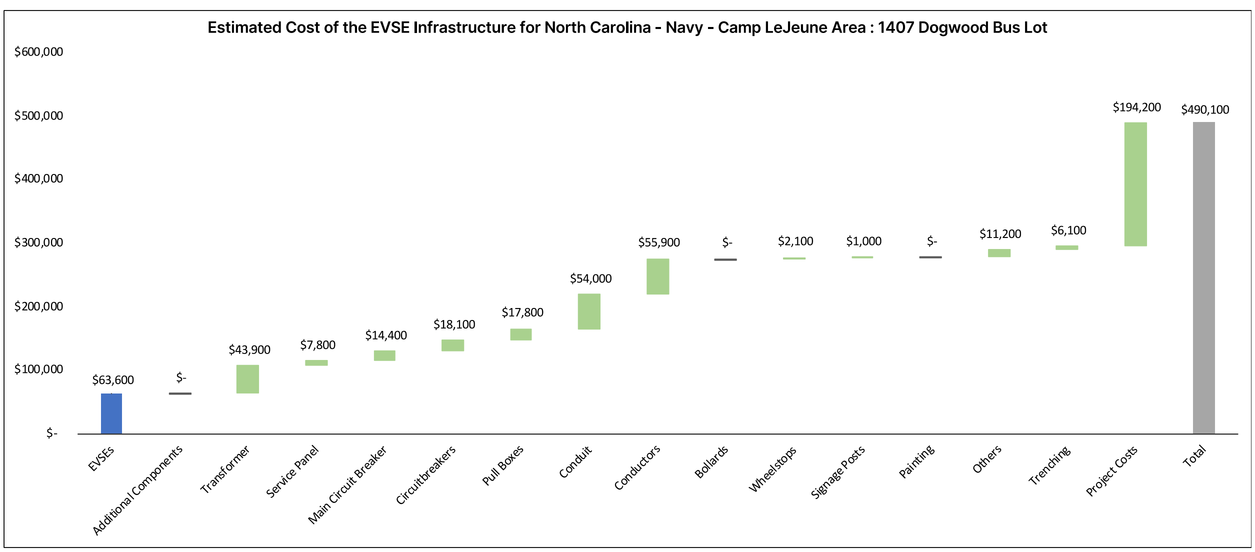

Figure 21. Cost Estimate for 1407 Dogwood Bus Lot in incremental costs format

3.5 Lot 200 Holcomb Boulevard

There are 13 light-duty vehicles parked in Lot 200 on Holcomb Boulevard next to Building 873. The Tiger Team discussed installing six EVSE units. Additional telematics data was not available to refine the analysis. Moreover, there is a covered parking structure in Lot 200 with a newer concrete slab. The high section of the roof appears to be in disrepair, but the wooden poles supporting it appear solid (Figure 22). The rest of the lot is large and gravel, with ample space for additional parking.

Single-port, wall-mounted Level 2 EVSE should be acquired for this location because they are generally less expensive to purchase and install than pedestal-mounted units. The EVSE can be hung directly on the structure poles, as illustrated in Figure 22, with the further right EVSE being placed between spots to provide access to up to nine EVs in the future.

Figure 22. Lot 200 parking structure

Photo by [Ranjit Desai], NREL

There is no meter data for Building 873, and the only transformer rating gathered at the site was a 10-kVA single-phase pole-mounted unit. At least 56 kVA is required to power the 6 EVSE ports at 240-V single-phase, and the next largest transformer size listed by Schneider Electric is 75 kVA. A 75-kVA transformer could be mounted on pole 68670 – 32672 on the other side of the fence. This construction will require trenching 80 feet through the gravel and 140 feet cutting through the concrete pad to run conduit and conductors. Figure 23 illustrates the recommended configuration.

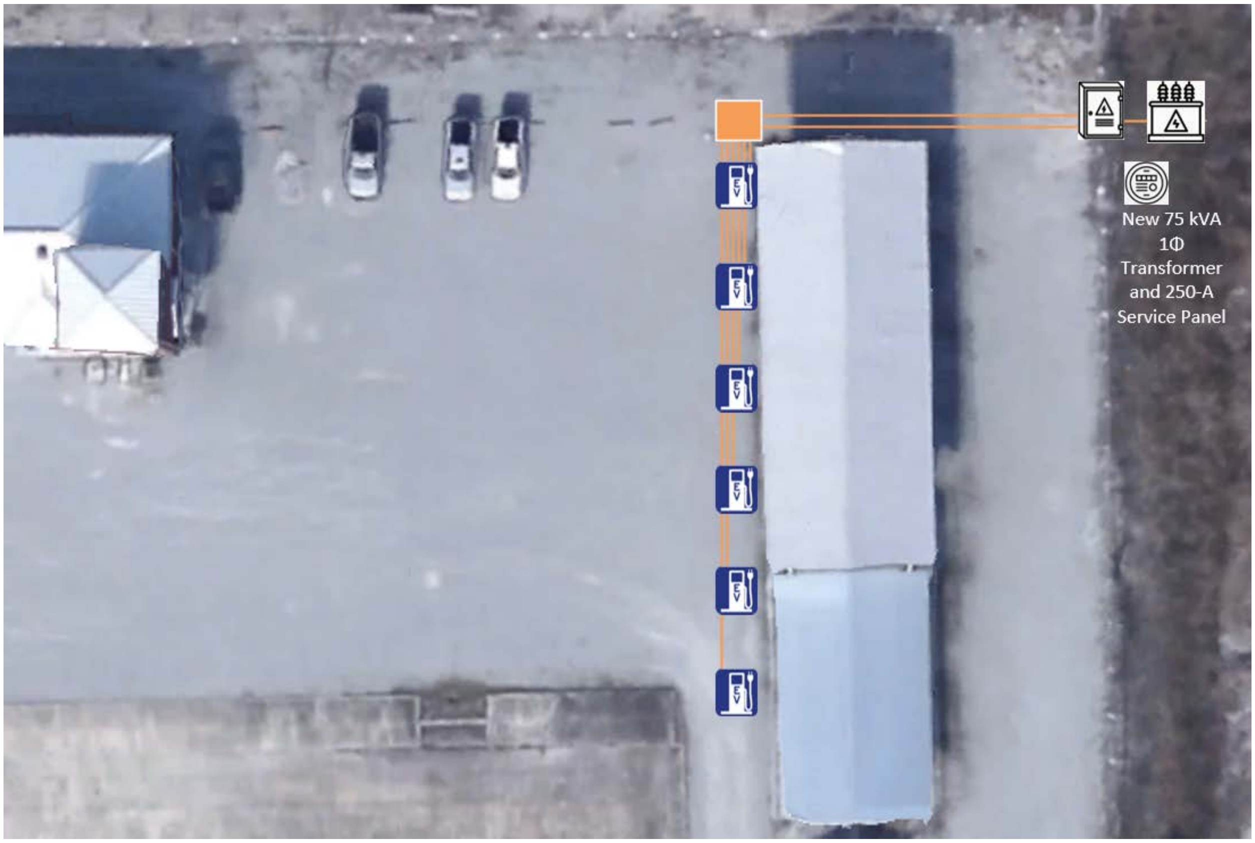

Figure 23. Recommended configuration for Lot 200 EVSE and electrical service

It would be over $1,000 cheaper to install EVSE on the backside of the parking structure (Figure 24). The cost difference is due to the shorter runs (approximately 35 feet per conductor and conduit and correspondingly shorter trench). However, all vehicles in Lot 200 currently park with their noses toward the front of the structure, and most EVs, including the Ford F-150 Lightning, have charging ports on the front of their vehicles.

Figure 24. The backside of Lot 200 parking structure

Photo by [Ranjit Desai], NREL

Cost Estimate:

Table 8. Cost Estimate for Lot 200 Holcomb Blvd.

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSE: 6 Units	$26,200
Additional Components	$-
Transformer	$6,200
Service Panel	$3,200
Main Circuit Breaker	$1,400
Circuit Breakers	$6,100
Pull Boxes	$3,600
Conduit	$7,500
Conductors	$5,300
Bollards	$-
Wheel Stops	$700
Signage Posts	$400
Painting	$-
Others	$5,300
Trenching	$5,900
Project Costs	$46,800
Total	**$118,600**

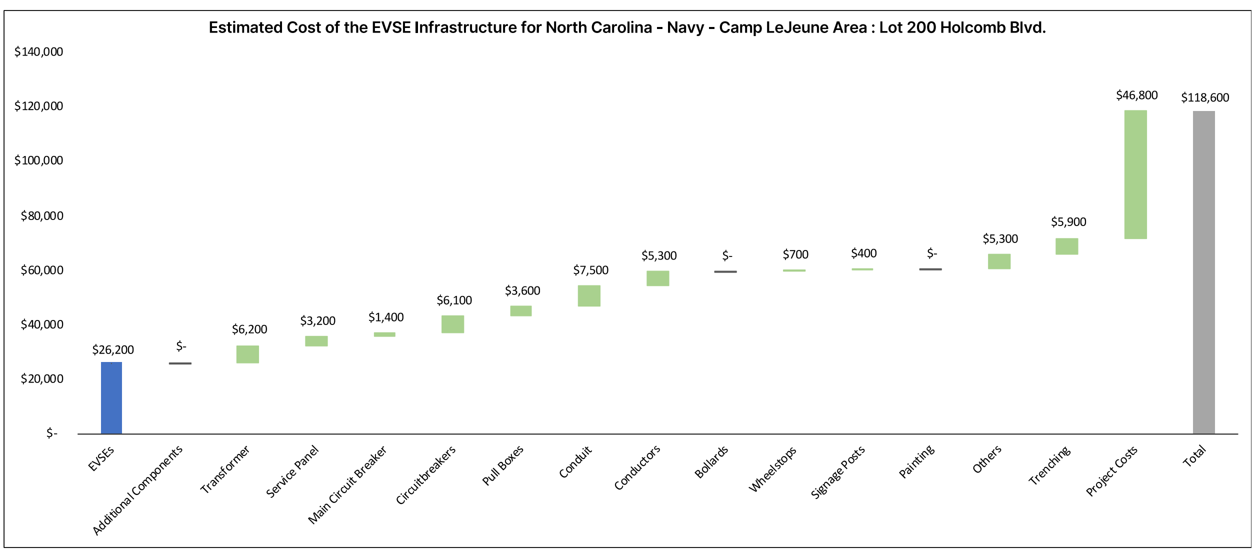

Figure 25. Cost Estimate for Lot 200 Holcomb Blvd. in incremental costs format

3.6 Building 25 Cross Street

Building 25 Cross Street is a secure location. There are six light-duty vehicles parked in the lot, and there is a Beam EV ARC solar charging unit in the parking lot, but the Tiger Team was instructed to prepare an assessment as though the EV ARC were not present because it could be moved. The team discussed installing four EVSE ports in the lot.

There is a 300-kVA three-phase transformer in the parking lot with sufficient capacity for two dual-port pedestal EVSE units. The recommended configuration of tapping the existing transformer and installing a new 200-A three-phase service panel is shown in Figure 26. The EVSE should be installed between spots with extended length charging cords to accommodate additional EVs. The first EVSE will be about 10 feet from the new service panel, and the second EVSE unit will be about 30 feet from the panel.

Figure 26. Recommended configuration for Building 25 EVSE and electrical service

Cost Estimate:

Table 9. Cost Estimate for Building 25 Cross Street

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSE: 2 Units	$13,300
Additional Components	$-
Transformer	$-
Service Panel	$3,200
Main Circuit Breaker	$1,400
Circuit Breakers	$4,100
Pull Boxes	$1,800
Conduit	$900
Conductors	$1,100
Bollards	$-
Wheel Stops	$500
Signage Posts	$300
Painting	$-
Others	$7,200
Trenching	$4,600
Project Costs	$24,800
Total	**$63,200**

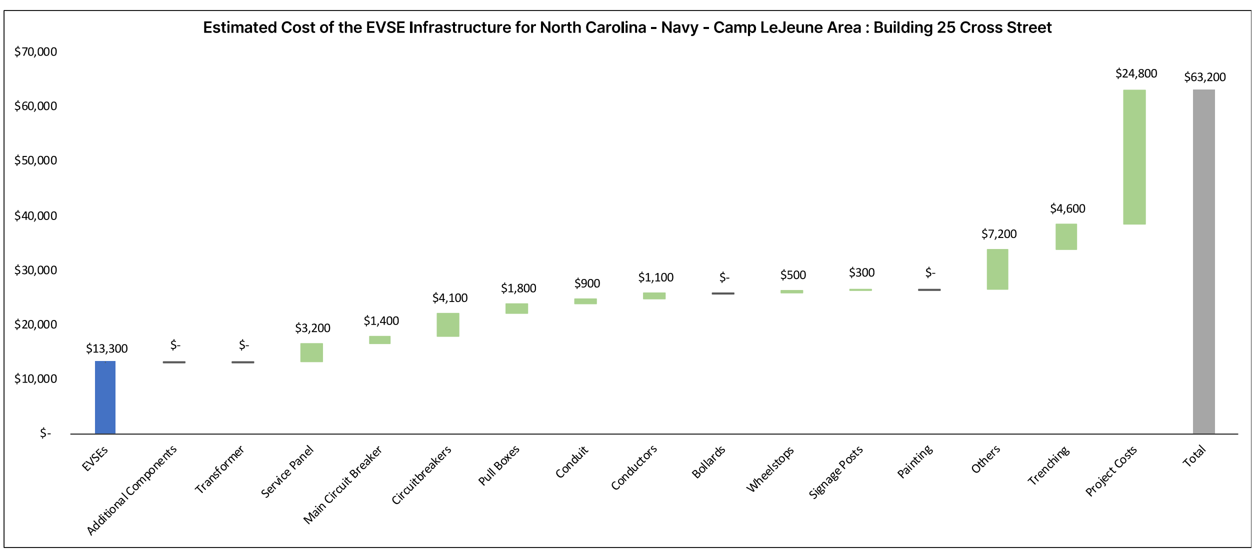

Figure 27. Cost Estimate for Building 25 Cross Street in incremental costs format

3.7 Building 773

There are 18 light-duty vehicles in the Building 773 parking lot. The Tiger Team discussed installing 10 EVSE ports in the form of 5 dual-port pedestal units in the back of the lot (Figure 28).

Figure 28. Building 773 parking lot location for EVSE (Pole Number 73243-45015)

Photo by [Cabell Hodge], NREL

A new single-phase 100-kVA pad-mount transformer will need to be installed to supply power to the EVSE. The primary run down the pole and to the new transformer is approximately 50 feet, and the first EVSE will be installed 15 feet from there. The EVSE should be installed between spots with extended length charging cords to accommodate additional EVs (Figure 29).

Figure 29. Recommended configuration for Building 773 EVSE and electrical service

Cost Estimate:

Table 10. Cost Estimate for Building 773

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSEs	$35,400
Additional Components	$-
Transformer	$7,000
Service Panel	$7,800
Main Circuit Breaker	$7,200
Circuit Breakers	$10,100
Pull Boxes	$3,600
Conduit	$9,300
Conductors	$9,700
Bollards	$-
Wheel Stops	$1,200
Signage Posts	$600
Painting	$-
Others	$9,500
Trenching	$5,400
Project Costs	$69,700
Total	**$176,600**

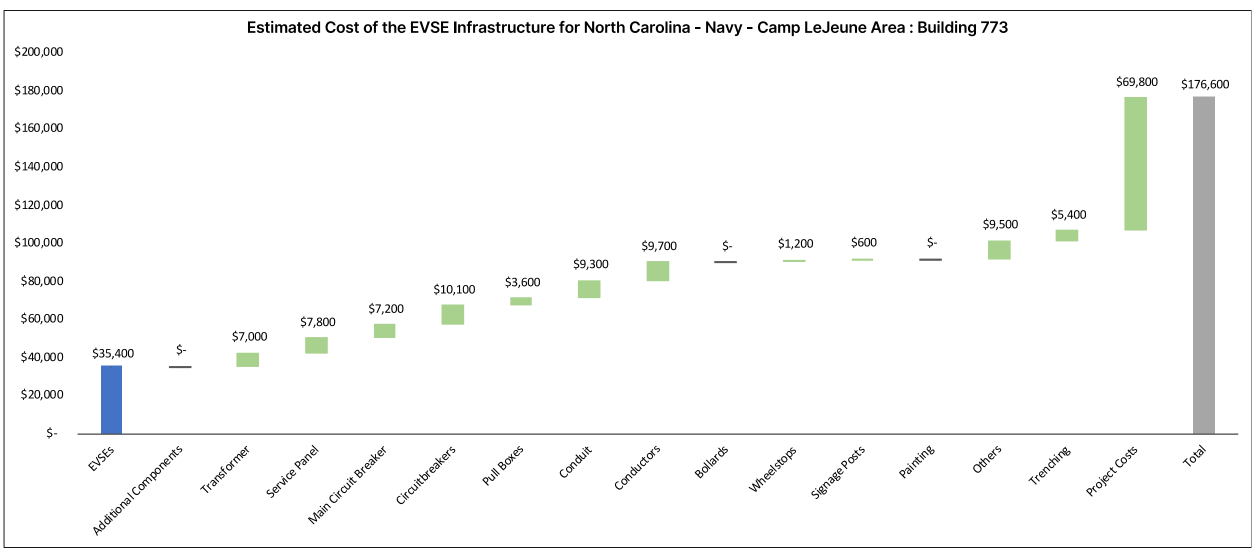

Figure 30. Cost Estimate for Building 773 in incremental costs format

3.8 Building AS-302 Police Station

There are 15 light-duty vehicles parked in the AS-302 lot. The Tiger Team discussed installing eight Level 2 EVSE ports in the parking area. There is a 500-kVA 12470 primary/208-Y secondary transformer behind AS-302 (Figure 31), and the peak monthly demand at that building was 82.8 kW in calendar year 2021. Therefore, the existing transformer could easily supply power to eight Level 2 EVSE ports (53.25 kW/56 kVA with a conservative 95% power factor). A new 400-A three-phase service panel and the meter should be installed to supply the EVSE separately.

Figure 32 displays the recommended configuration for the EVSE to avoid trenching through the parking lot and maximize the reach of the EVSE ports. All EVSE should be dual-port Level 2 pedestal units with extended-length cord-sets. The transformer icon in Figure 32 represents the existing transformer shown in E; the service panel and meter need to be installed. The run to the first EVSE is approximately 75 feet, and the run to the final EVSE is about 200 feet.

Figure 31. Transformer, panels, and generator behind AS-302

Photo by [Ranjit Desai], NREL

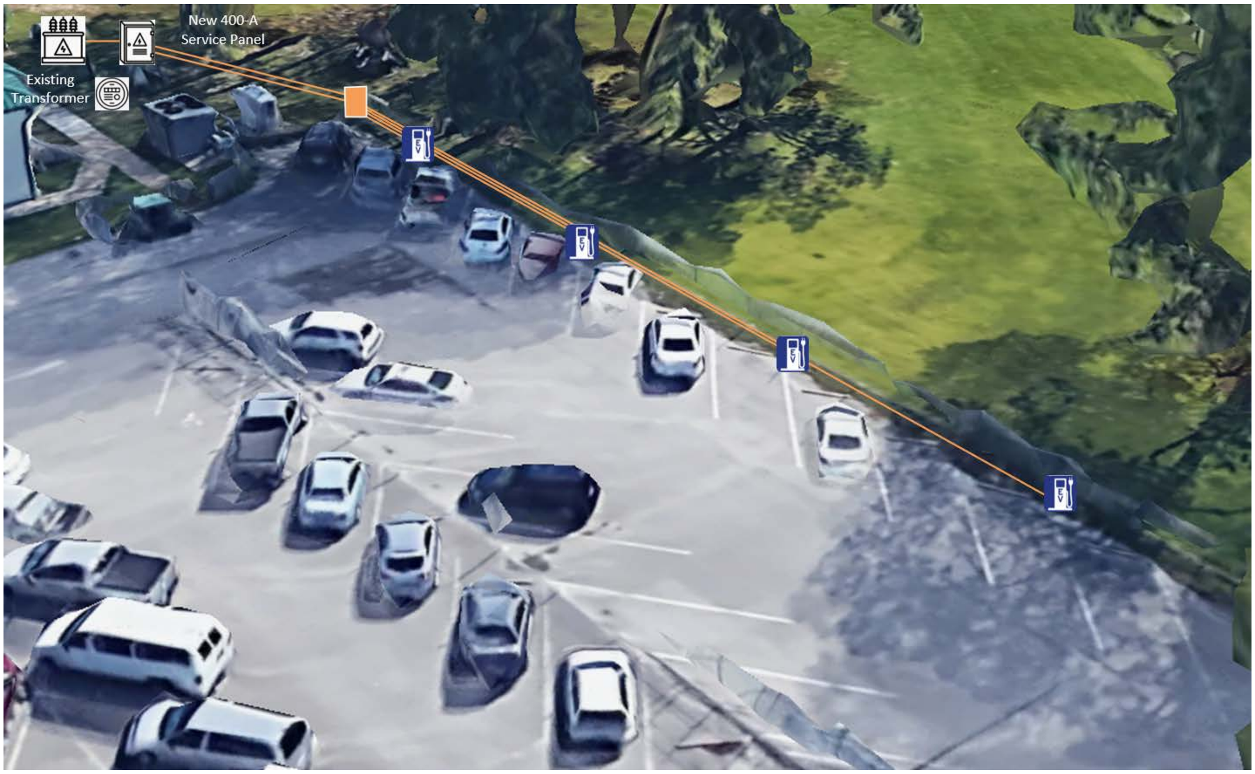

Figure 32. Recommended configuration for AS-302 EVSE and electrical service

Cost Estimate:

Table 11. Cost Estimate for Building AS-302

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSE: 5 Units	$35,400
Additional Components	$-
Transformer	$-
Service Panel	$7,800
Main Circuit Breaker	$7,200
Circuit Breakers	$10,100
Pull Boxes	$3,600
Conduit	$9,300
Conductors	$9,700
Bollards	$-
Wheel Stops	$1,200
Signage Posts	$600
Painting	$-
Others	$9,500
Trenching	$5,400
Project Costs	$65,300
Total	**$165,100**

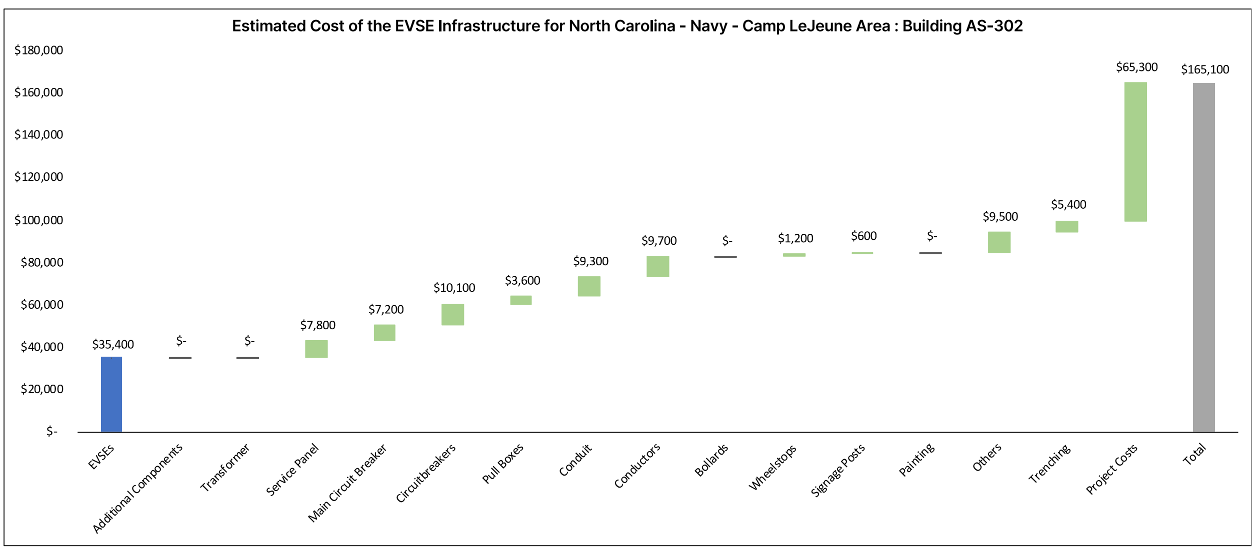

Figure 33. Cost estimate for Building AS-302 in incremental costs format

4 USCG Lejeune Sites

The USCG manages approximately 59 vehicles at about 7 locations on Camp Lejeune. The Tiger Team only assessed the parking lots at B-328, B-329, and near the barracks. USCG would like to take a different approach than MCB Lejeune to installation, POV charging as well as network solutions. USCG plans to install sufficient electrical capacity, conduit, wiring, and stubs for their long-term EV needs. However, they only want to install enough EVSE units for near-term needs, revisiting EVSE quantities every year or two. USCG would also like to allow POVs to use fleet EVSE when GOVs are not in use. This will likely be managed by signage restricting POVs from parking in GOV spots past a specific time, such as 4:30 p.m. In order to bill employees for the cost of electricity, USCG would like to use a networked charging solution that allows employees to charge POVs using a third-party mobile application.

4.1 Analyzing the Number of EVSE Ports Required

USCG provided daily driving and idling data on 35 of these vehicles. Each vehicle had 238 to 420 days of data associated with it. The NREL team analyzed these vehicles by location to determine the number of EVSE units required to support them if all 35 transitioned to EVs. These numbers were then multiplied by the number of total vehicles at the locations analyzed.

To determine the number of EVSE units needed by garage location, the Tiger Team developed a new version of EVI-Ratio, the model developed in the "Fleet Electrification Feasibility Study for the Department of Homeland Security" (Hodge et al. 2021).[20] EVI-Ratio institutes a rule that drivers only plug in their EVs when their state of charge falls below 80% (e.g., 181 miles for a 226-mile rated Nissan Leaf). This is an example of the analysis shown in the report mentioned above:

> "These assumptions and telematics data detailing daily vehicle miles traveled help determine the coincident charging load at each [garage]. The example garage in Figure 31 displays daily metrics for each vehicle's cumulative miles traveled since the last charge session on the left axis and the number of charging ports required on the right axis. The cumulative charge element of this figure is most prominent when Vehicle 2 travels 48 miles on December 20, leaving the vehicle with an 81% state of charge until it again drives 49 miles on December 28, dropping the vehicle below 80% and requiring a single charge session. Compare this to January 29, which is the only day in this period where simultaneous charging in the garage requires four EVSE units on the same day due to a large number of fleet vehicles traveling on the same day. This contrasts with January 9, where the total garage vehicle miles traveled exceeded that of January 29; only one charger was needed because most of the driving occurred in one vehicle."

[20] Hodge, Cabell, Jesse Bennett, Mark Singer, and David Lovullo. 2021. Fleet Electrification Feasibility Study for the Department of Homeland Security. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5400-80493.

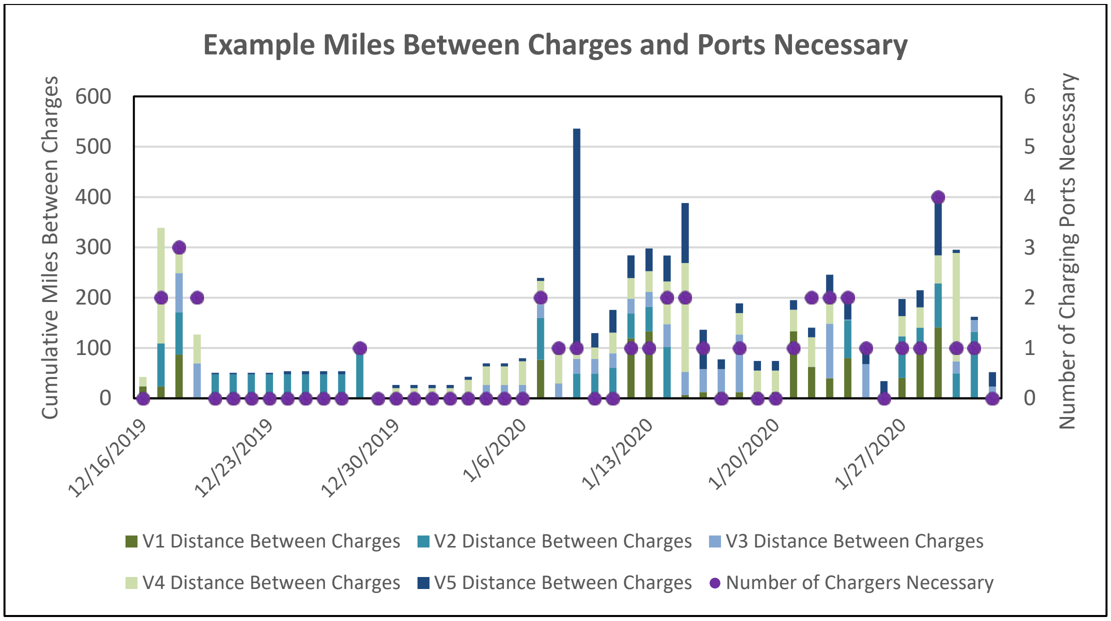

Figure 34. Coincident charging considerations, for an example garage

Source: Hodge et al. 2021[21]

The NREL Tiger Team analyzed the vehicles with telematics data provided by USCG and arrived at the ratios in Table 12. The weighted ratio of EV: EVSE in this dataset was 1.52:1. A larger dataset analyzed with DHS vehicles identified a weighted ratio of 1.41:1. In addition, the team identified how frequently the maximum number of EVSE ports would be required. This weighted average was 3.01% of all calendar days. Figure 35 depicts the frequency of daily distance traveled with a box-and-whisker plot for typical distances and dots representing outlier days.

[21] Hodge, Cabell, Jesse Bennett, Mark Singer, and David Lovullo. 2021. Fleet Electrification Feasibility Study for the Department of Homeland Security. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5400-80493. Internal report.

Table 12. Ratio of EV:EVSE for Vehicles Analyzed

Garage	Vehicles Analyzed	EVSE for Vehicles Analyzed	Ratio of EV: EVSE	Frequency of Maximum EVSE Needed
BB-326	1	1	1.00	11.21%
BB-327	1	1	1.00	6.92%
BB-328	7	6	1.17	0.66%
BB-329	15	4	3.75	0.58%
BB-329/USCG BARRACKS	6	6	1.00	2.24%
BB-54* SEE EXPANSION PLAN	1	1	1.00	7.69%
BB-6	1	1	1.00	15.98%
USCG BARRACKS	2	2	1.00	1.74%
USCG SMTD-EAST	1	1	1.00	33.33%
Total	35	23	1.52	3.01%

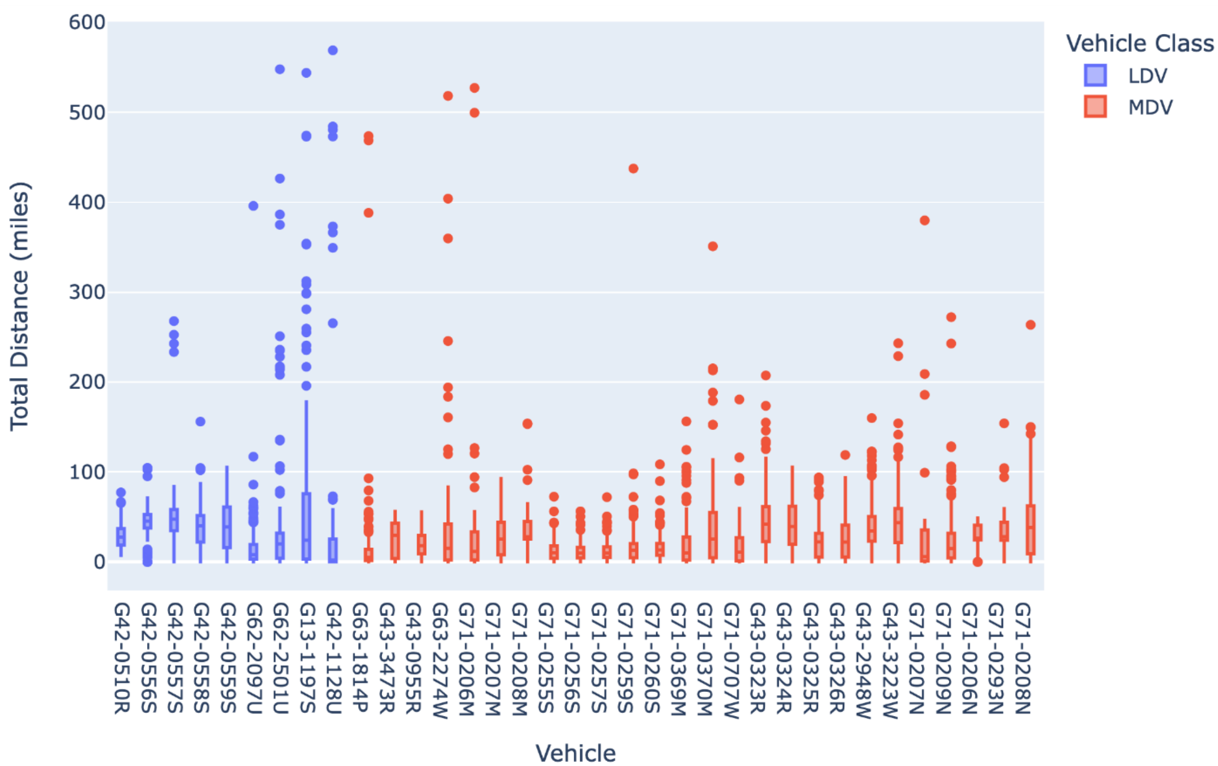

Figure 35. Frequency of daily distance traveled (in miles) by USCG vehicles

4.2 Building B-328

There are nine vehicles typically parked in the lot at Building B-328. Telematics data was available for seven of these vehicles, and as many as six vehicles would need charging in a given night if all transitioned to EVs. Holding the ratio steady and rounding up to the nearest whole number, eight EVSE units are required to ensure that the EVs have sufficient charging at Building B-328.

The Tiger Team discussed installing a new transformer in the Building B-328 parking lot. For the number of EVs and a capacity cushion of 15%, a 75-kVA transformer is recommended, preferably single-phase to provide maximum power to the EVSE at 240 V. There is already a set of transformers on the nearest pole. Therefore, the Tiger Team recommends installing a slack span 15 feet across to a new pole and installing a 75-kVA single-phase transformer on the new pole. Then a meter and 400-A single-phase service panel on the ground near the EVSE units. The run to the panel will be about 35 feet (pole number: 58295-35962), the nearest EVSE is approximately 10 feet from there, and the farthest EVSE will be approximately 75 feet.

In order to match the USCG phased approach, two dual-port EVSE units can be installed in the first construction project along with conduit and stubs to two more dual-port EVSE units to be installed at a later date. All EVSE at B-328 should have payment processing and authorization capabilities.

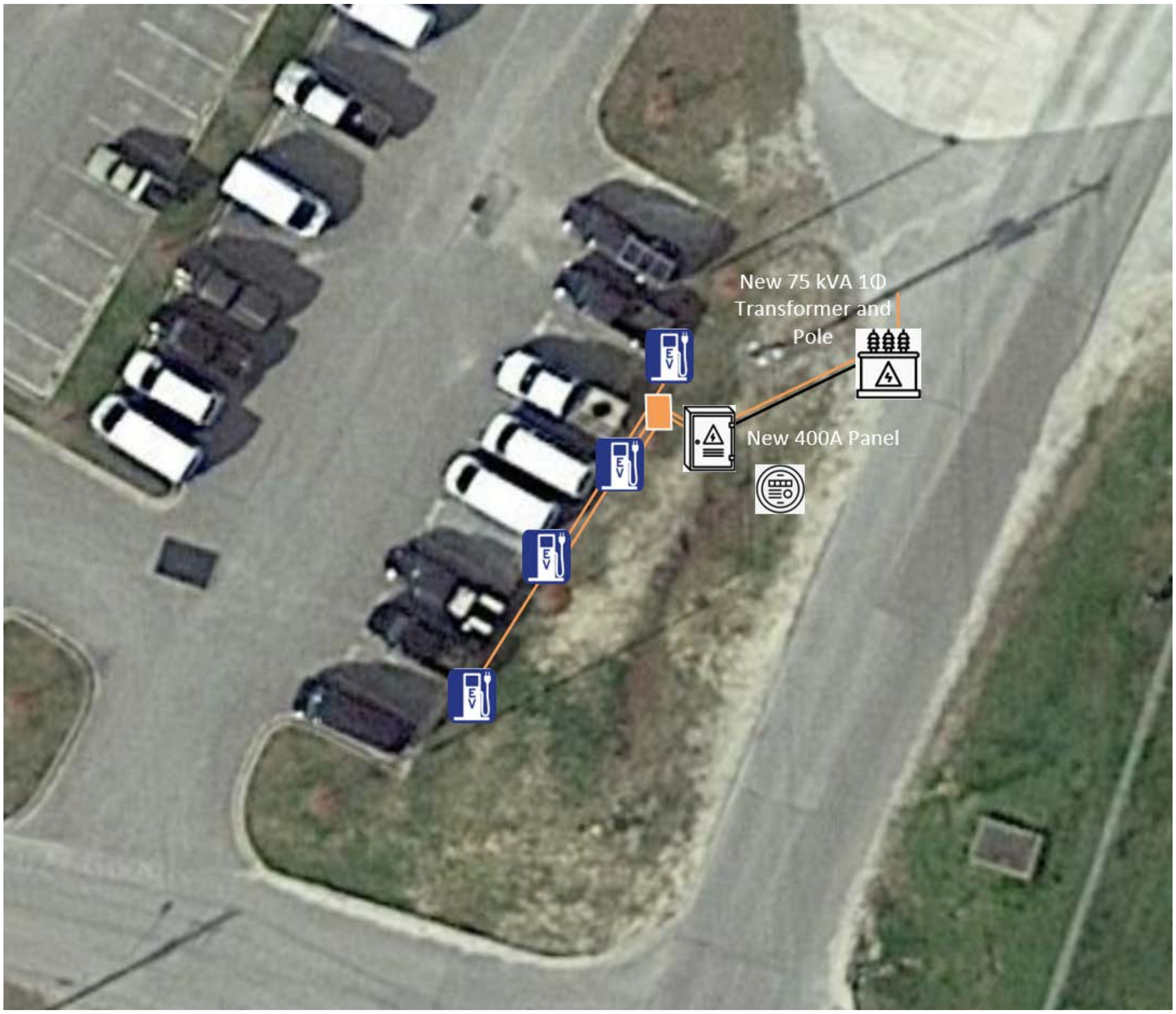

Figure 36. Schematic for Building B-328

Cost Estimate:

This cost estimate does not include the cost of running primary from pole 58295-35962 to a new pole, but it includes the new pole, transformer, and all equipment installed on the secondary side.

Table 13. Cost Estimate for Building B-328

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSE: 2 Units	$14,200
Additional Components (Utility Pole)	$18,300
Transformer	$6,200
Service Panel	$3,200
Main Circuit Breaker	$1,400
Circuit Breakers	$4,100

Entity	Component Costs
Pull Boxes	$1,800
Conduit	$4,600
Conductors	$5,100
Bollards	$-
Wheel Stops	$500
Signage Posts	$300
Painting	$-
Others	$8,100
Trenching	$5,200
Project Costs	$47,500
Total	**$120,500**

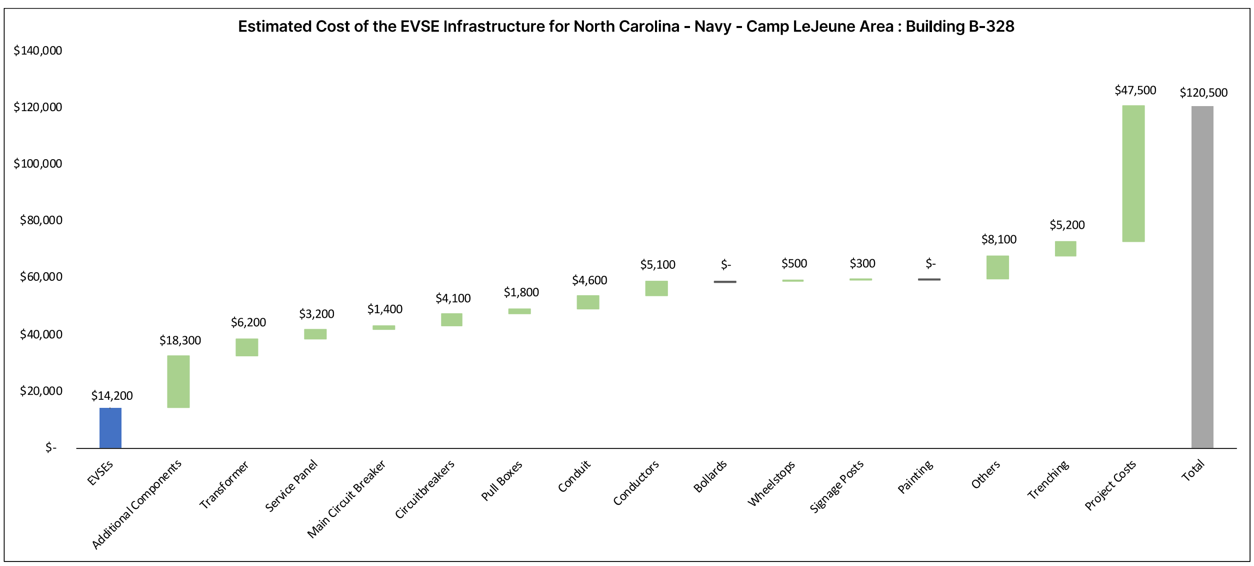

Figure 37. Cost estimate for Building B-328 in incremental costs format

4.3 Building B-329

There are 27 light-duty vehicles parked in the motor pool at Building B-329. Telematics data was available for at least 15 of these vehicles, although telematics data was provided for six additional vehicles characterized as Building B-329/USCG Barracks. Of the 15 vehicles definitively attributed to B-329, only four EVSE units would be required to support them; however, the other six vehicles attributed to B-329/USCG Barracks would require six EVSE ports. The combined ratio is 21 EVs:10 EVSE ports. Extrapolating to 27 EVs implies that 13 EVSE units would be necessary. It would be prudent to install electrical capacity for additional EVSE units if that number is insufficient. A 167-kVA single-phase transformer could support up to 18 EVSE units with a capacity cushion of approximately 15%. An existing 100-kVA transformer in the parking lot would not be sufficient (Figure 38).

Figure 38. Ranjit Desai and Dale Swink by an existing transformer in Building B-329 parking lot

Photo by [Cabell Hodge], NREL

The Tiger Team calculated the cost of installing six EVSE ports, one single-phase 400-A service panel, a meter, and transformer capacity and conduit for 12 additional EVSE ports in the first installation. A second phase of the construction project would include a second service panel, conductors, and the 12 additional EVSE ports (or fewer if USCG would like to subdivide the project into three phases). There are 22 parking spots located along the grass in the B-329 parking lot. Nine dual-port Level 2 EVSE (18 ports total) can be spread throughout these spaces to reach all 22 spaces, as illustrated in Figure 39. The lighter color EVSE and service panel represent equipment to be installed in a later project phase. The darker color EVSE are intentionally spread between parking spaces to reach as many vehicles as possible; they should use extended-length EVSE cordsets. The lighter color EVSE can use typical cord lengths. All EVSE at B-329 should have payment processing and authorization capabilities.

Figure 39. Recommended configuration for B-329 EVSE and electrical service

Cost Estimate:

Table 14. Cost Estimate for Building B-329

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSE: 6 Units	$42,400
Additional Components	$-
Transformer	$10,200
Service Panel	$7,800
Main Circuit Breaker	$7,200
Circuit Breakers	$12,100
Pull Boxes	$7,100
Conduit	$19,700
Conductors	$20,400
Bollards	$-
Wheel Stops	$1,400
Signage Posts	$700
Painting	$.-
Others	$9,800
Trenching	$5,400
Project Costs	$94,500
Total	**$238,700**

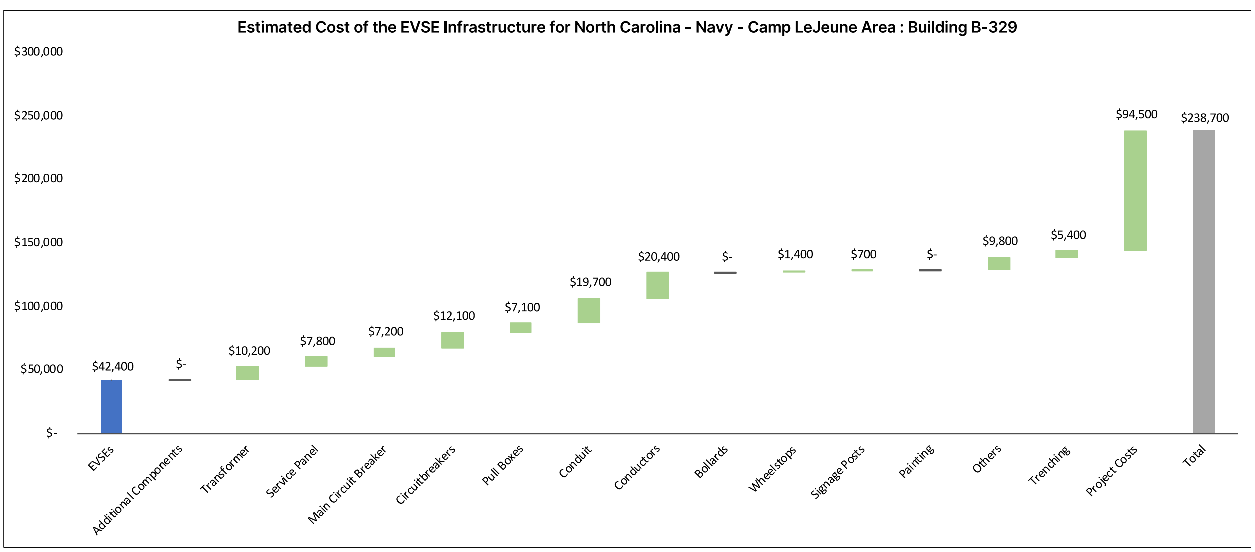

Figure 40. Cost estimate for Building B-329 in incremental costs format

4.4 Barracks Parking Locations

The NREL team assessed two parking locations near the USCG barracks where several of their vans park. The USCG staff estimated they had 20 vans parked by the barracks. Of the seven vans analyzed by NREL for charging needs, seven EVSE ports would be required, indicating a 1:1 ratio of EV: EVSE would be appropriate at the barracks. 20 EVSE ports for 20 vans is clearly a conservative estimate. However, with the USCG phased-implementation plan, USCG can determine whether 20 EVSE ports are actually required based on the utilization of EVSE installed during the first project phase. While electrical service was available near Parking Lot A in Figure 41, the nearest transformer was far from Parking Lot B and would require extensive boring (orange line). Therefore, the Tiger Team only assessed Parking Lot A in detail.

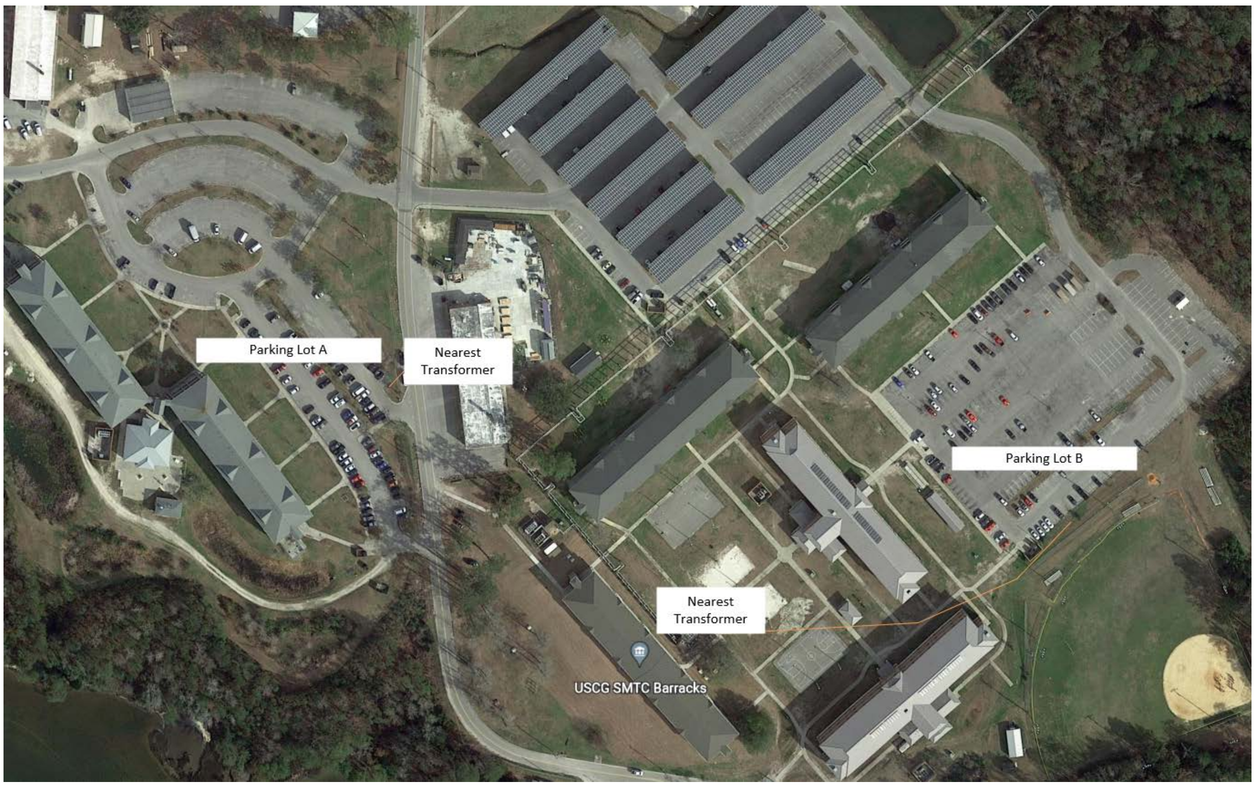

Figure 41. USCG barracks parking lots A and B

The Tiger Team calculated the cost of initially installing eight EVSE ports, one single-phase 400-A service panel and a meter, along with a 200-kVA transformer and conduit for 12 additional EVSE ports. A second phase of the construction project would include a second single-phase 400-A service panel, conductors and the 12 additional EVSE ports (or fewer if USCG would like to subdivide the project into three phases). There are over 100 parking spaces in the USCG barracks Parking Lot A (per the Figure 41 classification). However, parking near the barracks appeared to be in high demand during the site visit and from aerial imagery. Considering that the EV: EVSE ratio in the USCG vehicles analyzed worked out to 1:1, sharing EVSE may not be feasible in the location of the barracks. The Tiger Team does not recommend leaving space between EVSE units based on those two factors. Instead, dual-port Level 2 pedestal units should be installed side by side, as indicated in Figure 42. The lighter color EVSE and service panel represent equipment to be installed in a later project phase. Two bollards per

EVSE unit are recommended to protect the units from vehicular damage. The farthest EVSE installed in the first project phase is 80 feet, and the nearest 25 feet from the first service panel; the farthest EVSE installed in the second project phase is 98 feet from either panel. All EVSE USCG should have payment processing and authorization capabilities.

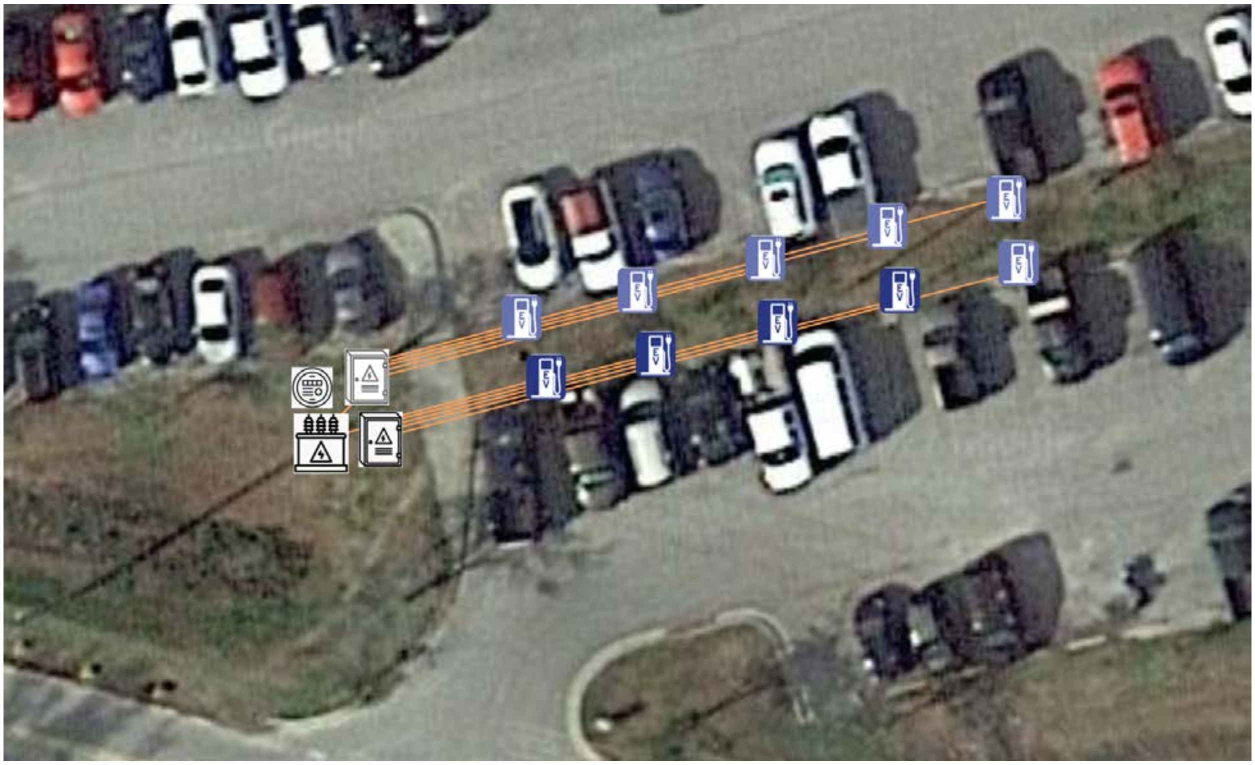

Figure 42. Recommended configuration for USCG Barracks EVSE and electrical service

Cost Estimate:

Table 15. Cost Estimate for USCG Barracks Parking Lot A

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	**Component Costs**
EVSE: 4 Units	$28,300
Additional Components	$-
Transformer	$12,200
Service Panel	$7,800
Main Circuit Breaker	$7,200
Circuit Breakers	$8,100
Pull Boxes	$3,600
Conduit	$7,300
Conductors	$7,800
Bollards	$-
Wheel Stops	$1,000
Signage Posts	$500
Painting	$-
Others	$8,900
Trenching	$5,300
Project Costs	$64,000
Total	**$162,000**

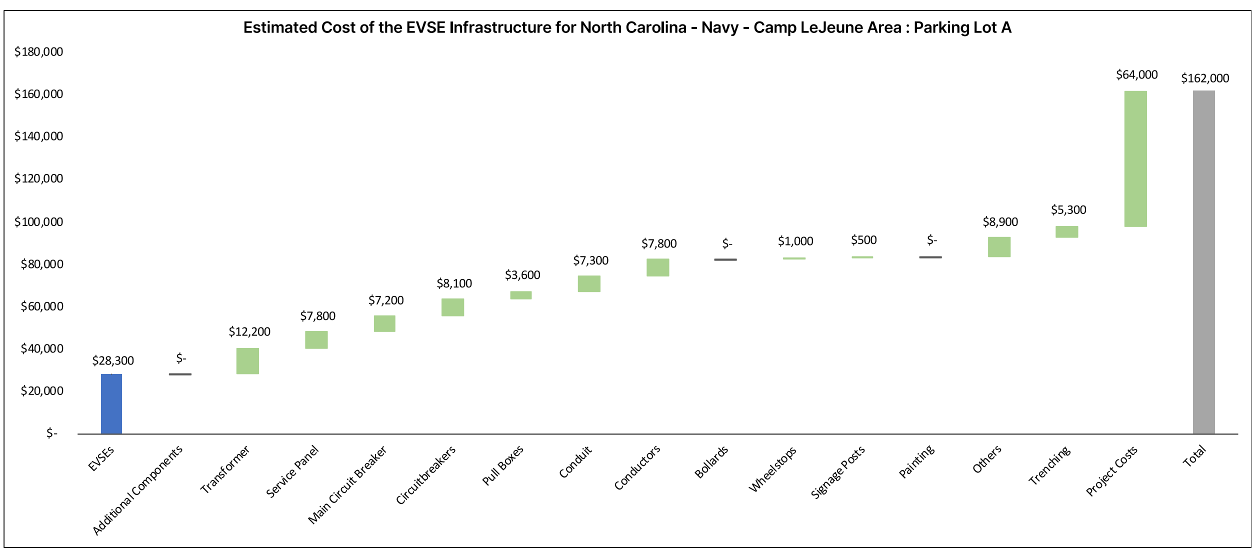

Figure 43. Cost estimate for Parking Lot A in incremental costs format

5 Marine Corps Community Service Lejeune Sites

The Tiger Team visited two Marine Corps Community Service (MCCS) sites: Building 895 and Building 88.

5.1 Building 895

There are 17 vehicles parked behind Building 895, all of which are sedans or SUVs. Annual vehicle utilization was estimated between 4,000 and 8,000 miles traveled per vehicle-year. The Tiger Team discussed installing four dual-port, pedestal-mounted EVSE units for a total of eight EVSE ports in the parking lot. The Tiger Team recommends acquiring extended-length cord-sets and positioning the EVSE between spots where they can reach multiple EVs.

There is a 225 kVA transformer behind the building (Figure 44), and the peak demand on that transformer was 79.8 kW in 2021. Assuming a 98% power factor, that leaves 143.6 kVA to support EVSE. Therefore, the existing transformer could easily supply power to 8 Level 2 EVSE ports (53.25 kW/56 kVA with a conservative 95% power factor). A new 400-A three-phase service panel and the meter should be installed to supply the EVSE separately. The run to the first EVSE is approximately 30 feet, and the run to the farthest EVSE is approximately 170 feet (Figure 45).

Figure 44. Building 895 parking lot and transformer

Photo by [Ranjit Desai], NREL

Figure 45. Recommended configuration for Building 895 EVSE and electrical service

Cost estimate:

Table 16. Cost Estimate for Building 895

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSE: 4 Units	$28,300
Additional Components	$-
Transformer	$-
Service Panel	$7,800
Main Circuit Breaker	$7,200
Circuit Breakers	$8,100
Pull Boxes	$3,600
Conduit	$6,800
Conductors	$7,200
Bollards	$-
Wheel Stops	$1,000
Signage Posts	$500
Painting	$-
Others	$8,900
Trenching	$5,300
Project Costs	$55,300
Total	**$140,000**

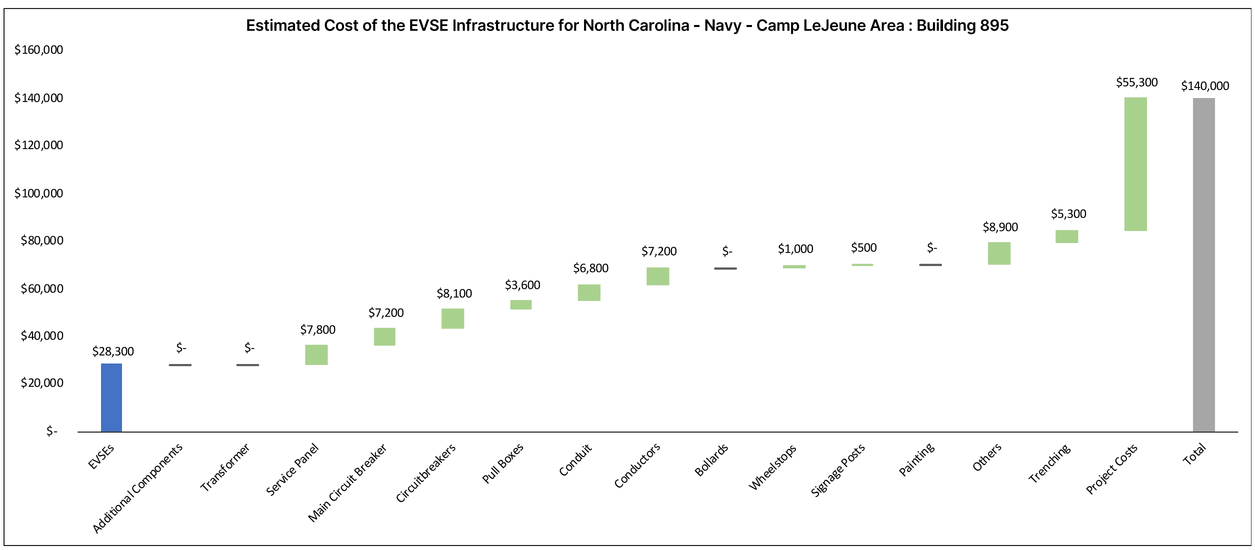

Figure 46. Cost estimate for Building B-895 in incremental costs format

5.2 Building 88

There are five light-duty vehicles and eight medium- or heavy-duty vehicles currently parked in front of Building 88. The Tiger Team discussed installing one dual-port Level 2 EVSE pedestal with an extended length cordset in the Building 88 parking lot.

There is a 112.5-kVA transformer behind Building 88 (Figure 47). Meter data was not available for this report. However, the apparent power requirements for two EVSE charging ports are only 14 kVA at a conservative 95% power factor. The parking lot is located on the front side of Building 88 (Figure 48). The wiring runs around the building is approximately 300 feet, which adds considerable cost to the EVSE installation at this location.

Figure 47. 112.5-kVA transformer behind Building 88

Photo by [Ranjit Desai], NREL

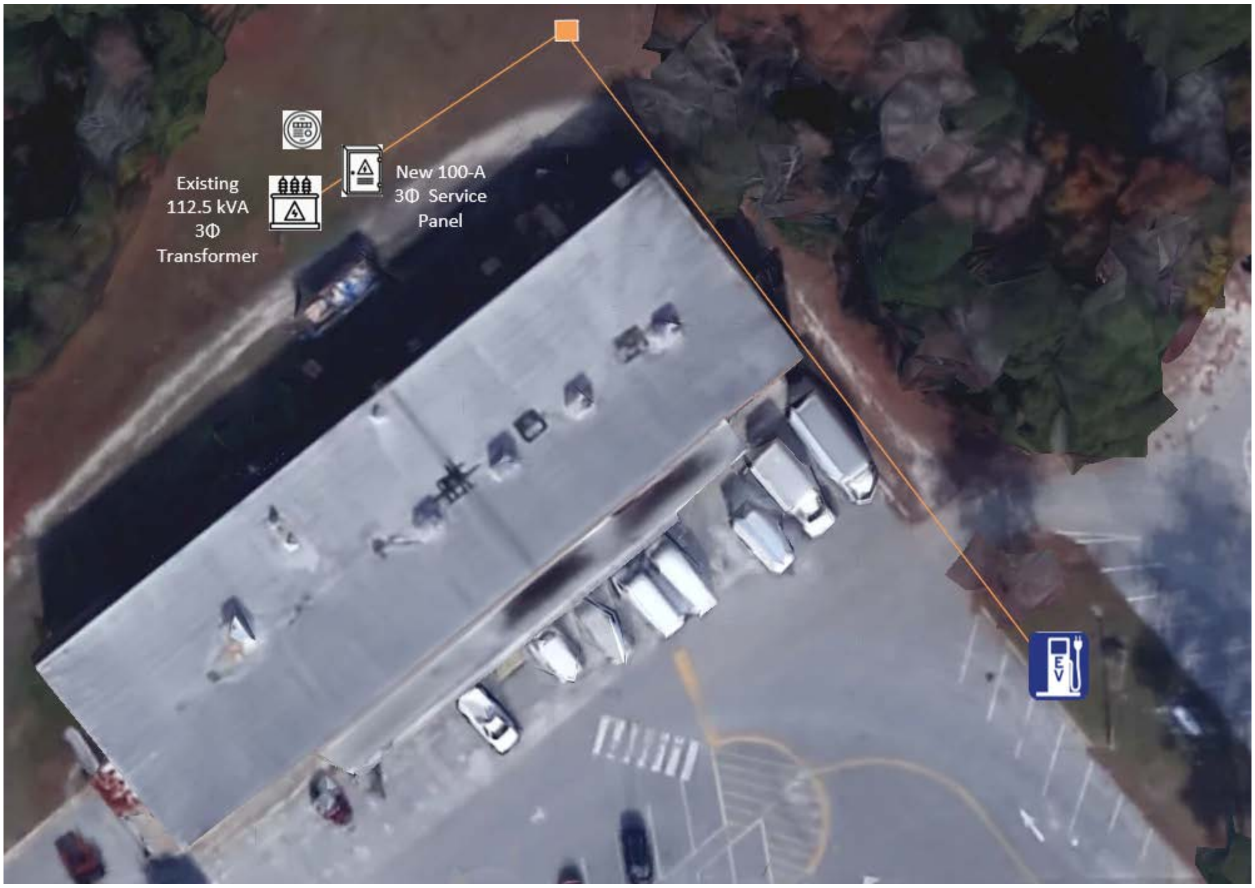

Figure 48. Recommended configuration for Building 88 EVSE and electrical service

Cost Estimate:

Based on the cost estimate calculation of $108,900 for two EVSE ports, Building 88 may not be the best location for EVSE. This is largely due to the distance from the prospective EVSE and the existing transformer. If this project moves forward, NREL recommends inspecting the building service panels to see if one could be tapped for EVSE units.

Table 17. Cost Estimate for Building 88

Note: (This is NOT a bid for contract. It is an estimate for research purposes.)

Entity	Component Costs
EVSE: 1 Unit	$7,100
Additional Components	$-
Transformer	$-
Service Panel	$3,200
Main Circuit Breaker	$1,400
Circuit Breakers	$2,100
Pull Boxes	$3,600
Conduit	$6,800
Conductors	$7,200
Bollards	$-
Wheel Stops	$300
Signage Posts	$200
Painting	$-
Others	$8,900
Trenching	$6,100
Project Costs	$30,400
Total	$77,300

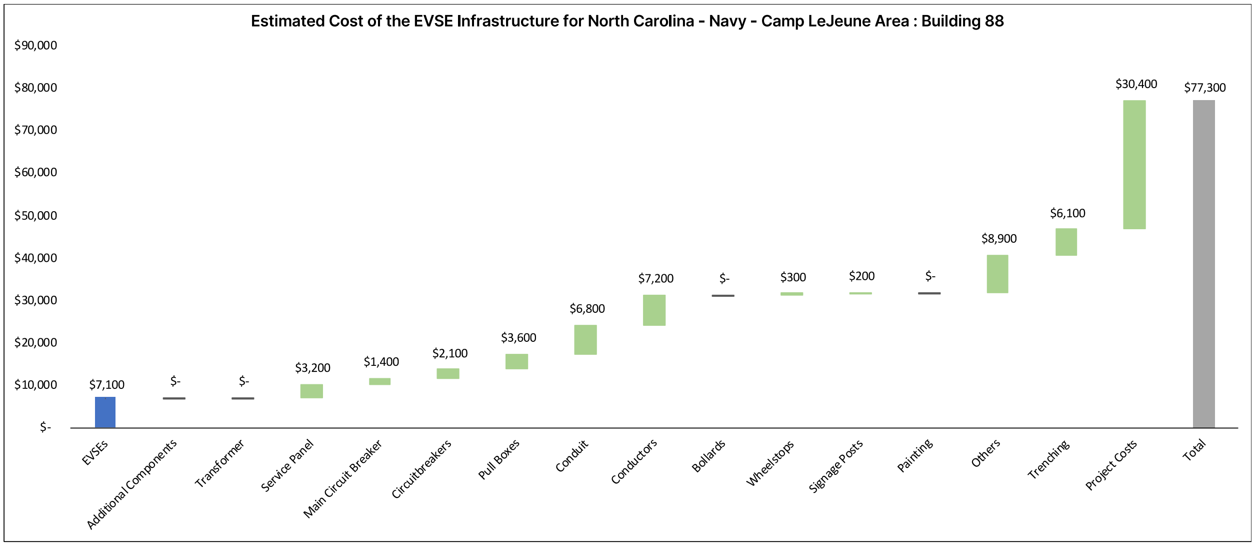

Figure 49. Cost estimate for Building B-88 in incremental costs format

6 Summary of Tiger Team Assessment

The Tiger Team assessed 14 locations and completed conceptual designs and cost estimates for 13 of those locations, as summarized in Table 18. If this project were completed in total at the estimates provided herein, it would cost approximately $2.66 million. As noted above, the cost estimates are based on RSMeans[22] and the USACE-published Areawide Cost Factors, but actual costs will likely differ.

After the installations of intended 111 EVSEs (summarized in Table 18) as per this Tiger Team Site Assessment, Camp Lejeune will be able to displace 579 metric Ton CO_2e of greenhouse gas emissions[23] in one year.

Table 18. Summary of Cost Estimates

Fleet	Building	Number of Light-Duty Vehicles	Number of EVSE Ports Planned	New Transformer?	Estimated Cost
MCB Lejeune	1005	24	12	Yes	$181,000
	1110	12	6	No	$129,900
	1308	7	4	Yes	$149,700
	1407	35	18	Yes	$490,100
	Lot 200	13	10	Yes	$118,600
	25	6	4	No	$63,200
	773	17	10	Yes	$176,600
	AS-302	15	8	No	$165,100
USCG	328	9	8	Yes	$120,500
	329	27	13	Yes	$238,700
	Barracks	20	8	Yes	$162,000
MCCS Lejeune	895	17	8	No	$140,000
	88	2	2	No	$77,300
Total	**--**	**204**	**111**	**--**	**$2,212,700**

[22] Source: https://www.rsmeansonline.com.

[23] Estimated using the ZPAC ("ZPAC Tool Results from Grand Teton National Park, National Park Service." Zero-emission vehicle Planning and Charging (ZPAC) Tool (internal NREL tool). August 2022) Analysis for three (MCB, USCG and MCCS) agencies at Camp Lejeune MCB.

6.1 Next Steps

The plans outlined in this report provide a framework for where and how EVSE could effectively be installed at Camp Lejeune. Once funding is secured and required environmental compliance is completed, the next steps in this process are for Camp Lejeune to reach out to EVSE installers to request quotes for the installations. During this time, Lejeune should also coordinate these installations with their local utility, facility managers, and building electrification project managers. The NREL Tiger Team is also available to provide any guidance or technical support throughout this process. Ensuring each of these stakeholders is appropriately engaged throughout the EVSE installation process will ensure the fleet will have robust and reliable EVSE available throughout the fleet electrification process.