DOCKETED	
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Project Title:	Electric Vehicle Charging Infrastructure Reliability
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Submitted On: 11/29/2023
Docket Number: 22-EVI-04

EV Charger Field Testing Workshop PowerPoint

Additional submitted attachment is included below.

Electric Vehicle Charging Infrastructure Reliability

EV Charger Field Testing Protocol Workshop

November 30, 2023

ITS UCDAVIS Institute of Transportation Studies

UCDAVIS Electric Vehicle Research Center
Institute of Transportation Studies

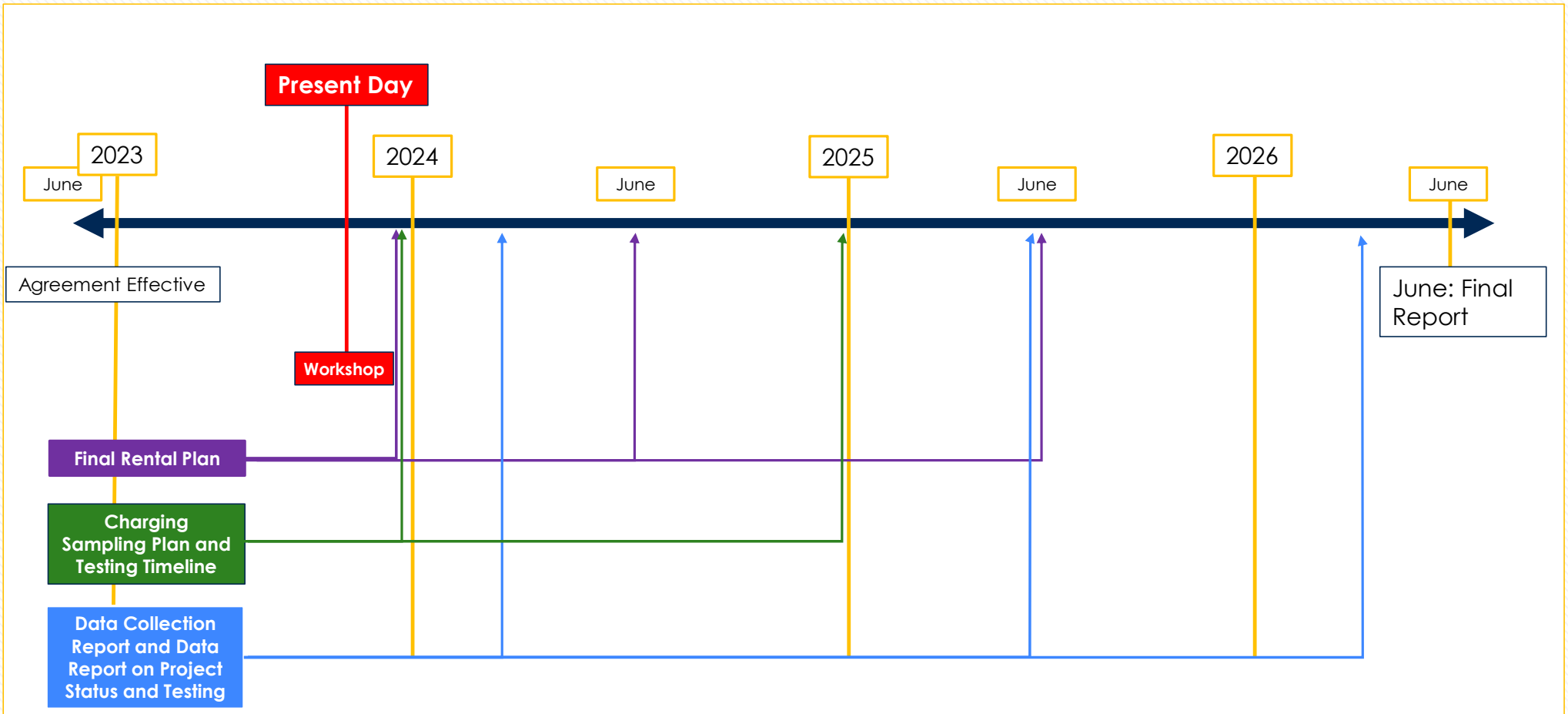
CALIFORNIA ENERGY COMMISSION

Project Overview

UCDAVIS Electric Vehicle Research Center
Institute of Transportation Studies

CALIFORNIA ENERGY COMMISSION

- Agreement terms
  - 6/16/23-6/30/26
- Objective
  - Determine the reliability of the public charging infrastructure in California.
- Goals
  - Test the most commonly purchased electric vehicles (EVs) across California
  - Test top charging manufacturers
  - Sample 3,600 different chargers both Level 2 (L2) and Direct Current Fast Chargers (DCFCs)
    - This includes testing in urban, rural, low-income communities (LIC) disadvantaged communities (DACs)



Schedule of Deliverables

Snapshot of Award #600-22-009

WHO:
UC Davis Electric Vehicle Research Center

WHERE:
Seven regions across California

WHEN:
2024-2027

WHAT:
Sample size of 3,600 chargers

WHY:
Determine public charging infrastructure reliability

WHO:

Meet the Team

UCDAVIS Electric Vehicle Research Center
Institute of Transportation Studies

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Director

Alan Jenn
Assistant Professor

Vaishnavi Karanam
Postdoctoral Researcher

Tisura Gamage
Graduate Student Researcher

Dahlia Garas
Program Manager

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Project Manager

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Programmer

Level 2

In California, there are **14,653 Level 2** charging locations, with an average of two (2) chargers per location*.

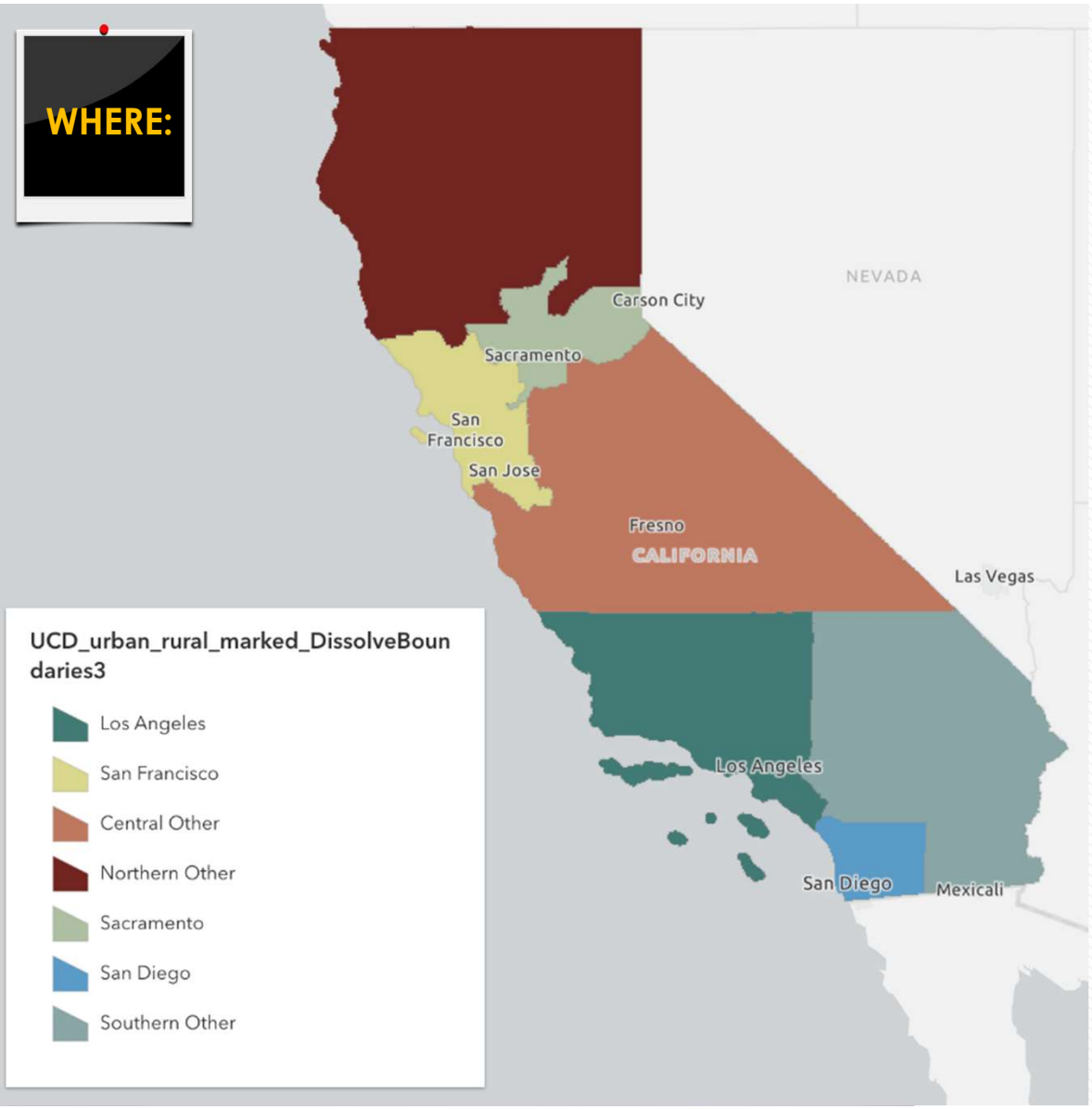
Our goal is to test ~two (2) chargers from approximately 1,500 locations **for a total of ~2,000**.

DCFC

In California, there are **2,045 Direct Current (DC) Fast charging** locations with an average of four (4) chargers per location*

Our goal is to test ~four (4) chargers from approximately 500 locations **for a total of ~2,000**.

**Per the Alternative Fuels Data Center (AFDC)*



REGIONAL BREAKDOWN

Los Angeles

San Francisco

Sacramento

San Diego

<u>"Other" Regions</u>

Central Other

Northern Other

Southern Other

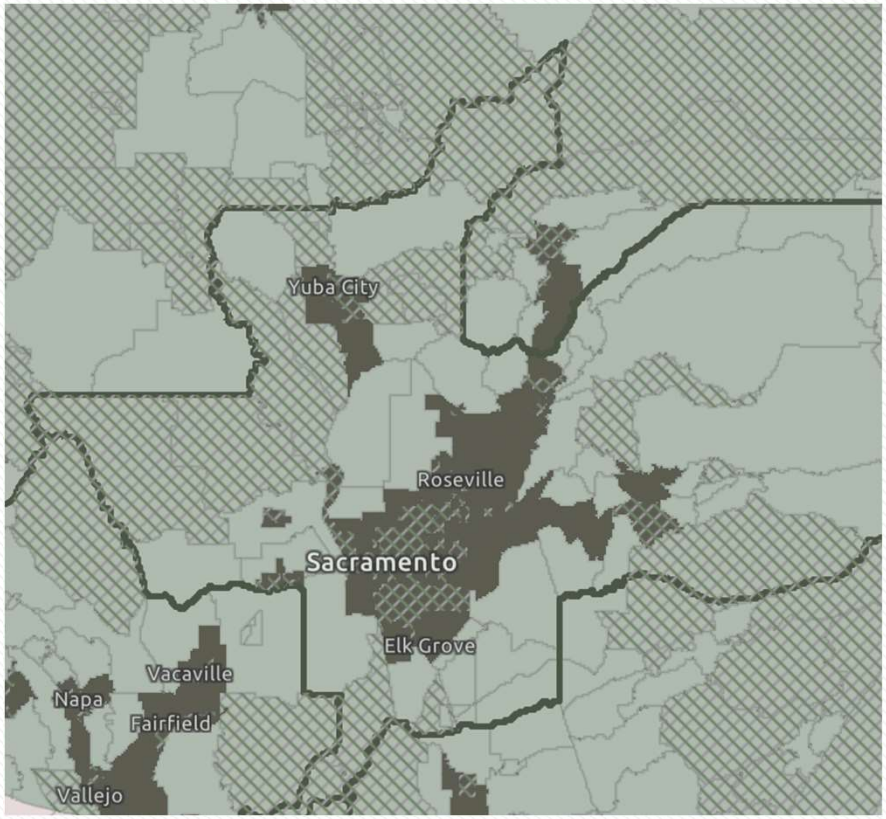
Disadvantaged Communities (DACs) and Low-Income Communities (LIC)

Disadvantage Communities or Low-income Communities

Greater Region Boundaries

Rural/Urban

- Urban
- Rural
- NA



WHY:

- The goal of this agreement is to **understand the reliability** of the public charging infrastructure in California from the **perspective of EV drivers**.
- Failure rates will be measured by testing EV chargers operating in California using a **standardized testing protocol** developed as part of this agreement.
- Success will be measured by completing the required number of tests, with minimal error rate, such that the data can inform the California Energy Commission (CEC).

GLOSSARY OF TERMS

Charging Location:

An Electric Vehicle (EV) charging location refers to a general area or facility where electric vehicles can be charged. This could encompass a variety of settings such as parking lots, garages, or designated spaces within a city. For this study, every row within the Alternative Fuels Data Center's public charger dataset represents a unique charging location.

Charging Site:

An EV charging site refers to a specific location within the general charging location area that houses a set of charging stations.

Charging Station:

An EV charging station is a facility designed to charge electric vehicles. It typically includes one or more charging ports, a power supply system, and control equipment. Charging stations can vary in terms of charging speed (Level 1, Level 2, or DC fast charging).

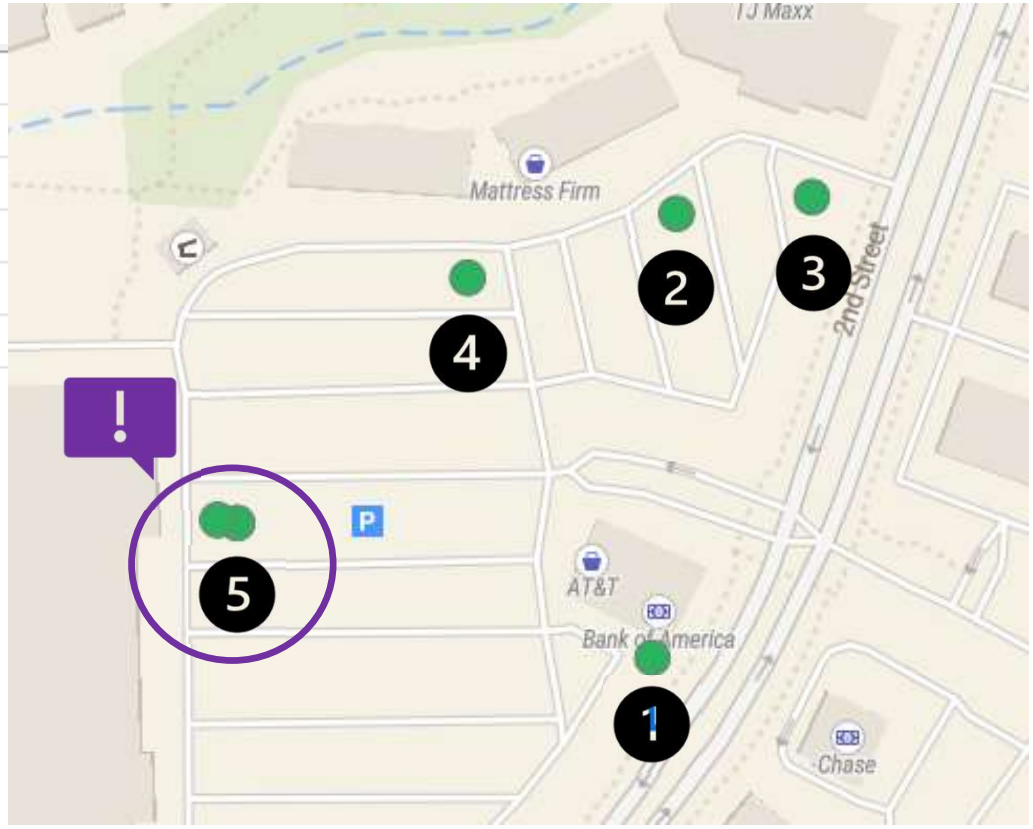
Charging Port:

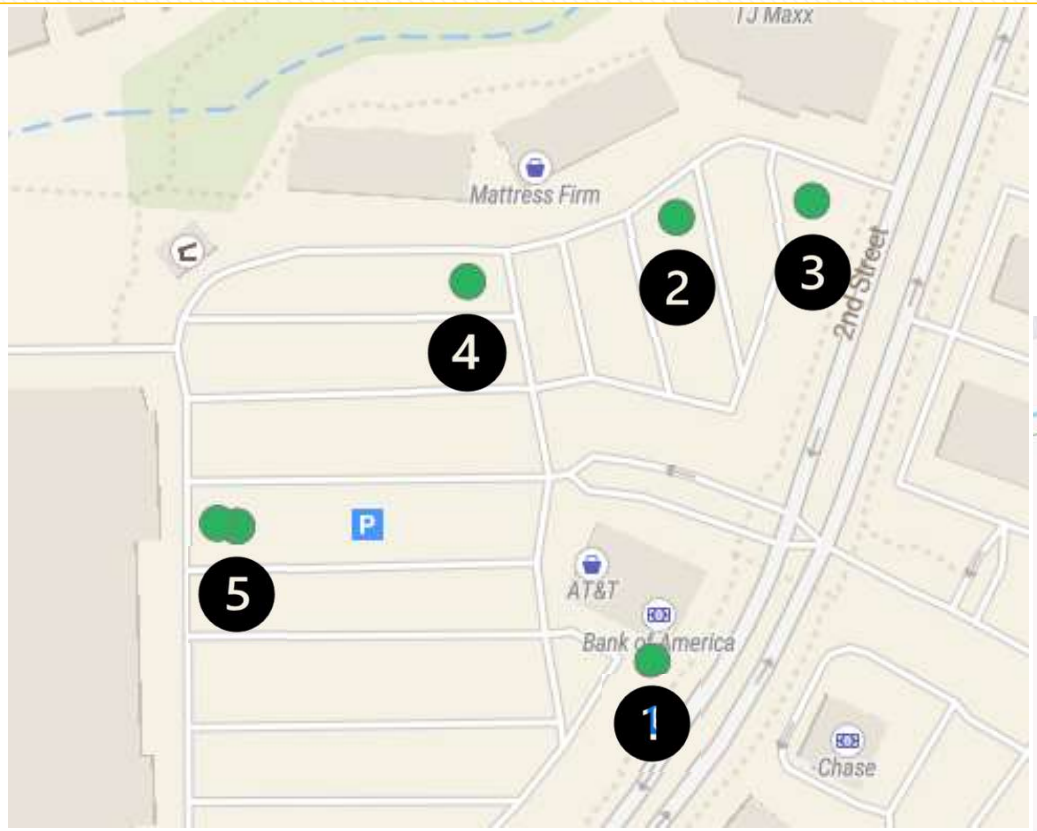
An EV charging port supplies power for charging one vehicle at a time, even if it has multiple connectors. The device containing these EV charging ports can be called a charging station, which may feature one or more charging ports.

Location Selection Overview

Per AFDC, the Davis Target parking lot has five (5) charging locations

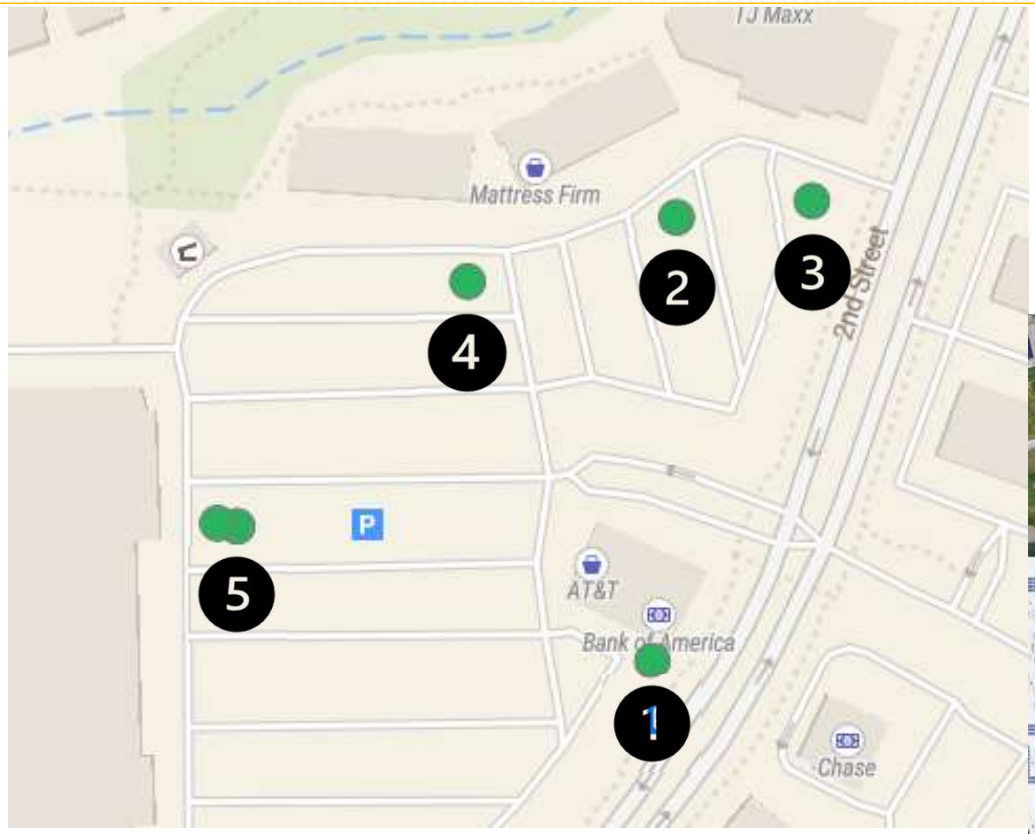
	Station Name	Street Address
1-	TARGET CORP T2455 1	3001-3563 2nd St
2-	TARGET CORP T2455 2	4601 2nd St
3-	TARGET CORP T2455 3	4601 2nd St
4-	TARGET CORP T2455 4	3805 Faraday Ave
5-	TARGET CORP T2455 6	4601 2nd St





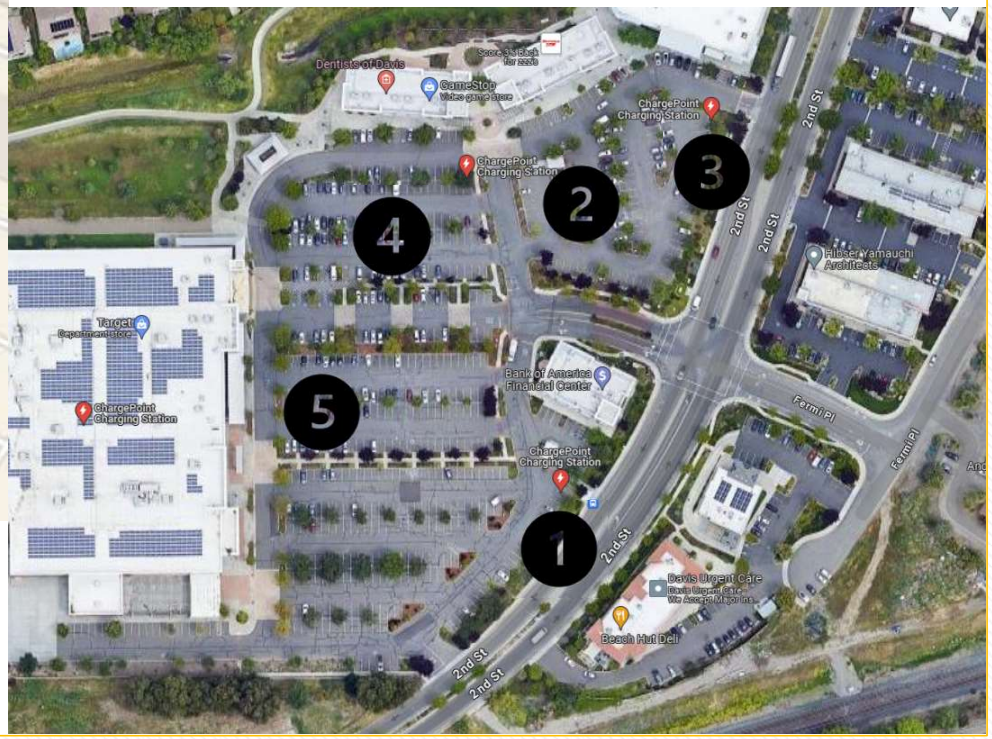
AFDC Map

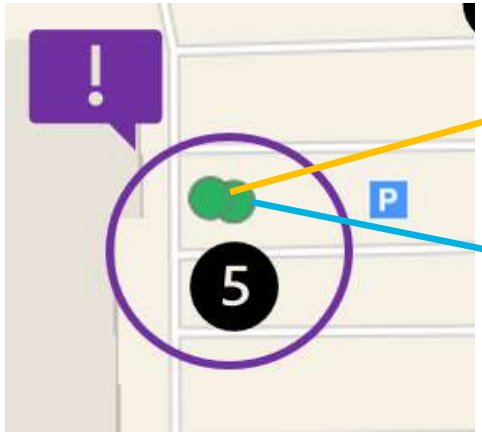
Google Map



AFDC Map

Google Map

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ELECTRIC VEHICLE CHARGING STATION
EV VEHICLE PARKING ONLY

Protocol Prep

1. Hiring students
2. Assign car
3. Assign route(s)
4. Arrive at the office and pick up an iPad that has the protocol/survey pre-loaded
5. Research begins before getting into the vehicle

VIDEO: DRAFT PROTOCOL

(Draft Protocol)

DISCUSSION

Questions

Comments

Feedback

ORAL COMMENTS

- Limited to three minutes or less per speaker and one person per organization.
- To comment **via Zoom**, use the "raise hand" feature so the administrator can announce your name and unmute you.
- To comment **via telephone**, press *9 to "raise your hand" and *6 to mute/unmute.

WRITTEN COMMENTS

- May be submitted to the Docket Unit by 5:00 p.m. on December 14, 2023.
- Written comments may also be submitted by email. Include docket number 22-EVI-04 and EV Charger Field Testing Protocol in the subject line and email to docket@energy.ca.gov.

MAILED COMMENTS

A paper copy may be mailed to:

California Energy Commission
Docket Unit, MS-4
Docket No. 22-EVI-04
715 P Street
Sacramento, CA 95814

NOTE: *Written and oral comments will become part of the public record of this proceeding with access available via any internet search engine.*

UCD CHARGE Initiative

- Consumer Hub for the Advancement of Reliability and Growth of EV Infrastructure (CHARGE) Initiative
  - UCD Charger Testing and Reliability Study
  - Smart Home Test Facility
  - Charging usage and demand modeling studies
  - Consumer satisfaction studies
- Invitation for participation
  - UCD Charger Testing and Reliability Study
    - testing protocol development
    - Add sample for a specific OEM/region/charging provider
    - Add experience and consumer experience data collection
  - Smart Home Facility
    - Lab test of charging experience and training
    - Consumer facing software testing
    - Smart home integration

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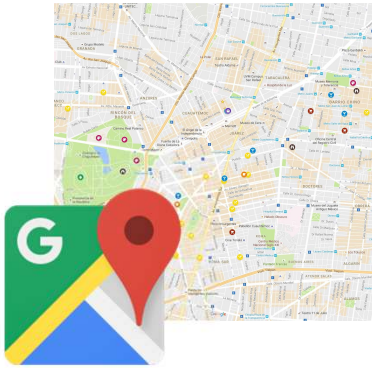
Thank you!

Please feel free to reach out to us!

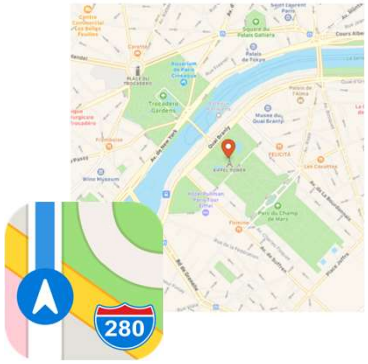
En Route to Chargers | UC Davis Reliability Project

Navigate to charging locations using assigned navigation app, recording:

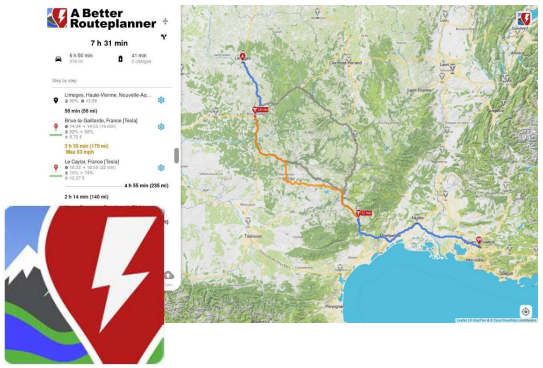
- Ease of locating charging site (Likert or rubric-based rating)
- Ease of locating chargers within site (Likert or rubric-based rating)



Google Maps



Apple Maps



A Better Route Planner

Tesla (OEM Nav)

Initial Preparation for Testers

UC Davis Reliability Project

1. Before leaving:
    a. Download relevant EVSP apps
    b. Attain relevant memberships (obtain RFID cards if applicable)
    c. Download relevant
2. Tester given assignment based on their time/location availability. Assignment includes:
    - Route to drive
    - Charger locations to test
    - Navigation method
    - Payment/Connection method
    - Vehicle to test
3. Pre-trip checklist:
    - Number of chargers at each location
    - Availability and operationality of each charger
    - Charger attributes (model, power, connector, payment)
    - Vehicle selection
    - Vehicle SOC
    - Time of start

On-Site: "Tester's" Charger

UC Davis Reliability Project

- Availability of charger

1. Park in charger parking spot
   - Ease of parking
   - Parking orientation
   - Charger model and power
   - ADA compliance
2. Examine physical condition of charger
   - Screen condition/status
   - Cable and connector condition
3. Attempt to charge payment using assigned payment method
   - Payment method
   - Ease of payment
   - Number of attempts
   - Failure events + error codes reported by charger
4. Connect charger to vehicle
   - Successful connection
   - Successful initiation
   - Energy dispensed in test time frame
   - Peak power dispensed
   - Failure events + error codes reported by charger

Protocol for 3 & 4 will be more specifically developed depending on vehicle and charger combinations

On-Site: Other Chargers

UC Davis Reliability Project

1. Take picture of all chargers at location
2. Examine other chargers
   - Availability
   - Parking Orientation
   - Operational status of chargers
3. Determine general environment of location
   - Weather (temperature, etc.)
   - Location safety (how to measure?)
   - Property type
   - Services and surrounding businesses