

I-80 / SR 65 Interchange Truck Alternative Fueling Feasibility Study

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Feasibility Study

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Executive Summary

The Interstate 80 (I-80) and State Route (SR) 65 interchange is a vital transportation hub in the Placer County region, connecting two major routes that serve different functions and markets for freight movement in Northern California. The Placer County Transportation Planning Agency (PCTPA) commissioned Jacobs to conduct a feasibility study (FS) to explore the potential of installing battery-electric truck (BET) charging infrastructure and hydrogen refueling infrastructure (HRI) at or near the interchange, in response to the increasing demand for sustainable and efficient trucking solutions in the region. The FS's objective is to assess the viability and benefits of BET charging stations and HRI, as well as the challenges and opportunities for implementing and operating these technologies.

The approach consisted of three steps: corridor traffic data analysis, technology mix determination, and market assessment of alternative fuel trucks and infrastructure. The corridor analysis used truck data from StreetLight to provide insights into movements, volumes, and dwell times. The technology mix determination used trip characteristics to recommend the most suitable technologies for each site. The market assessment projected the future demand for BET charging facilities and HRI based on the evolving trends and potential of electric and hydrogen trucking fleets. The FS aimed to provide a comprehensive plan that supports the transition to sustainable and efficient trucking solutions in the region.

The FS explored the potential of establishing alternative truck fueling at the I-80/SR 65 interchange, which is currently underserved for both alternative fuel trucking and available truck parking. The FS analyzed the current and future demand for BET charging stations and HRI based on the traffic patterns and operational characteristics of medium-duty and heavy-duty trucks in the region. An optimized mix of alternative fuel types was proposed, balancing the needs and preferences of different truck categories and promoting the transition to cleaner and more sustainable transportation solutions.

The high-level site screening considered 11 candidate sites near the I-80/SR 65 interchange and evaluated them based on fatal flaws and implementation considerations. The screening used a color-coded matrix to indicate the level of challenge posed by each criterion for each site. Five sites were eliminated because they were too far from the interchange to meet the corridor demands. One site was eliminated because it lacked adequate space and access, and one site was eliminated because of stakeholder concerns. The remaining three sites were selected for further evaluation.

Based on the traffic data and truck volumes analysis, technology assessment, site selection, and funding considerations, the Draft Feasibility Study recommends PCTPA consider the following:

1. Carrying the three identified sites into the environmental phase to attract a private company to purchase and develop a site for truck alternative fuel purposes.

2. Evaluate some of sites that were determined to be too remote from the interchange as part of a separate I-80 alternative fuel site corridor study.

3. Initiate a Countywide alternative fuel study to identify a coordinated plan of future potential sites that consider proximity and distance needed for hydrogen refueling and electric charging.

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Acronyms and Abbreviations

AST	aboveground hydrogen storage tank
BET	battery-electric truck
Caltrans	California Department of Transportation
CARB	California Air Resource Board
CEQA	California Environmental Quality Act
CTC	California Transportation Commission
DC	direct current
DTSC	California Department of Toxic Substances Control
ESVE	electric vehicle supply equipment
EV	electric vehicle
FCEV	fuel-cell electric vehicle
FS	feasibility study
ft^2	square foot (feet)
GHG	greenhouse gas
GIS	geographic information system
H_2	hydrogen
HRI	hydrogen refueling infrastructure
I-80	Interstate 80
ITA	Infrastructure Technology Assessment
kg	kilogram(s)
kW	kilowatt(s)
kWh	kilowatt-hour(s)
MW	megawatt(s)
NOx	nitrogen oxide
PCTPA	Placer County Transportation Planning Agency

PG&E	Pacific Gas and Electric Company
ROM	rough order of magnitude
SACOG	Sacramento Area Council of Governments
SR	State Route
TCEP	Trade Corridor Enhancement Program
U.S.	United States
ZEV	zero-emission vehicle

1 Introduction

The Interstate 80 (I-80) and State Route (SR) 65 interchange is a vital transportation asset in the Placer County region, serving as a gateway for the movement of goods and vehicles across Northern California. The interchange connects two major routes that have different functions and characteristics. I-80 is the primary west–east route in Northern California, providing all-weather access across the Sierra Nevada for major goods movement into the Sacramento and San Francisco Bay areas. I-80 is part of several national and state transportation networks and systems that reflect its importance and role in the freight industry, and was approved as a Top 6 Freight Corridor under Senate Bill 671 by the California Transportation Commission on December 6, 2023.

SR 65 is a north–south route that connects the cities of Lincoln, Rocklin, and Roseville with I-80. SR 65 is a Terminal Access route that also belongs to the 2020 California Freight Mobility Plan, which identifies projects and strategies to improve the efficiency and safety of freight movement in the state.

The Placer County Transportation Planning Agency (PCTPA) recognized the significance of this interchange and the growing demand for sustainable and efficient trucking solutions in the region. PCTPA commissioned Jacobs to conduct a feasibility study (FS) to explore the potential of this interchange to support the transition to zero-emission vehicles (ZEVs). The study's objective is to assess the viability of installing battery-electric truck (BET) charging stations and hydrogen refueling infrastructure (HRI) to accommodate the increasing number of medium- and heavy-duty trucks that use the interchange.

The demand for ZEVs has increased exponentially in the past decade, driven by various laws and initiatives in California that aim to reduce greenhouse gas (GHG) and nitrogen oxide (NOx) emissions from the transportation sector. One of the most notable is the *Advanced Clean Trucks Regulation* by the California Air Resource Board (CARB), which mandates manufacturers to sell ZEVs as a percentage of their annual sales, starting from 2024.

The *Advanced Clean Trucks Regulation* is expected to result in about 300,000 ZEVs on California roads by 2035, which will reduce GHG emissions by 17 million metric tons and NOx emissions by 1.4 million tons. This regulation is a major incentive for developing ZEV charging infrastructure in California, as well as other complementary policies and programs that support the deployment and adoption of these technologies.

The I-80/SR 65 interchange is a strategic location for establishing truck alternative fuel infrastructure, as it is an important node for freight movement in Northern California. The interchange serves a large and diverse market of truck operators and users, such as:

- Local delivery services
- Regional distribution centers
- Long-haul carriers
- Agricultural producers

The interchange also offers opportunities for integrating alternative truck fuel infrastructure with other existing or planned facilities and amenities, such as truck parking

The study identified and analyzed the optimal sites and configurations for installing BET charging stations and HRI at or near the interchange, considering the technical, economic, and other factors that influence the feasibility and desirability of these technologies. The study also provides recommendations and guidance for next steps, as well as identify the potential funding sources and partnerships that can facilitate the development of these facilities.

2 Infrastructure Technology Assessment

To determine how best to meet the demands of the I-80 and SR 65 corridors, an Infrastructure Technology Assessment (ITA) was conducted. The ITA identified and evaluated the feasibility of establishing BET charging facilities and HRI to support the increasing volume of medium- and heavy-duty truck traffic passing through the area.

This ITA used four custom analyses provided by StreetLight, including:

1. Traffic movement evaluations
2. Estimated truck volumes
3. Dwell times
4. Distribution of truck weight classes

The ITA determined the optimum provision of charging and refueling equipment for existing trip patterns, while enticing private developers to build, operate, and maintain these crucial facilities. Ultimately, the ITA laid the groundwork for a sustainable and robust decarbonized trucking infrastructure, advancing the region's transportation network into a greener and more efficient future.

2.1 Methodology

Corridor traffic analysis provides essential data and insights to inform an ITA. Traffic movements, truck volumes, tours, and dwell times through the corridor provide an understanding of the traffic patterns and operational characteristics of medium- and heavy-duty trucks. This in-depth characterization becomes the backbone of future work and allows for informed decision-making in determining the optimum provision of BET charging facilities and HRI. By aligning infrastructure development with actual trucking demand, this ITA aims to establish efficient, reliable, and financially attractive facilities that meet the specific needs of the trucking industry and promote sustainable transportation solutions in the region.

The ITA follows a systematic, data-driven approach designed to yield holistic and comprehensive results (Figure 2-1) and employs a linear methodology. The three main steps of this approach are as follows:

1. Corridor traffic data analysis
2. Technology mix determination
3. Market assessment of ZEV and infrastructure

Figure 2-1. Infrastructure Technology Assessment Methodology

The first step was conducting an in-depth corridor traffic data analysis, leveraging data provided by StreetLight's comprehensive transportation analytics. This analysis included metrics from StreetLight, such as:

- Volume
- Calibrated index
- Tours analysis
- Dwell time

These metrics offers valuable insights into truck movements, volumes, and dwell times.

The second step involved determining the most suitable technology mix to serve future customers, informed by trip characteristics from the corridor traffic data analysis. This critical phase considered the assumptions made for electric vehicle (EV) and hydrogen (H_2) suitability based on trip lengths so that the recommended technologies align with the specific truck profiles identified in the traffic data analysis.

The third step was to conduct a market assessment of alternative fuel trucks and related infrastructure to understand the evolving trends and potential for EV and H_2 trucking fleets. This assessment guided the ITA in projecting the future demand for BET charging facilities and HRI based on traffic analysis results, allowing for strategic planning and scalability. This informed the next part of the FS, which involved the screening analysis of potential sites near the interchange for prioritization.

The overarching goals of the ITA were to estimate the corridor demand forecast by vehicle class, considering the varying travel patterns and operational needs of different truck categories.

Additionally, the ITA aimed to recommend the most suitable technology for each site, so that the infrastructure can be optimized for specific trucking demands.

Last, by estimating the required infrastructure for BET and HRI, the ITA provided a comprehensive plan that supports the sustainable growth of the trucking industry and promotes the adoption of clean and efficient transportation solutions near the I-80/SR 65 interchange.

2.2 Corridor Traffic Data

Data for medium- and heavy-duty trucks for the 3-year period from January 2019 to December 2021 were analyzed for the following components:

- Zone Activity (Truck Volume) on Freeway Segments
- Tours Analysis for Truck Movements on Freeway Segments
- Dwell Analysis within a 10-Mile Buffer of the Interchange

The COVID pandemic occurred in early 2020, and the StreetLight data shows that there was no decline in heavy duty truck volumes and a 15 percent decline in medium duty truck volumes between February and March 2020. By June 2020, medium duty truck volumes returned to normal taking into account seasonal variations.

The StreetLight analyses compiled for this assessment helped determine the volume distribution of medium- and heavy-duty trucking along the corridor, as well as further categorize the volume into local and regional and long-haul and interstate traffic to assist in determining the preferred fueling infrastructure technology.

Limitations and Cautions: It is important to note that while StreetLight volume and calibrated index allow for normalization and interpretation of changes in trip activity, the analysis of tour length and dwell time does not have the same normalization capability. As such, caution is recommended when interpreting changes from month to month because variability may be influenced by sample size fluctuations. Nevertheless, the combination of these analyses, processing the data in multiple ways, and incorporating the StreetLight specialized definitions provided a robust foundation for the efforts to identify and evaluate the potential for BET charging facilities and HRI near the I-80/SR 65 interchange. The results of these analyses serves as a foundation for further ITA and site selection to best accommodate the demand and needs of the trucking industry in the region.

2.3 Zone Activity (Truck Volume) on Freeway Segments

Volume represents the estimated total truck trips as calculated by the StreetLight machine learning algorithm. This metric provided an estimate of the total trip activity, also known as average daily traffic, for medium- and heavy-duty trucks at three strategic freeway segments near the I-80/SR 65 interchange. As shown on Figure 2-2, the highest truck volumes are on I-80 eastbound and westbound, with traffic coming from and to SR 65 at this interchange.

Figure 2-2. 2019-2021 Average Daily Medium-duty and Heavy-duty Truck Volumes

2.4 Truck Movements on Freeway Segments

A tours analysis was performed on the data to determine the movement of medium- and heavy-duty trucks near the interchange (Figures 2-3 and 2-4). A tour is defined as a string of consecutive trips made by the same truck that can be considered part of the same movement. For this project, a trip was considered part of the prior trip's tour if it began within 0.6 mile and 4 hours of that trip's end. The tours analysis provided a comprehensive understanding of the sequence of trips made by medium- and heavy-duty trucks.

Figure 2-3. 2019-2021 Average Daily Medium-duty Truck Trip Lengths

Figure 2-4. 2019-2021 Average Daily Heavy-duty Truck Trip Lengths

2.5 Dwell Analysis within a 10-mile Buffer

StreetLight conducted a dwell analysis on the medium- and heavy-duty trucks within a 10-mile buffer surrounding the I-80/SR 65 interchange. Dwell refers to the time between two consecutive trips made by the same truck. For this analysis, trips were considered only if the successor trip began within 0.6 mile of the prior trip's end. The dwell analysis provided information about the idle times and waiting periods of trucks, providing information about potential waiting times and operational patterns.

In California, truck drivers and other employees must be given a 30-minute meal break if they work more than 5 hours in a day, and drivers who work a shift of 10 hours or more are entitled to a second 30-minute meal break. Employees are also entitled to a 10-minute rest period for each 4 hours that they work in a day.

The StreetLight data in Table 2-1 show that for medium-duty trucks, the average dwell time is a lengthy 353 minutes, with 30-minute dwell times occurring 42.14% of the time on average, but with 600-plus-minute dwell times at 15.81%. This is illustrative of multiple scenarios, notably the fact that many medium-duty trucks layover for long periods of time or have depots close by. It could be anticipated that some level of medium-duty truck traffic to a future site may want to use the charging infrastructure overnight or over extended periods of time. Longer dwell time amenities and also lower-power BET charging should be prioritized within the site development.

The StreetLight data in Table 2-2 show that for heavy-duty trucks, the average dwell time is only 137 minutes, with 30-minute dwell times occurring 44.69% of the time on average. This is illustrative of multiple scenarios, but most typically point to short deliveries in the surrounding urban area, loading and unloading activities in surrounding industrial warehouses, and short breaks by long-haul trucks traveling through the corridor. These data will inform the layout and amenities of a potential site, with the focus of quick, 30-minute stops for refueling and charging necessary for heavy-duty trucks.

Table 2-1. Medium-duty Truck Dwell Times within a 10-mile Radius

Average Dwell Time (min)	Dwell < 30 min	Dwell 30-60 min	Dwell 60-120 min	Dwell 120-180 min	Dwell 180-600 min	Dwell 600+ min
353	42.14%	16.53%	12.39%	4.97%	8.19%	15.81%

< = less than
min = minute(s)

Table 2-2. Heavy-duty Truck Dwell Times within a 10-mile Radius

Average Dwell Time (min)	Dwell < 30 min	Dwell 30-60 min	Dwell 60-120 min	Dwell 120-180 min	Dwell 180-600 min	Dwell 600+ min
137	44.69%	21.36%	13.47%	5.03%	9.06%	6.47%

2.6 Technology Mix Determination

The technology mix determination step was important in shaping the future charging and refueling infrastructure for the I-80/SR 65 interchange area. This step involves making informed decisions about which of the following are most suitable for addressing the diverse needs of the trucking industry in the region:

- BET technology
- H_2 fuel-cell electric vehicle (FCEV) technology
- Both technologies

The average one-way trip lengths identified in the corridor traffic data analysis were evaluated for both medium- and heavy-duty trucks.

2.6.1 Assumptions

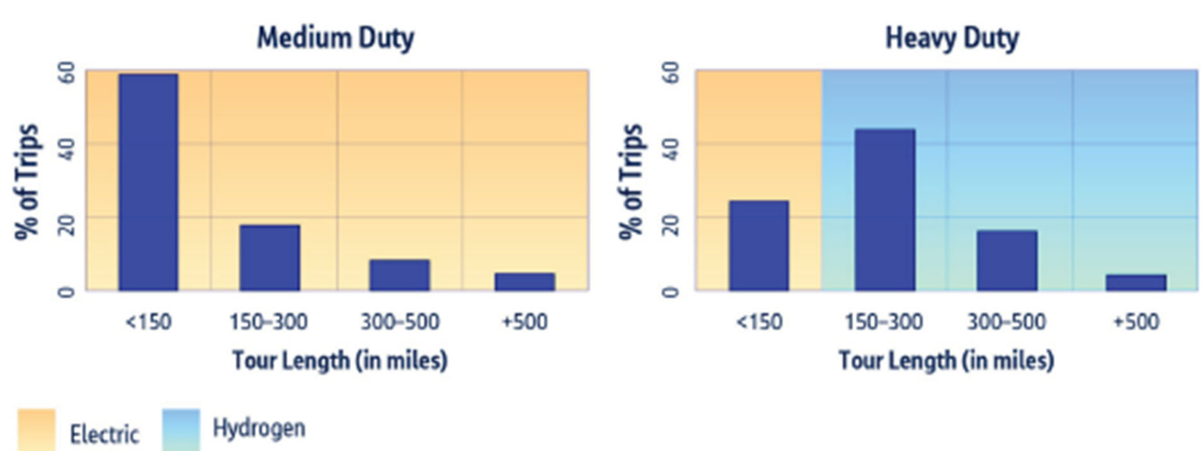
Two assumptions guide the selection of the most suitable technologies for medium- and heavy-duty truck categories:

1. EVs are best suited for all medium- trucks and heavy-duty trucks traveling less than 150 miles. This assumption is based on the understanding that medium-duty trucks engaged in middle-mile trucking and local and regional vocational operations typically undertake shorter one-way trips, making them ideal candidates for the range and charging capabilities of current EV technology. Likewise, heavy-duty trucks traveling less than 150 miles, despite their weight class, can be effectively served by EVs, especially with the availability of overnight charging facilities.

2. H_2 FCEVs are best suited for heavy-duty trucks traveling more than 150 miles. This assumption recognizes that heavy-duty trucks engaged in regional haul and drayage operations require vehicles with extended driving ranges and faster refueling times. H2 FCEVs, with their capacity for longer ranges and quicker refueling than current BET models, are considered the best solution for these heavy-duty trucks. Moreover, this assumption considers the steep grade of the I-80 corridor between Rocklin and Truckee, where these heavy-duty trucks commonly traverse, and addresses potential challenges related to range and charging associated with battery-electric technology.

Figure 2-5 shows how most medium-duty tours in the sample are in the 150 miles and under category, while heavy-duty tours in the sample were more typically between 150 and 300 miles on I-80 and SR 65.

Figure 2-5. Tour Length Distribution for Medium-duty and Heavy-duty Trucks



2.6.2 Typical Truck Profiles

Based on these assumptions, medium-duty trucks, characterized by an average one-way trip length of approximately 33 to 35 miles, are best suited for BETs and will require EV supply equipment. These trucks typically engage in middle-mile trucking and local and regional vocational operations, making EVs a practical and environmentally friendly choice for their relatively shorter hauls. Additionally, heavy-duty trucks traveling less than 150 miles are also deemed suitable for EVs. Despite being heavy-duty, their relatively shorter one-way trips can be well-supported by current industry pack sizes, enabling overnight charging at the proposed facilities.

However, heavy-duty trucks with average one-way trip lengths greater than 150 miles are better suited for H_2 FCEV. These trucks, typically involved in regional haul (truck pulling trailer) and drayage (truck carrying shipping container) operations with roughly 300-mile round trips would benefit from H_2 fuel-cell trucks because these vehicles offer longer driving ranges and faster refueling times than current BET models. Based on the observations from the corridor traffic data analysis, the typical medium- and heavy-duty truck profiles can be summarized based on their one-way trip lengths and the assumed roundtrip distances (Table 2-3).

Table 2-3. I-80/SR 65 Medium and Heavy-duty Truck Characteristics

Characteristic	Medium-duty Truck	Heavy-duty Truck
Average One-Way Trip Length	Approximately 33 to 35 miles	Approximately 157 to 162 miles
Assumed Roundtrip Distance	Estimated to be around 70 miles (assuming two one-way trips)	Estimated to be around 320 miles (assuming two one-way trips)
Description	Mainly engaged in local or regional operations, covering relatively shorter distances; involved in middle-mile trucking and local and regional vocational tasks	Heavy-duty trucks passing through on I-80 are engaged in more extended regional haul and drayage operations; they cover significantly longer distances than the medium-duty trucks

2.6.3 Challenges for Heavy-duty Electric Trucks

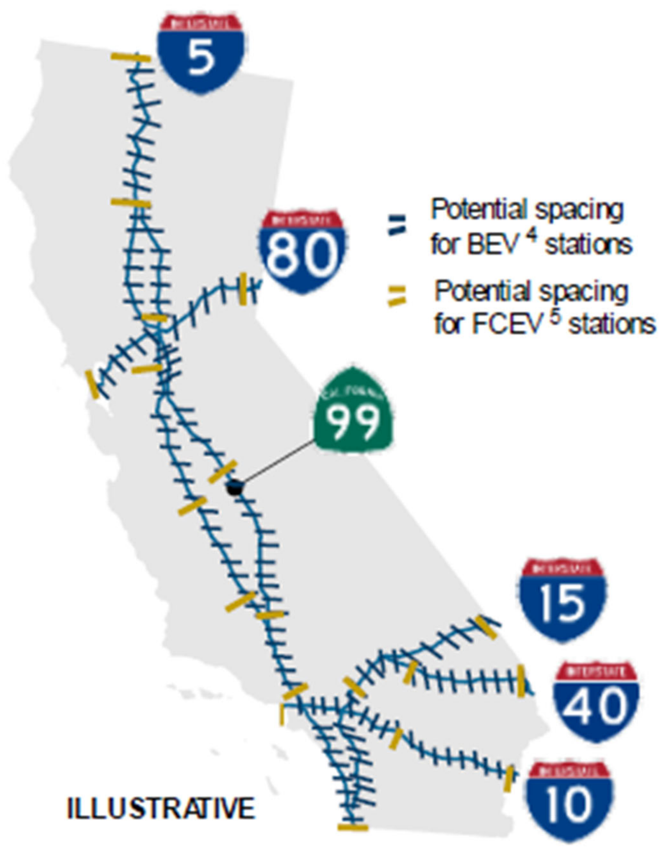
The data reveal that while medium-duty BETs can adequately handle the assumed roundtrip distance of approximately 70 miles, the heavy-duty BETs might face challenges covering the assumed roundtrip distance of approximately 320 miles. The steep grades between Rocklin and Truckee on I-80 can further exacerbate this challenge for heavy-duty BETs. Hydrogen H_2 FCEVs can help address potential range and charging challenges.

2.6.4 Infrastructure Considerations

To support the transition to alternative fuel trucks, electric charging and HRI must meet the different needs of medium- and heavy-duty trucks. For medium-duty trucks, overnight charging facilities could be sufficient, given their relatively shorter roundtrip distances. However, fast-charging infrastructure will be crucial for heavy-duty trucks, especially in the steep grade areas, so they can cover the longer distances within their operational range.

Spacing of truck stops along I-80 and SR 65 is also a consideration. California Senate Bill 671 requires that the California Transportation Commission prepare a Clean Freight Corridor Efficiency Assessment to identify freight corridors, or segments of corridors, and the infrastructure needed to support the deployment of medium- and heavy-duty ZEVs. Figure 2-6 shows that at least six electric charging locations and one H_2 refueling locations will be needed between Sacramento, California and Reno, Nevada.

Figure 2-6. Potential Minimum Viable Truck Stop Locations along Interstate 80



2.7 Market Assessment of Zero-Emission Vehicles and Infrastructure

A market assessment of ZEVs and related charging infrastructure helps understand the evolving trends and potential for electric and H_2 trucking fleets, and it forms the cornerstone of the projection of future demand for charging and refueling infrastructure. This high-level examination, guided by traffic analysis results, not only enables strategic planning and scalability, but also feeds into the next step of the FS, which focuses on the screening analysis of potential sites near the I-80/SR 65 interchange for prioritization.

2.7.1 Electric and Hydrogen Trucks

In the past decade, battery-electric and H_2 as primary propulsion fuels for medium- and heavy-duty trucks have grown from niche impractical technologies to mainstream products readily offered by top truck manufacturers. BET product on the market currently ranges from medium-duty class 2B, last-mile delivery vans, to heavy-duty, class 8, drayage and regional trucks, along with other vocational trucks and buses in between. Hydrogen, due to its similar fueling speed to diesel and high onboard energy storage capabilities, has become a potential alternative in long-haul trucking as a feasible and easy zero-emission alternative. Figure 2-7 shows the market progression of BET, with full implementation occurring in 2023, while H_2 should realize full implementation by 2024.

Figure 2-7. Electric Truck Market Progress Over Time

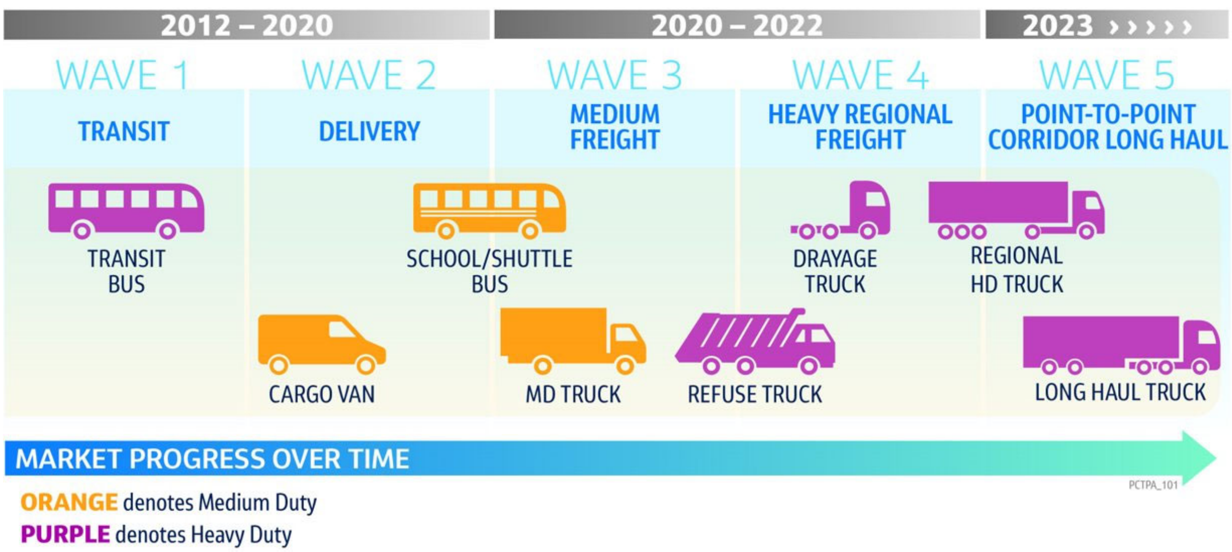


Table 2-4 shows the makes, models, and specifications of some common BETs, and regional, dry van, and drayage trucks on the market.

Table 2-4. Specifications of Some Common Battery-electric, Regional, Dry Van and Drayage Trucks on the Market

Weight Class	Make	Model	Range (miles)
Heavy Duty (class 6/7/8)	Nikola	TRE BEV	330
	Tesla	Semi	500
	Peterbuilt	579EV	150
	Volvo	VNR Electric	275
	Lion	8	200
	Freightliner	eCascadia	230

Weight Class	Make	Model	Range (miles)
Medium Duty (class 2b/3/4/5)	Lion	5	200
	Lion	6	200
	Bollinger	B4	185
	International	eMV	135
	Lightning eMotors	ZEV4	130
	Freightliner	eM2	250
	Brightdrop	Zevo 400	250
	Brightdrop	Zevo 600	250

Table 2-5 shows the makes, models, and specifications of some common H_2-fueled, long-haul trucks on the market.

Table 2-5. Specifications of Some Common Hydrogen-Fueled, Long-haul Trucks on the Market

Weight Class	Make	Model	Range (miles)
Heavy Duty (class 6/7/8)	Nikola	TRE FCEV	500
	Hyundai	Xcient	450
	Kenworth/Toyota	T680FCEV	450
	Hyzon	HYHD8-110	350
	Hylion	Hypertruck FC	500

2.7.2 Hydrogen Truck Refueling

In California, the HRI for heavy-duty trucking is a growing focus, with concentration near strategic locations, such as the Port of Long Beach, Los Angeles, and Ontario, California. Currently, three operational, dedicated heavy-duty trucking, H_2 refueling stations are located in these areas, all operated by Shell Hydrogen. This indicates a significant initial investment by Shell, reflecting both the state's commitment to clean energy and the logistics needs of these port areas. Shell has also announced plans to expand its H_2 infrastructure to other locations, including West Sacramento.

Pilot Flying J, Travel Centers of America, and Love's/Trillium, other private developers, have planned or announced projects. These investments and plans signal a growing recognition of H_2 as a viable fuel alternative for heavy-duty trucking within the state, and the anticipated expansion of these facilities suggests a robust future for HRI in California.

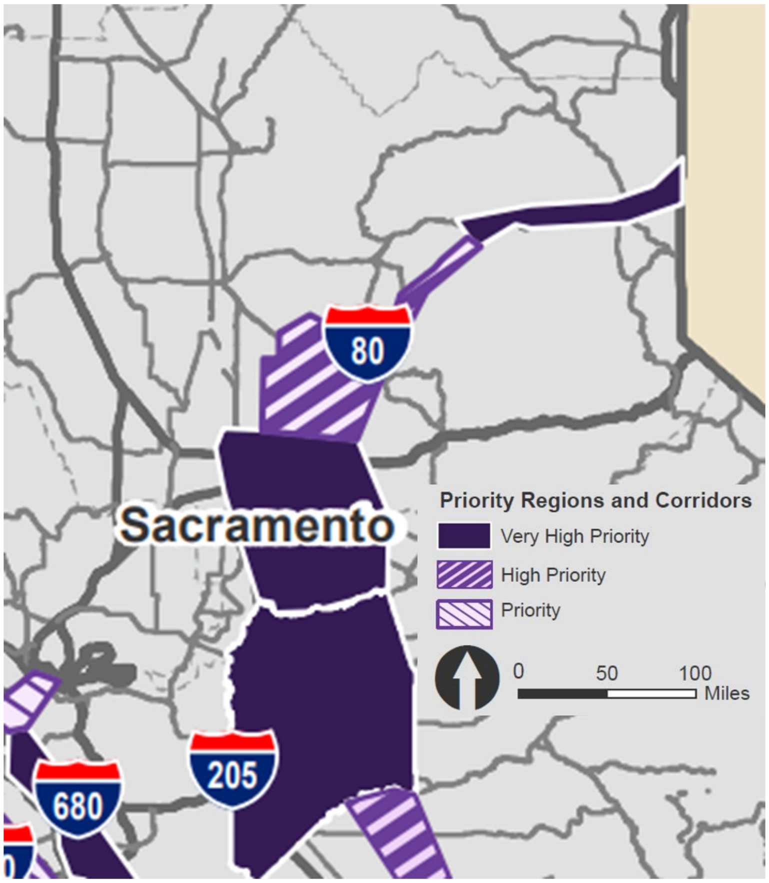
2.7.3 Electric Truck Charging

California has rapidly emerged as a focal point toward a greener trucking landscape. Private electric charging companies, such as Voltera Power, Terawatt, Electrify America, and WattEV, are growing there footprint across Northern California. In addition, joint ventures, such as GreenLane (a collaboration of Daimler, NextEra, and Blackrock) and Pilot Flying J (partnering with GM), along with Travel Centers of America (now under BP) are working to build charging networks, further exemplifying the robust private investment in this space. Together, they are not only enhancing the charging infrastructure in California but are also crafting a blueprint for integrating ZEVs.

2.7.4 Truck Parking Needs

The I-80 corridor is part of the nationwide truck parking shortage due to heavy truck traffic, where existing truck parking facilities are frequently at or near capacity. Per the California Statewide Truck Parking Study (Caltrans 2022), the I-80 Truckee Corridor is designated as a Very High Priority, with a deficit of 165 spaces during the peak hour (Figure 2-8). The lack of adequate parking spaces leads to trucks parking in undesignated areas, causing safety concerns and congestion. Additionally, limited parking options can force drivers to either cut their driving short or exceed legal driving hours to find a suitable spot, potentially compromising safety and regulatory compliance. The California Trucking Association as part the stakeholder group for this study expressed the need for additional parking and stated that support for any site from the Association would be based on providing on-site truck parking.

Figure 2-8. California Statewide Truck Parking Study Priority Regions



The California Statewide Truck Parking Study also illuminated the urgent need to expand the charging and refueling infrastructure for electric and H_2-powered trucks, noting:

> *"Providing zero emission fuels (ZEF), described under Policy and Program Strategies in Support of Truck Parking, may not be feasible everywhere but at a minimum should be considered at all future truck parking capacity projects" (Caltrans 2022).*

The transition to ZEVs adds another layer of complexity to the parking challenge. The infrastructure required for charging or refueling these vehicles is currently insufficient along I-80 and SR 65, threatening to slow the transition to cleaner transportation options. The industry's rapid movement toward sustainability demands an equally agile response in infrastructure development.

Several interlinked solutions must be considered. In addition to the expansion of existing facilities or building new ones is an urgent need to incorporate charging and refueling stations for electric- and H_2-powered trucks. Leveraging technology to provide real-time parking and charging station availability; exploring public-private partnerships to boost investment; and a coordinated approach between the state, local authorities, and private sector could all form part of a comprehensive strategy.

2.7.5 Technology Recommendations

Electric batteries and H_2 FCEV technologies are ever evolving and stand to both significantly grow in efficiency and commercial viability in the coming decades.

Currently, this particular stretch of I-80 and SR 65 corridors are substantially underserved for alternative fuel trucking, vehicle charging and refueling locations, and diesel and gasoline fueling locations. An analysis of the current I-80 corridor from Reno, Nevada to Sacramento, California, as well as the SR 65 corridor from Roseville to Yuba City, California shows no existing H_2 or battery-electric public heavy-duty truck facilities, and only one diesel truck facility (the Pilot 49er truck stop). Demand and need is high along the corridor, and new truck facilities are badly needed, regardless of fuel type. A future site development in the vicinity of the I-80/SR 65 interchange would be well situated from both a customer traffic and revenue standpoint.

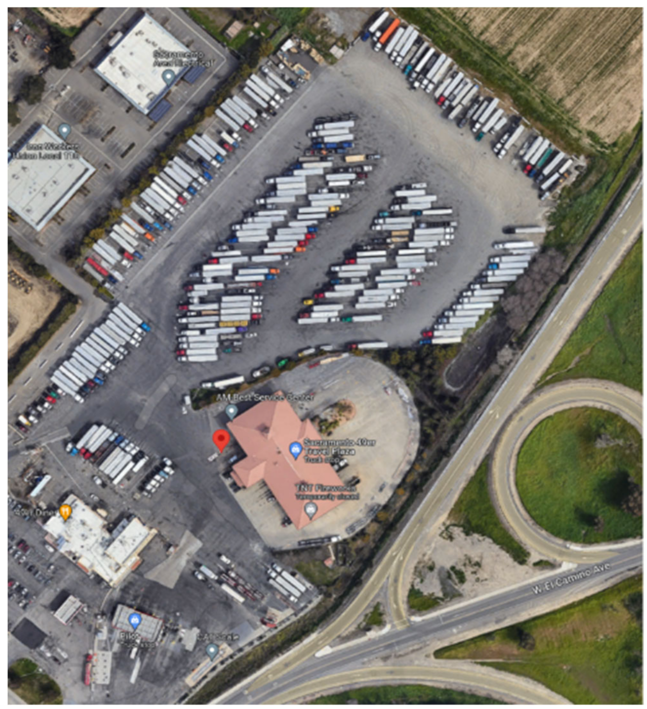


Figure 2-9. Existing Pilot 49er Truck Stop in Sacramento, California

The Pilot 49er truck stop is roughly 20 miles west of the I-80/SR 65 interchange and the only major truck stop within the immediate vicinity along I-80. The Pilot 49er truck stop consists of the following (Figure 2-9):

- 225 non-fueling parking bays
- 6 pull-through fueling lanes for heavy- and medium-duty trucks
- 8 light-duty passenger fuel pump locations
- 2 weigh scale locations
- 1 restaurant
- 1 convenience store
- 1 six-bay truck maintenance facility

The I-80/SR 65 interchange area is likely to have a mix of medium- and heavy-duty truck traffic, each with distinct trip lengths and operational requirements. The technology mix determination step considers these specific truck profiles and associated trip lengths to propose an optimized mix of BET and HRI. By striking a balance between the two technologies, the proposed infrastructure aims to meet the varied operational needs of the trucking industry, while promoting the adoption of cleaner and more sustainable transportation solutions in the region. The goal is to serve the most customers and drivers along the corridor, ensure futureproofing, and serve multiple types of vehicles. The assumption is that the mix of infrastructure for each site would match and be proportional to the type of vehicle and driver who uses the corridor daily, and would include a mix of multiple technologies. In addition, the site should also provide for heavy-duty truck and trailer layover parking, which is badly deficient in this area of I-80, SR 65, and the greater California freeway network.

This approach sets the stage for a well-integrated and futureproof infrastructure that can adapt to the evolving demands of the trucking sector and advance the region's commitment to reducing GHG emissions and promoting environmental stewardship.

2.7.6 Vehicle User Characteristics

Based on current battery technologies and the trends of vehicle types and industries with battery-EVs, it is likely that medium-duty trucks will be battery-electric. Even medium-duty trucking with trips more than 500 miles, given their low weight requirements and higher efficiencies, are anticipated to trend toward battery-electric technologies. Battery-electric will also be the most prevalent technology in heavy-duty trucking with regional, drayage, and urban haul use cases less than 150 miles. An example is heavy-duty, dry van trucking that serves regional beverage, food distributor, and less-than-truckload trucking in the greater Sacramento region.

The regional medium- and heavy-duty trucks will be primarily charged overnight in private depot yards but will need mid-day on-route fast-charging stations so that they can meet each day’s changing needs. The demand for medium- and heavy-duty trucks capable of mid-day fast charging for BETs is very large, and it is anticipated that this will result in the greatest revenue generation and vehicle traffic to a future site.

This usage scenario is important to highlight, as the site’s amenities and concession should be developed so as to provide the following:

- Quick food and beverage offerings
- Fast charging to provide layover times of approximately 20 to 40 minutes, typically during a lunch break
- Sitting areas, and lunch and breakfast options for drivers
- Potential for valet service to park, plug, and unplug trucks to avoid drivers needing to operate chargers; this has an added benefit of efficiently using fast-charging stations and efficient truck movements once the charge session has concluded

While a much smaller percentage of truck traffic traveling though the corridor long distance (more than 150 miles), heavy-duty truck traffic is also a category that should not be ignored when developing service infrastructure. This truck type and usage scenario is anticipated to be predominantly H_2 FCEVs in the coming decades due to limitations on BET ranges. The Roseville and Rocklin area, along with the larger Sacramento region, is an important corridor for the growth of H_2, long-haul trucking; thus, a site should include some provisions for H_2 fueling.

2.7.7 Site Characteristics

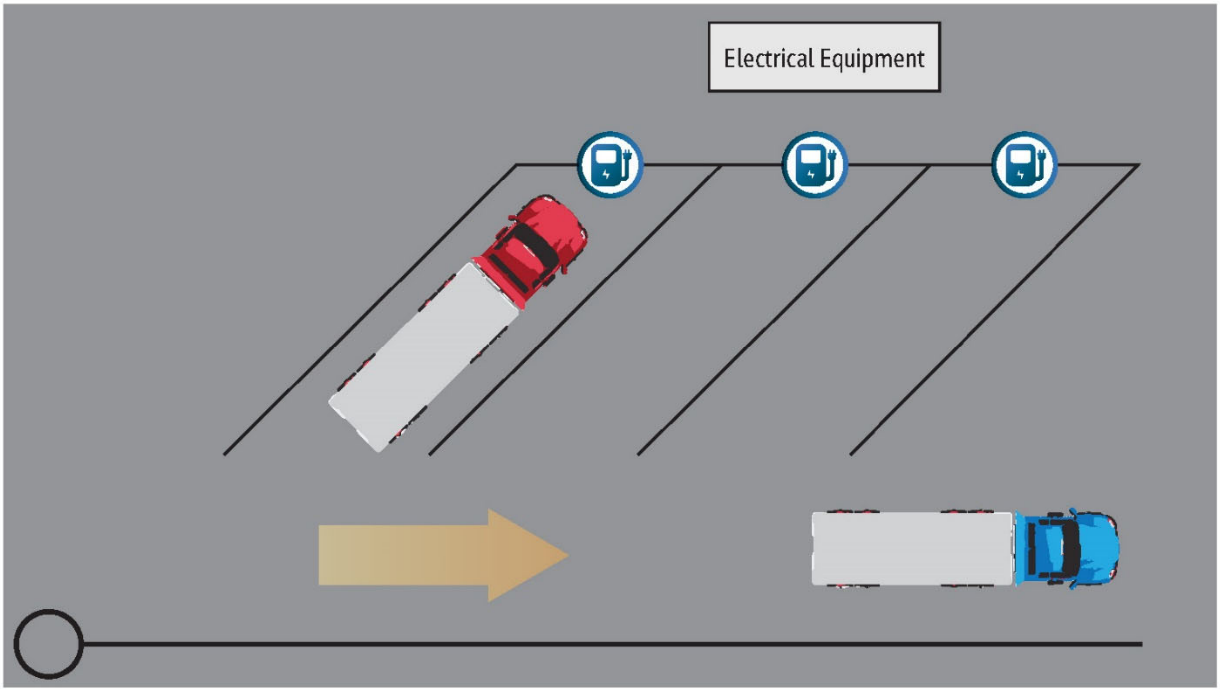
Using the average volume data, it was determined that approximately 80% of available fueling and charging stalls should be allocated for regional and urban medium- and heavy-duty BETs. H_2 heavy-duty trucks with trips more than 150 miles constitute roughly 20% of the total volume, and it is expected that these vehicles would constitute the future H_2 fueling demand.

Depending on specific layout, size, and exit and entrance requirements, the ideal site should consist of four separate areas to accommodate different trucking types and address projected future needs:

1. Of the 80% allocated for BET stalls, 75% should be able to service medium-duty vans, trucks, and vocational trucks. These facilities should include facility features, such as:
    - Nose-in parking (Figure 2-10)
    - Waiting queue areas
    - Valets
    - Large screens showing charger status in food areas
    - Sitting areas

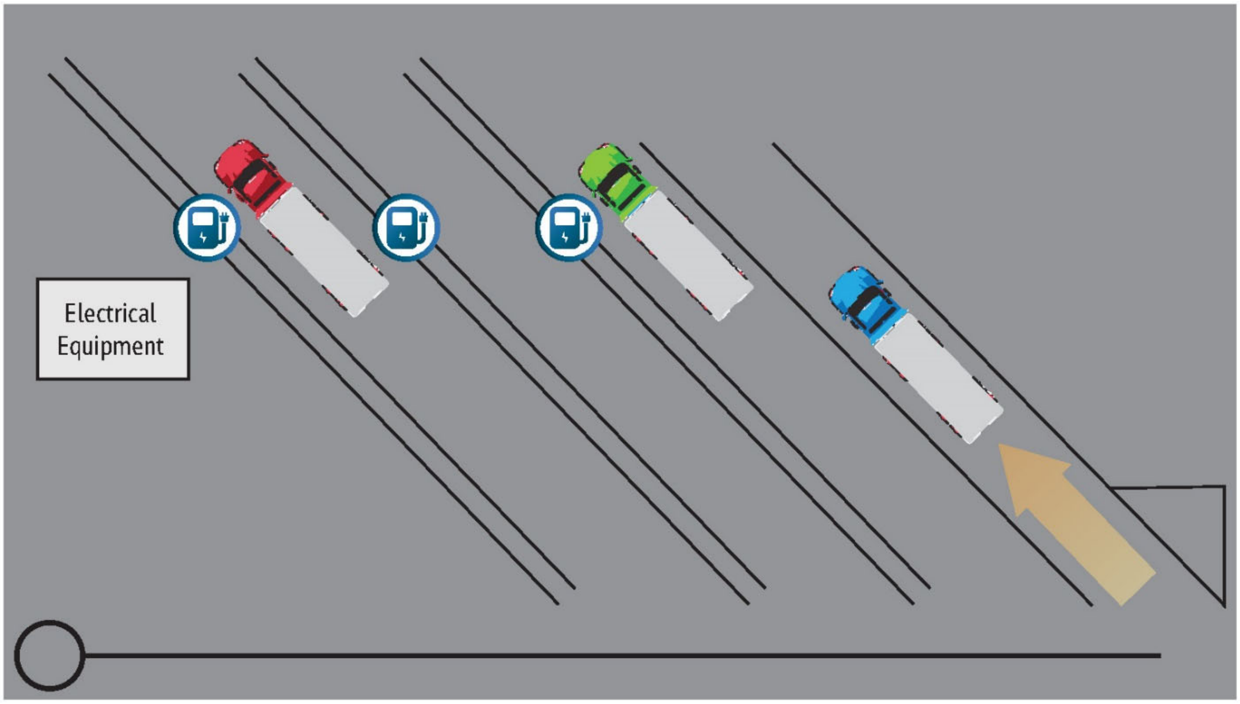
This area would primarily serve fleet vehicles that require mid-day and lunch break charging.

Figure 2-10. Example Nose-in Parking



2. In addition to the 80% allocated for BET stalls, 25% should be designed for heavy-duty trucks and trailers with pull-through stalls with 350-kilowatt (kW) fast chargers for short (less than 1-hour dwell times) (Figure 2-11). Like the medium-duty scenario, this is envisioned to primarily serve daily mid-day charging needs of local and regional trucking companies.

Figure 2-11. Example Pull-through Truck Parking Stall Layout



3. Approximately 20% of the total stalls available for both BET and H_2 trucks should provide H_2 refueling for heavy-duty trucks and trailers and should be designed for a vehicle refuel dwell time of no more than 15 minutes. Long-haul trucking, while a smaller percentage of the corridor's traffic, represents a crucial population that ultimately will also need to be served in the coming decades.

4. Dedicated parking should be provided for heavy-duty trucks and trailers requiring longer overnight layover needs. These parking areas should be co-located with the heavy-duty EV and H_2 truck and trailer areas, addressing the lack of general heavy-duty truck parking along the immediate stretch of I-80.

3 Site Analysis

Selection of suitable sites involved developing a list of sites to consider and ranking them against high-level screening criteria. Three sites were selected using the high-level screening criteria and were evaluated in greater detail, as described in this section.

3.1 Sacramento Area Council of Governments Coordination

Sacramento Area Council of Governments (SACOG) is currently leading a separate FS for truck alternative fuel in the Northern California Megaregion. The study identified 55 candidate locations based on geographic information system (GIS) data, stakeholder input, and recommendations from various sources. These sites met specific criteria, including:

- Industrial zoning
- Proximity to freeway exits
- Leveraging other transportation projects
- Not next to residential areas

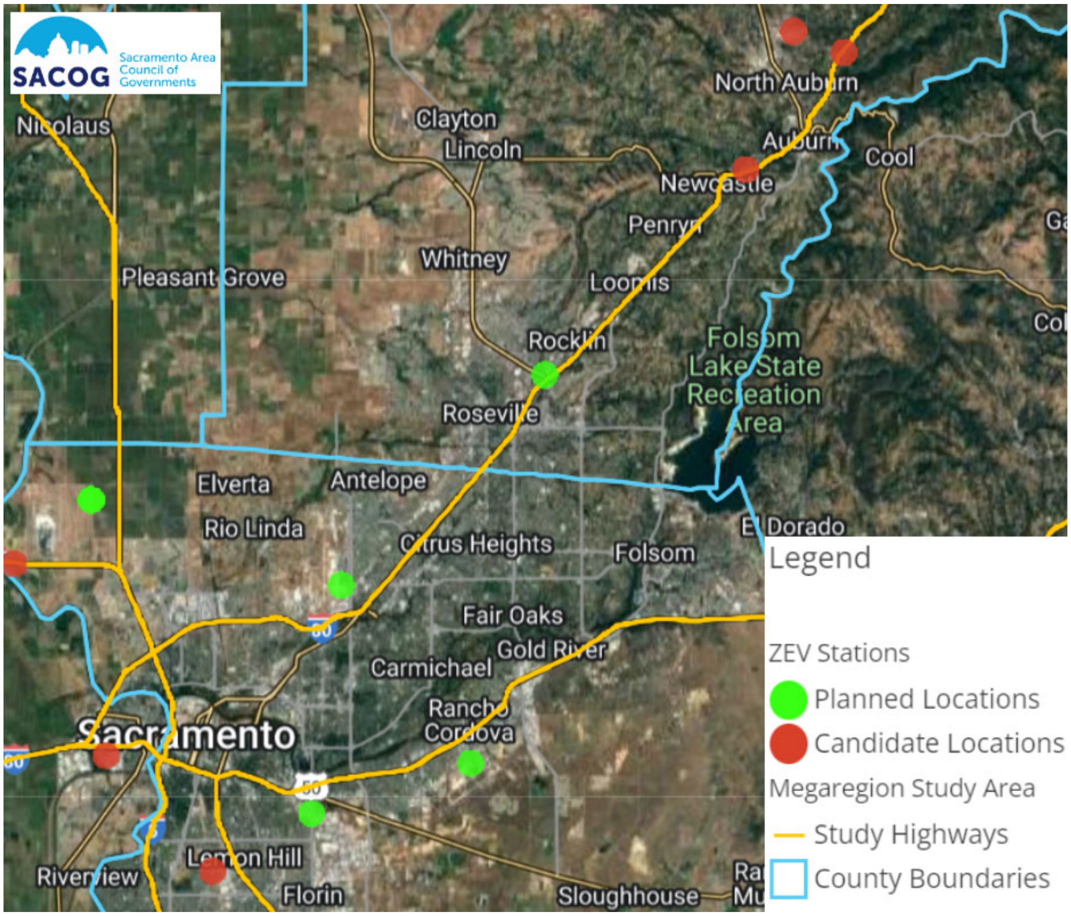
After feedback from the Steering Committee, 42 sites were selected for further evaluation. Using GIS data, Google Maps, property records, and capacity maps, the project team assessed factors that could impede the construction of a ZEV fueling hub or make the site economically unviable compared to others in the area. This led to the categorization of the remaining 43 sites into 3 groups, each requiring distinct approaches for feasibility, outreach, community engagement, and business models.

The study also referenced earlier work by the California Fuel Cell Partnership, defining three types of stations: Clusters, Connectors, and Destination stations. These stations vary in size and purpose, accommodating overnight charging, daytime opportunity charging, and other services.

Additionally, SACOG has compiled a database of considered locations for ZEV fueling facilities. Figure 3-1 shows a screenshot from this database.

Figure 3-1. SACOG Desired Locations for Zero-emission Vehicle Fueling Facilities

Source: SACOG, 2023



Current ZEV station development is underway, with various agencies and developers actively engaging with fleets and planning for depot and public charging. The 2023 *California Building Code* mandates EV-ready infrastructure for new commercial and industrial buildings with loading docks or truck parking. Several charging hubs are already operational or in planning stages in Sacramento, Livermore, and Tracy, while H_2 stations are also being considered for the region. The process of identifying candidate locations involved considering factors, like:

- Jurisdictional support
- Near-term demand
- Property accessibility
- Economic impact
- Alignment with existing and planned infrastructure

Sites were screened to verify suitability, resulting in a final list of more than 40 locations in the 3 main categories.

For existing truck fueling stations, the team recommends direct engagement with owners and operators to educate them about ZEV opportunities. Sites meeting Megaregion criteria are listed, along with their respective cities. Sites listed for sale are recommended for evaluation, with results shared with real estate brokers representing the properties. Feasibility analyses may lead to sales or listings, potentially expediting privately funded ZEV station development. Sites not for sale, including those owned by government agencies or private entities, require outreach to gauge interest and willingness to participate in an evaluation. Community engagement is essential to provide ZEV fueling benefits to residents and businesses.

The study also provides information about expected throughput and peak demand at the identified stations, which will be crucial for planning and development. Table 3-1 shows the candidate sites identified in Placer County.

Table 3-1. Placer County Candidate Sites

City	Address	Description
Auburn	14330 Musso Road	Industrial building on land leased from UP through 2032
Auburn	10201 Ophir Road	Vacant property
Auburn	13666 New Airport Road	Undeveloped land near airport
Emigrant Gap	41975 Nyack Road	Authorized and unauthorized truck parking

Source: SACOG, 2023

3.2 High-level Site Screening

The goal of the high-level site screening was to consider all candidate sites and refine the list based on fatal flaws and implementation considerations. Figure 3-2 summarizes the conclusions of the screening, and Sections 3.1.1 through 3.1.3 provide details.

Figure 3-2. Site Screening Matrix

Site	1 Roseville Electric Substation	2 Miner Ravine	3 Roseville Pkwy	4 Taylor Rd	5 Secret Ravine Ramp	6 Galleria	7 Sierra College	8 Horseshoe Bar	9 Penryn	10 Bell
Acreage	15.7		14.2	2.8		20				
Ownership	PG&E		City of Roseville	Strauch Trust		Galleria LLC				
Electric Charging			Can Not Excavate							
Hydrogen Refueling	Overhead Powerlines		Can Not Excavate							
Revenue Generation Potential	Large		Large	Small		Large				
Site Development Cost			Ramp Access	Low						
Site Development	Overhead Powerlines		No Digging	Needed for 80/65		Pending Development				
Environmental and Community Considerations	Former Landfill		Nearby Apartments Former Burn Dump	Nearby Church		Former Landfill				
Truck Route Access										
Grant Funding - CEJST Mapping										
Local Agency Concerns	High Traffic Area		Old Landfill	None		High Traffic Area				

Potential Issues: Low Medium High

Five sites were screened out because they are not close enough to the I-80/SR 65 interchange. These sites include:

- Miner Ravine (Site 2)
- Sierra College (Site 7)
- Horseshoe Bar (Site 8)
- Penryn (Site 9)
- Bell (Site 10)

Secret Ravine Ramp (Site 5) was screened out because it is lacks sufficient operating space and because it has no technically feasible options for site access.

The other four sites were evaluated based on the criteria in Figure 3-2 and assigned a color based on its level of performance against a given criterion, as follows:

- A green cell indicates the criterion appears to pose no challenge to a site's feasibility.
- A yellow cell indicates the criterion appears to pose a challenge to a site's feasibility.
- An orange cell indicates the criterion appears to pose a significant challenge to a site's feasibility.

Roseville Electric Substation (Site 1) was eliminated through discussions with stakeholders because Pacific Gas and Electric Company (PG&E) (owner) has purposed this space for future expansion of the electrical substation. Babeeta Nagra, PG&E, included the following justification for the team to eliminate Site 1:

> *"While PG&E currently has undeveloped land around its Atlantic Substation (known as Site 1 Roseville Electric Substation in the I-80/SR 65 Interchange Truck Alternative Fueling Feasibility Study); there are future expansion plans at the substation that would minimized availability of access and land on the property. At this time, PG&E would suggest SACOG remove site 1 from its evaluation criteria as a potential site due to future development on the site."*

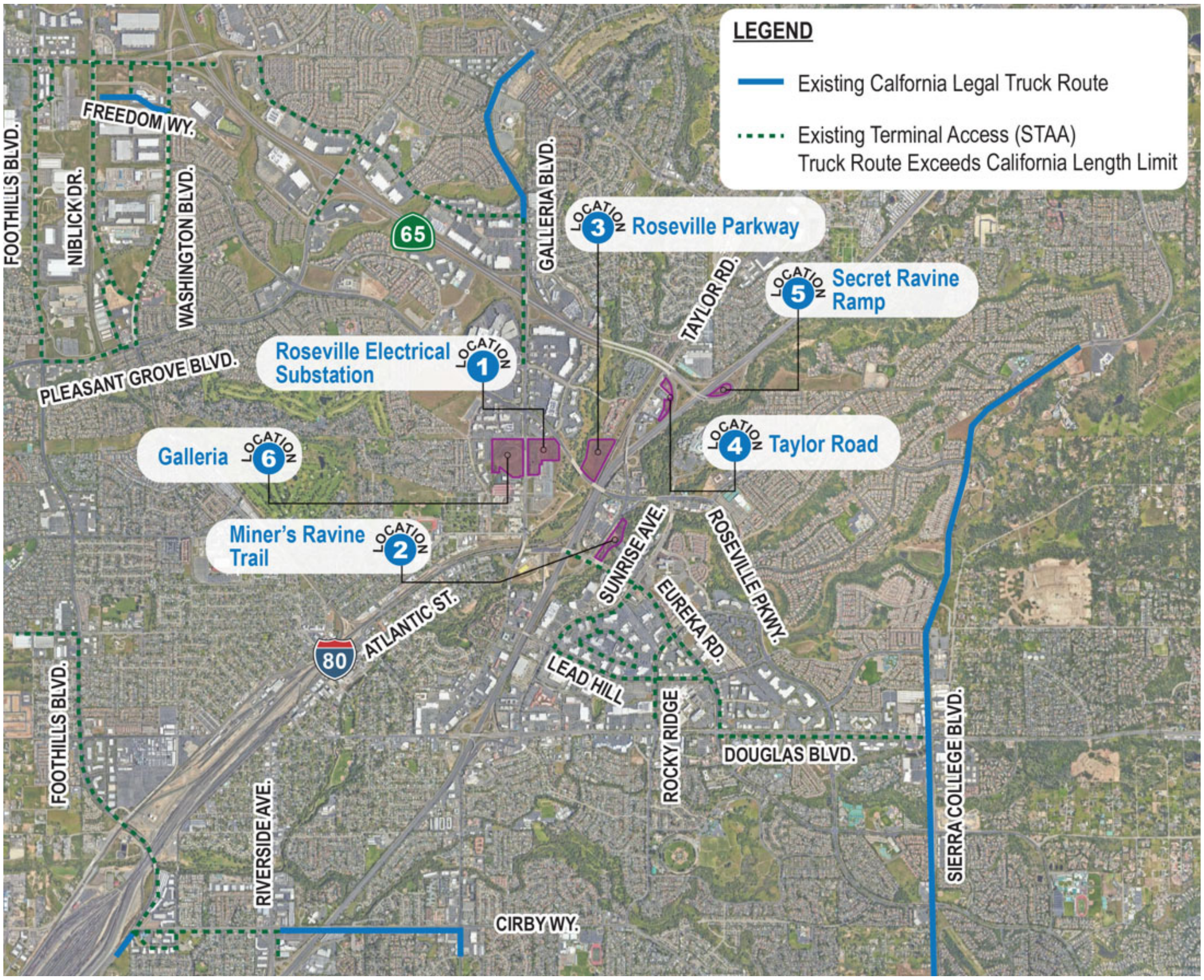
Seven sites were screened out during the high-level site screening, leaving Roseville Parkway (Site 3), Taylor Road (Site 4), and Galleria (Site 6) to be evaluated during the detailed site evaluation.

3.2.1.1 California Legal Truck Routes

All three remaining sites (sites 3, 4, and 6) are not accessible by California Legal Truck Routes within the City of Roseville. Various regional corridor priorities may change this, but this is an important feasibility consideration, as well as a consideration for the sites' competitiveness for funding.

Figure 3-3 shows the existing truck routes as they relate to the nearby sites considered by this study.

Figure 3-3. California Legal Truck Routes



3.3 Detailed Site Evaluation

Three sites were identified to progress to a detailed design phase and are discussed in this section.

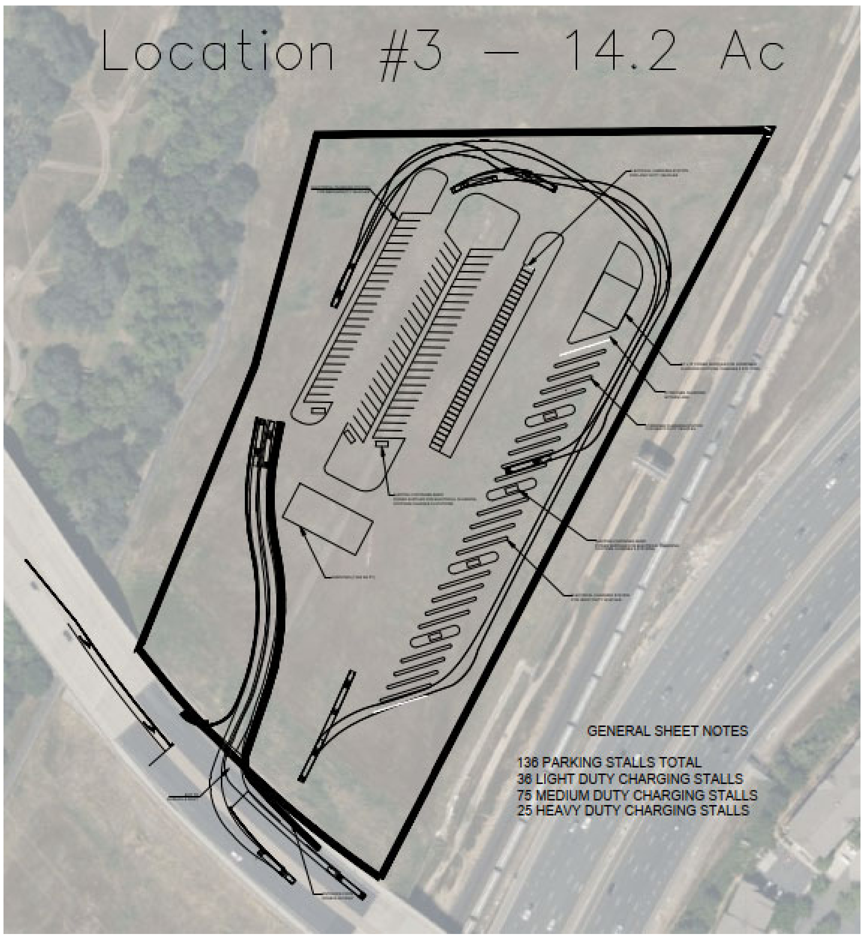
3.3.1 Roseville Parkway (Site 3) Overview

Site 3 is one of three recommended sites for medium- and heavy-duty truck charging and refueling along the I-80/ SR-65 corridor in Roseville, California. The primary factors influencing this recommendation are the number of vehicles associated with the site, access to the site, and the available power. This site includes fueling islands, charging and fueling equipment, as well as a large 7,800 square foot (ft^2) concession building. A total of 136 vehicles can be served at this site. The vehicles include parking spaces to accommodate 36 light-duty, 75 medium-duty, and 25 tractor-trailer heavy-duty vehicles. The medium- and heavy-duty quantities represent approximately 0.4% of the overall daily I-80 combined eastbound and westbound corridor traffic volume.

Figure 3-4 shows a detailed parking layout, with truck turning analysis of the site for reference. A higher resolution layout is shown in the Appendix. The schematic design in the Appendix shows additional detail, including a detailed charging and refueling equipment layout.

The subsections that follow the site layout provide a summary of the site conditions and upgrades needed to charge the associated vehicles.

Figure 3-4. Site 3 Layout



3.3.1.1 Electric Vehicle Supply Equipment and Hydrogen Fueling Equipment Summary

Site 3 is located atop a capped landfill site, complicating the traditional way of installing electric vehicle supply equipment (EVSE) and H_2 fueling facilities. It is anticipated that aboveground gantries, raceways, and trestle structures will be used to distribute H_2 fuel and electrical wiring throughout the facility.

The site has the capacity to serve a total of136 vehicles (36 light-duty, 75 medium-duty, and 25 tractor-trailer heavy-duty). Five of the planned 25 pull-through heavy-duty lanes are allocated for H_2 refueling, while the remaining spaces are dedicated for BETs.

It is anticipated that Level 3 direct current (DC) charging of up to 150 kW should be used for the light-duty and medium-duty vehicles, considering the need for a quick mid-day charge, with vehicle battery pack sizes ranging from 90 to 300 kilowatt-hours (kWh).

It is anticipated that the vehicles classified as heavy-duty, with Class 8 truck and trailer combinations would be served by 350 kW DC charging systems. This larger size will help futureproof the site and enable quick approximately 30-minute charging times for semi-truck vehicles, with battery packs ranging from 200 to 900 kWh.

To serve the needs of the region's customers and accommodate the parking lot layout, it is recommended that fifty-six 150-kW dual-port DC charging systems and twenty 350-kW single-port DC charging systems be installed across the parking areas at Site 3.

Hydrogen fueling equipment sizing will be based upon the installation of five pull-through refueling lanes. Each lane can have one dispenser that can accommodate 350 and 700 bar refueling. It is anticipated that the lanes will serve heavy-duty H_2 FCEVs that have onboard capacity of approximately 50 kilograms (kg) of H_2.

Adjacent to the refueling lanes will be the H_2 refueling equipment compound. The compound will contain H_2 storage (bulk and high pressure), compressors or cryopumps, and chillers or vaporizers. Hydrogen can be either stored as a compressed gas or as a liquid. Because of the quantities of H_2 and logistics, we anticipate that the H_2 will be stored in liquid form. The H_2 storage quantity for the site will be approximately 10,000 kg.

Site 3 also is a good candidate for the deployment of substantially sized aboveground storage tanks (ASTs) for H_2 and associated distribution systems for H_2 FCEVs. Hydrogen facilities require significant footprint, approximately 8,000 to 10,000 ft^2, and Site 3 can accommodate these H_2 facilities. It is projected that the H_2 fueling infrastructure onsite would have the ability to support primarily heavy-duty, long-haul semi-truck volume, in addition to supplying H_2 to light-duty passenger vehicles as well.

3.3.1.2 Civil Summary

Access to Site 3 from Interstate 80 is via the Atlantic Street/Eureka Road interchange, Taylor Road, and Roseville Parkway. Departing the site to return to the freeway would utilize the same routes in the opposite directions. Vehicles accessing from Westbound I-80 are required to weave across three lanes of traffic on Atlantic Street to access Taylor Road, which may be difficult for large trucks and could impact traffic operations. A new, signalized intersection on Roseville Parkway would be required to access the facility. From the new intersection, a 525-foot-long roadway to the site would need to be constructed to accommodate the approximately 25-foot elevation difference between the site and elevated Roseville Parkway. The new intersection and connecting roadway would be designed and constructed per City of Roseville standards.

The local roadways accessing this site are not currently legal truck routes per the City of Roseville's Truck Route Map. Coordination with the City and potential additional capital improvements would be necessary to permit these roadways to be used by trucks to access the site.

As mentioned in the previous section, Site 3 would be constructed on top of a capped landfill. Significant environmental mitigation could be required to develop the site. Excavation would not be permitted, requiring the import of material to accommodate site grading and provide cover for underground utilities.

3.3.1.3 Electrical Summary

The primary incoming electrical feed would be supplied by the local municipal utility, Roseville Electric, and would be routed through overhead aerial lines adjacent to the site along Galleria Boulevard. Exact sizing of the service and primary medium-voltage tie-in points are still to be determined.

The anticipated electrical loads of the site consist of the following elements:

- Site lighting and building loads: 200 kW
- Fifty-six 150 kW DC fast charger for light-duty and medium-duty vehicles
  - Peak load: 8.4 megawatts (MW)
  - Expected nominal load: approximately 3 MW
- Twenty 350 kW DC fast charger for heavy-duty tractor-trailers
  - Peak Load: 7 MW
  - Expected Nominal Load: approximately 4 MW
- Hydrogen fueling infrastructure:
  - Peak Load: approximately 250 kW

Given the scale and size of the electrical needs for the site, onsite renewables, battery storage, and integrated charger management software should be explored to support balanced energy usage.

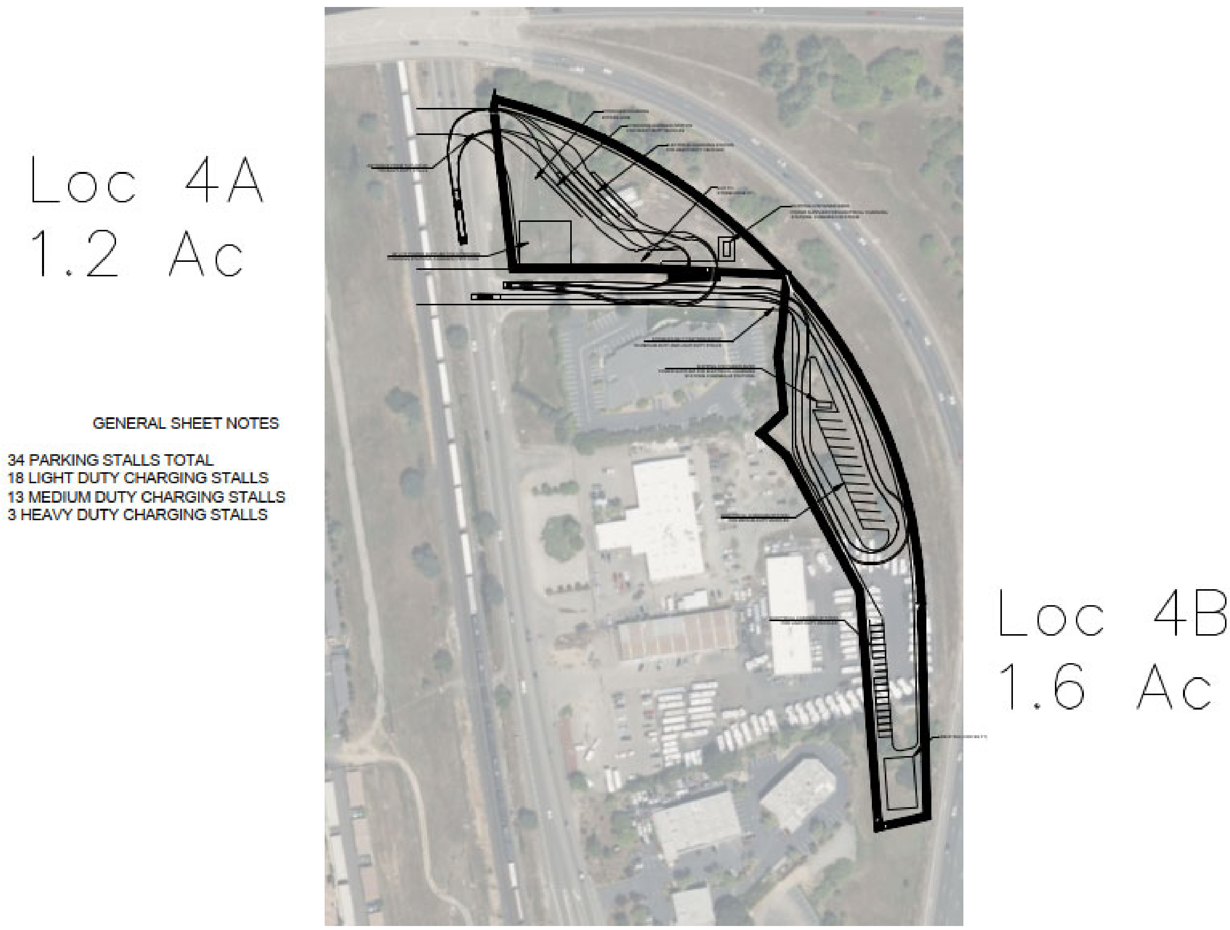
3.3.2 Taylor Road (Site 4) Overview

Site 4 is one of three recommended sites for medium- and heavy-duty truck charging and refueling along the I-80/ SR-65 corridor in Roseville, California, and is the smallest site, comprising 1.2 acres. From a feasibility and developer attractiveness standpoint, Site 4 represents the most feasible site for establishing ZEV charging and fueling adjacent to the I-80/SR-65 interchange.

The primary factors influencing this recommendation are the number of vehicles associated with the site, access to the site, and the available power. This site includes fueling islands, charging and fueling equipment, as well as a smaller 2,800 ft^2concession building. A total of 34 vehicles can be served at this site. The vehicles include parking spaces to accommodate 18 light-duty, 13 medium-duty, and 3 pull-through lanes for tractor-trailer heavy-duty vehicles. The medium- and heavy-duty quantities represent approximately 0.1% of the overall daily I-80 combined eastbound and westbound corridor traffic volume.

Figure 3-5 shows a detailed parking layout, with truck turning analysis of the site for reference. A higher-resolution layout is shown in the Appendix. The schematic design in the Appendix shows additional detail, including a detailed charging and refueling equipment layout.

Figure 3-5. Site 4 Layout



The following subsections provide a summary of the site conditions and upgrades needed to charge the associated vehicles. Refer to the schematic design for complete details.

3.3.2.1 Electric Vehicle Supply Equipment and Hydrogen Fueling Equipment Summary

Site 4 is located adjacent to the I-80/SR-65 interchange, and bounded on the north by Taylor Road. It is intermixed between multiple mixed-use sites, including a recreational vehicle dealership and medical office building complex.

The site has the capacity to serve a total of 34 vehicles (18 light-duty, 13 medium-duty, and 3 tractor-trailer heavy-duty). One of the planned three pull-through heavy-duty lanes is allocated for H_2 refueling, while the remaining spaces are dedicated for BETs.

It is anticipated that Level 3 DC charging of up to 150 kW should be used for the light-duty and medium-duty vehicles, considering the need for a quick mid-day charge, with vehicle battery pack sizes ranging from 90 to 300 kWh. It is anticipated that the vehicles classified as heavy-duty, with Class 8 truck and trailer combinations, would be served by 350 kW DC charging systems. This larger size will help futureproof the site and support quick, approximately 30-minute charging times for semi-truck vehicles, with battery packs ranging from 200 to 900 kWh.

To serve the needs of the region's customers and accommodate the parking lot layout, it is recommended that fifteen 150 kW dual-port DC charging systems and three 350 kW single-port DC charging systems be installed across the parking areas at Site 4.

Site 4 also represent good candidates for the deployment of smaller-sized H_2 ASTs and associated distribution systems for H_2 FCEVs. While only a single pull-through H_2 fueling lane is shown on the layout, it is anticipated that this should be adequate to meet the needs of future truck traffic.

H_2 fueling equipment sizing will be based upon the installation of three pull-through refueling lanes. Each lane can have one dispenser that can accommodate 350 and 700 bar refueling. It is anticipated that the lanes will serve heavy-duty H_2 fuel cell trucks that have onboard capacity of approximately 50 kg of H_2.

Adjacent to the refueling lanes will be the H_2 refueling equipment compound. The compound will contain H_2 storage (bulk and high pressure), compressors or cryopumps, and chillers or vaporizers. H_2 can be either stored as a compressed gas or as a liquid. Because of the quantities of H_2 and logistics, we anticipate that the H_2 will be stored in liquid form. The H_2 storage quantity for the site will be approximately 6,000 kg.

Hydrogen facilities require a significant footprint, approximately 4,000 to 6,000 ft^2, and site 4 can accommodate these H_2 facilities. It is projected that the H_2 fueling infrastructure onsite would have the ability to support primarily heavy-duty, long-haul semi-truck volume, in addition to potentially supplying H_2 to light-duty passenger vehicles as well.

3.3.2.2 Civil Summary

Access to Site 4 from westbound Interstate 80 is via the Atlantic Street/Eureka Road interchange and Taylor Road. From eastbound I-80 access is from the Taylor Road interchange. Vehicle departing the site to return to the westbound freeway would utilize the Taylor Road interchange while eastbound vehicles would use Taylor Road to the Atlantic Street/Eureka Road interchange. Similar to Site 3, vehicles accessing from Westbound I-80 are required to weave across three lanes of traffic on Atlantic Street to access Taylor Road, which may be difficult for large trucks and could impact traffic operations. A new, signalized intersection on Taylor Road at Stonehouse

Court would be required to access the facility. The new intersection and connecting roadway would be designed and constructed per City of Roseville standards.

The local roadways accessing this site are not currently legal truck routes per the City of Roseville's Truck Route Map. Coordination with the City and potential additional capital improvements would be necessary to permit these roadways to be used by trucks to access the site.

Access and civil concerns include the following:

- Confined site with minimal staging area.
- Access to and from site unto Taylor Road is difficult, but not infeasible.
- Generally, site is a good candidate for development by a third-party developer.

The site cannot easily accommodate increased truck and commercial traffic due to the distance from the I-80 interchange with Eureka Road, as well as the designation of Taylor Road as a non-truck route corridor. Vehicles accessing the site from westbound I-80 or toward eastbound I-80 will need to travel more than 1 mile on local streets. To maintain safe and efficient traffic flow in and out of the site, the heavy-duty fueling and charging area will require an entrance off of Taylor Road and an expansion of Stonehouse Court to accommodate existing truck traffic during turning.

3.3.2.3 Electrical Summary

The primary incoming electrical feed would be supplied by the local municipal utility, Roseville Electric, and would be routed through overhead aerial lines adjacent to the site along Taylor Road. Exact sizing of the service and primary medium-voltage tie-in points are still to be determined.

The anticipated electrical loads of the site consist of the following elements:

- Site lighting and building loads: 100 kW
- Fifteen 150 kW DC fast charger for light-duty and medium-duty vehicles
  - Peak Load: 2.25 MW
  - Expected Nominal Load: approximately 1 MW
- Three 350 kW DC fast chargers for heavy-duty tractor-trailers
  - Peak Load: 1.1 MW
  - Expected Nominal Load: approximately 700 kW
- Hydrogen fueling infrastructure:
  - Peak Load: approximately 150 kW

Given the scale and size of the electrical needs for the site, primary power availability from Roseville Electric should be feasible. Onsite renewables, specifically solar canopies, should be explored to offset daytime and mid-day charging demand.

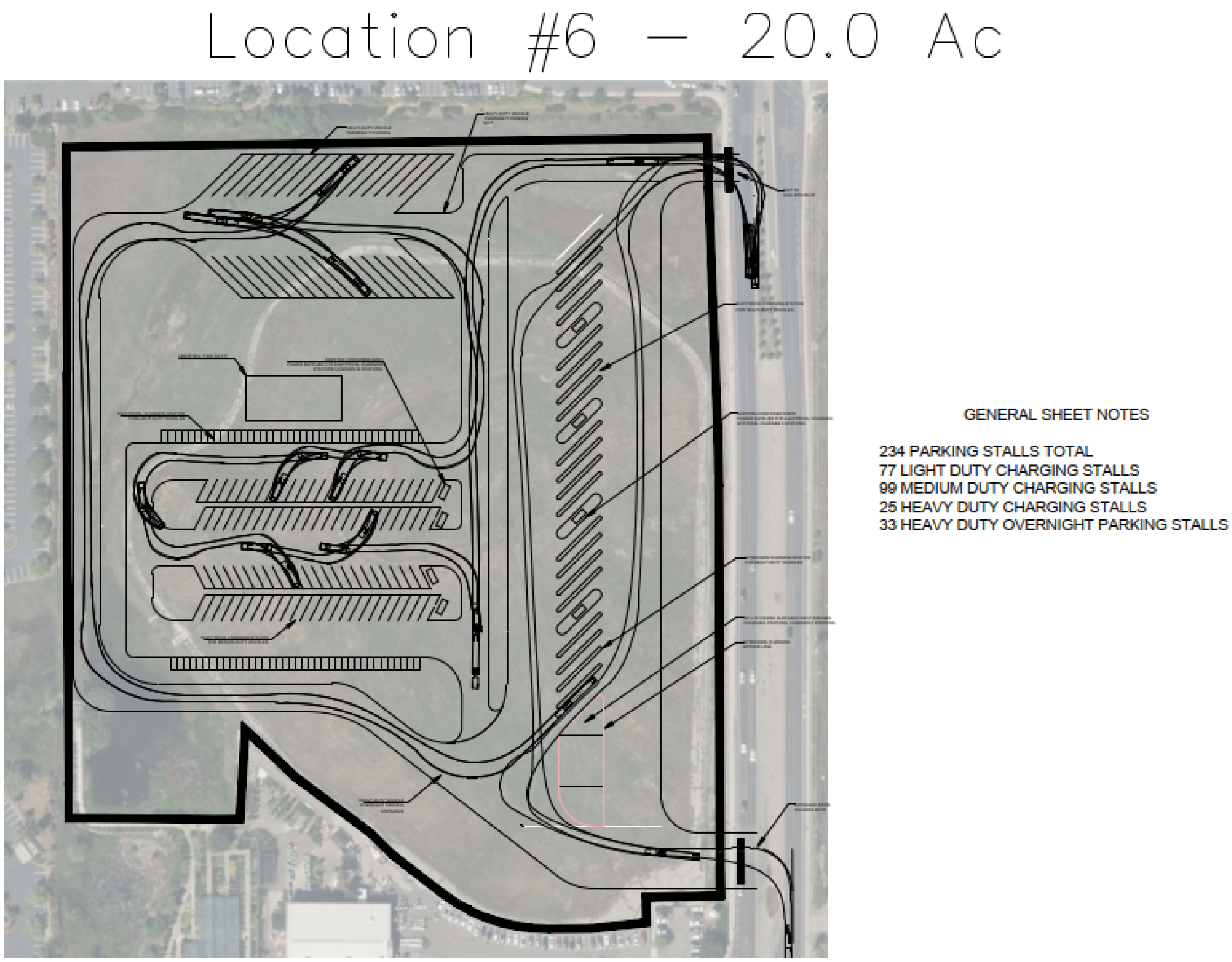
3.3.3 Galleria (Site 6) Overview

Site 6 is one of three recommended sites for medium- and heavy-duty truck charging and refueling along the I-80/ SR-65 corridor in Roseville, California and is the largest site, comprising 20 acres.

The primary factors influencing this recommendation are the number of vehicles associated with the site, access to the site, and the available power. This site includes fueling islands, charging and fueling equipment, as well as a large 7,800 ft^2concession building. A total of 201 vehicles can be served at this site, with an additional 33 spaces allocated for non-fueling and charging overnight parking. The site's charging and fueling parking spaces can accommodate 77 light-duty, 99 medium-duty, and 25 tractor-trailer heavy-duty vehicles. The medium- and heavy-duty quantities represent approximately 0.8% of the overall daily I-80 combined eastbound and westbound corridor traffic volume.

Figure 3-6 shows a detailed parking layout, with truck turning analysis of the site for reference. A higher-resolution layout is shown in the Appendix. The schematic design in the Appendix shows additional detail, including a detailed charging and refueling equipment layout.

Figure 3-6. Site 6 Layout



The following subsections provide a summary of the site conditions and upgrades needed to charge the associated vehicles.

3.3.3.1 Electric Vehicle Supply Equipment and Hydrogen Fueling Equipment Summary

Site 6 is located atop a capped landfill site with grades approximately 10 feet higher than the adjacent Galleria Road, complicating the traditional way of installing EVSE and H_2 fueling facilities. It is anticipated that aboveground gantries, raceways, and trestle structures will be used to distribute H_2 fuel and electrical wiring throughout the facility.

The site has the capacity to serve a total of 201 vehicles (77 light-duty, 99 medium-duty, and 25 tractor-trailer heavy-duty). Five of the planned 25 pull-through heavy-duty lanes are allocated for H_2 refueling, while the remaining spaces are dedicated for BETs.

It is anticipated that Level 3 DC charging of up to 150 kW should be used for the light-duty and medium-duty vehicles, considering the need for a quick mid-day charge, with vehicle battery pack sizes ranging from 90 to 300 kWh. It is anticipated that the vehicles classified as heavy-duty, with Class 8 truck and trailer combinations, would be served by 350 kW DC charging systems. This larger size will help futureproof the site and support quick approximately 30-minute charging times for semi-truck vehicles, with battery packs ranging from 200 to 900 kWh.

To serve the needs of the region's customers and accommodate the parking lot layout, it is recommended that eighty-eight 150 kW dual-port DC charging systems and twenty 350 kW DC charging systems be installed across the parking areas at Site 6.

H_2 fueling equipment sizing will be based upon the installation of five pull-through refueling lanes. Each lane can have one dispenser that can accommodate 350 and 700 bar refueling. It is anticipated that the lanes will serve heavy-duty H_2 FCEVs that have onboard capacity of approximately 50 kg of H_2.

Adjacent to the refueling lanes will be the H_2 refueling equipment compound. The compound will contain H_2 storage (bulk and high pressure), compressors or cryopumps, and chillers or vaporizers. H_2 can be either stored as a compressed gas or as a liquid. Because of the quantities of H_2 and logistics, we anticipate that the H_2 will be stored in liquid form. The H_2 storage quantity for the site will be approximately 10,000 kg.

Site 6 also represents a good candidate for the deployment of H_2 ASTs and associated distribution systems for H_2 FCEVs. H_2 facilities require a significant footprint, approximately 8,000 to 10,000 ft^2, and Site 6 can accommodate these H_2 facilities on a large scale. It is projected that the H_2 fueling infrastructure onsite would have the ability to support primarily heavy-duty, long-haul semi-truck volume, in addition to potentially supplying H_2 to light-duty passenger vehicles as well.

3.3.3.2 Civil Summary

Access and civil concerns include the following:

- Site is approximately 10 feet above the grade of Galleria Road, potentially leading to traffic flow inefficiencies.
- Access to Galleria Road may require signal intersection and restrictions to truck direction of traffic, and two exit and entrance turn lanes on Galleria Road.
- Site upgrades and underground work is not feasible due to the landfill, causing major barriers for a future developer.

The site cannot easily accommodate increased truck and commercial traffic due to the proximity to Roseville Galleria shopping district, as well as the designation of Atlantic Street, Wills Road, and Galleria Boulevard as non-truck route corridors. The site topography represents a challenge, given that the current site is higher elevation than the surrounding areas and roadway, so additional civil work will be required to develop ramps to provide easy access to the site by heavy-duty truck and trailer vehicles. To maintain safe and efficient traffic flow in and out of the site, two exits and entrances will be required off of Galleria Road, requiring new traffic signals, as shown on the high-level site layout on Figure 3-6.

3.3.3.3 Electrical Summary

The primary incoming electrical feed would be supplied by the local municipal utility, Roseville Electric, and would be routed through overhead aerial lines adjacent to the site along Taylor Road. Exact sizing of the service and primary medium-voltage tie-in points are still to be determined.

The anticipated electrical loads of the site consist of the following elements:

- Site lighting and building loads: 200 kW
- Eighty-eight 150 kW DC fast charger for light-duty and medium-duty vehicles
  - Peak Load: 13 MW
  - Expected Nominal Load: approximately 8 MW
- Twenty 350 kW DC fast charger for heavy-duty tractor-trailers
  - Peak Load: 7 MW
  - Expected Nominal Load: approximately 5 MW
- Hydrogen fueling infrastructure:
  - Peak Load: approximately 250 kW

Given the scale and size of the electrical needs for the site, onsite renewables, battery storage, and integrated charger management software should be explored to support balanced energy usage.

3.3.4 Environmental Considerations

Site development is subject to environmental review under the *California Environmental Quality Act* (CEQA), including preparation of an environmental impact assessment document. This section discusses the potential environmental impacts associated with the three sites being advanced to detailed design, focusing on the most important topics of environmental concern. During detailed design, each of these topics should be further explored to support decision-making regarding the preferred alternative, given the potential for some environmental considerations to greatly affect site development costs and schedule. Primarily, this is of greatest concern for the closed landfills where reuse opportunity will be dictated by the California Department of Toxic Substances Control (DTSC).

Table 3-2 is a high-level evaluation of the three sites based on important topics of environmental concern. Potential environmental impacts are based on the conceptual site layouts shown on Figures 3-4, 3-5, and 3-6. If alternative access routes are proposed or other major offsite work is included in the project description, additional environmental impacts may occur.

Table 3-2. Environmental Considerations

Environmental Concern	Site 3 (Galleria)	Site 4 (Taylor Road)	Site 6 (Roseville Parkway)
Hazardous Materials	DTSC restricts reuse and will need to update allowable land uses to accommodate this development.	No apparent constraints. Consider Phase 1 site assessment to determine potential for impacts.	DTSC restricts reuse and will need to update allowable land uses to accommodate this development.
Land Use	Potential for City of Roseville to determine that development is consistent with land use designation and zoning is unknown.	Likely that City of Roseville will determine that development is consistent with land use designation and zoning.	Designation of General Open Space by the City of Roseville is assumed to require a General Plan Amendment to allow development.
Nuisance Concerns (Operation)	Low concern due to high traffic area and nearby industrial uses.	Moderate concern – industrial area but adjacent to medical office building.	Moderate concern from apartments on northern side and expectation that site will remain as open space.
Nuisance Concerns (Construction)	Low concern due to large site that should accommodate most construction activity.	Impacts may be unlikely depending on medical building activity. Taylor Road ingress and egress may require traffic control.	Construction noise will affect residents north of the site. Roseville Parkway ingress and egress may require traffic control.
Biological and Cultural Consultations	Capped landfill indicates very low level of biological and cultural concern.	Undeveloped site indicates some – but low – potential for concern.	Capped landfill indicates very low level of biological and cultural concern.

A simple summary of Table 3-2 could be that Site 4 appears to have the least potential for environmental impacts; therefore, it might be considered environmentally superior. That conclusion is typical for environmental review, where development equates to an adverse impact. However, the much larger footprints of sites 3 and 6 mean greater support for EV charging and H_2 refueling, which contribute to much broader environmental benefits. The current structure of environmental review does not provide much opportunity for these benefits to be considered; however, environmental benefits should be incorporated into the analysis in some way and not just focus on a least-harm approach.

In addition to the substantive concerns that must be addressed, environmental review and approval processes also must be considered during detailed design. At this conceptual level of analysis, it is premature to fully develop a process roadmap. However, the following topics are recommended for further discussion.

- Consideration of two equally reasonable roles for PCTPA and the City of Roseville:
  - PCTPA as the Applicant for development review, with City of Roseville as the CEQA Lead Agency

  - PCTPA as the CEQA Lead Agency, with City of Roseville conducting needed land use updates as a CEQA Responsible Agency

- The specific role of DTSC as a CEQA Responsible Agency for Site 3 and Site 6, and what specific actions would be taken by DTSC during the development review process
- Potential CEQA streamlining given the project's important role in the transition to renewable energy; it is our understanding that new CEQA exemptions are being developed for some types of projects, including H_2 fueling
- Any federal environmental review that may be triggered by federal funding; federal agencies are actively promoting the energy transition; however, full consideration under the *National Environmental Policy Act* and related consultations are likely to be required as a caveat of all federal funding processes

3.3.5 Cost Estimates

The costs in Table 3.3 were developed based on unit pricing taken from historical costs of a variety of similar projects for the three sites. Unfortunately, given the uniqueness of a truck charging and refueling sites of this scale, there are not any similar sites that have been developed of this type. In addition, sites 3 and 6 involve site civil work with landfill and hazardous materials considerations, which dramatically increases the variability and potential cost of those sites and these considerations have been estimated as part of the costs in Table 3.3. Further scoping and exploration are recommended to further refine the site civil upgrade costs.

Table 3-3. Preliminary Site Cost Estimates

Cost Component	Site 3	Site 4	Site 6
Site Civil Upgrades	$21,300,000	$4,200,000	$30,000,000
Electrical Grid Upgrades	$4,500,000	$4,500,000	$4,500,000
EV Charger Equipment (150 kW)	$5,600,000	$1,500,000	$8,800,000
EV Charger Equipment (350 kW)	$5,000,000	$750,000	$5,000,000
H_2 Equipment	$5,000,000	$3,000,000	$5,000,000
Building and Facilities Construction	$3,900,000	$1,400,000	$3,900,000
Signal and Roadway Upgrades for Site Access	$1,200,000	$2,500,000	$2,500,000
Design and Engineering	$3,073,000	$1,095,500	$4,109,000
Total	$47,000,000	$17,000,000	$63,000,000

Unit costs were developed and used based on the following rough assumptions:

- Site civil upgrades were estimated at $1,500,000 per acre.
- EV charger equipment was estimated at $100,000 per 150 kW charging system, and $250,000 per 350 kW charging system.
- H_2 equipment was estimated at $1,000,000 per fueling lane.
- Building and facilities construction was estimated at $500/ft2 of new building construction.
- Signal and roadway upgrades for site access was estimated at $1,200,000 per new signaled intersection development.
- Design and engineering costs were estimated at 7% of the overall construction and equipment costs.

4 Funding Considerations

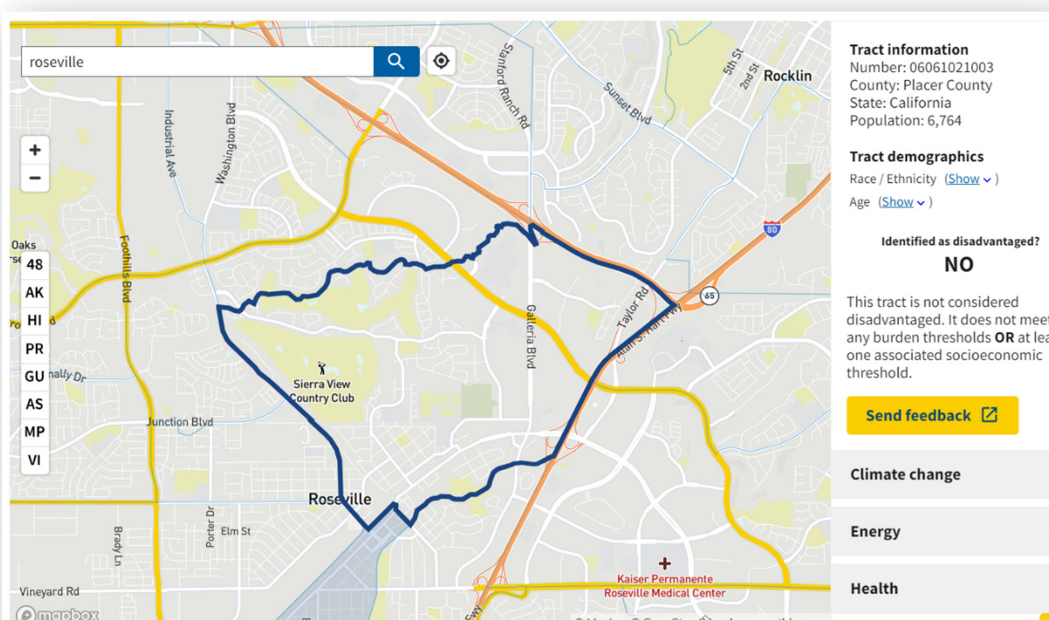
This section discusses the funding considerations for the project.

4.1 Federal Funding

Federal funding options to advance the project are limited primarily due to the site's location, which is outside of a census-designated "disadvantaged community." Although a number of federal grant programs make funding available to advance charging and fueling infrastructure development (often as a component of a larger transportation or community development investment), the programs are highly competitive and are known to prioritize grant awards to disadvantaged communities. Figure 4-1 shows that the only disadvantaged community in the project vicinity is in the area of Old Town Roseville, south of the three project sites.

Despite this obstacle, it is recommended that PCTPA continue to monitor federal grant opportunities in the event that federal funding priorities change or new grant programs emerge. The U.S. Department of Transportation's (USDOT's) Charging and Fueling Infrastructure Grant Program is solely focused on providing grants for charging and fueling infrastructure projects and is expected to announce its first round of awards by early 2024, with another round of grants available beginning in spring 2024. Awards from the first round of this program will help to inform the types of projects that are expected to compete well in future program cycles (USDOT 2023).

Figure 4-1. Federal Justice 40 Disadvantaged Communities Map



4.2 State Funding

In 2017, California Governor Brown signed into law Senate Bill 1, which levies fuel taxes on gasoline and diesel fuel sold in the state. Revenue from the tax funds multiple discretionary and formulaic programs designed to maintain the California transportation system in a state of good repair. One of these programs includes the Trade Corridor Enhancement Program (TCEP), which is designed to fund projects on the California freight transportation network. ***This project is considered an eligible project activity for TCEP, and PCTPA should consider applying for this funding to help finance the project.***

Additionally, the California State Senate passed Senate Bill 671 that directs the California Transportation Commission (CTC) to develop a Clean Freight Corridor Efficiency Assessment. The assessment recommends priority freight corridors on the state and interstate highway system governed by California Department of Transportation (Caltrans). One of the top six priority segments is I-80 within the project area as shown in, which means the CTC will be more likely to select this project for funding in upcoming cycles for TCEP.

Figure 4-2. SB 671 Priority Corridors

Top 6 Priority Clean Freight Corridors

The California Transportation Commission's (Commission) Clean Freight Corridor Efficiency Assessment (Assessment) outlines a path forward for California to plan and implement zero-emission freight infrastructure by identifying the initial infrastructure needed to support zero-emission goods movement.

To identify the initial infrastructure needed, the Commission first identified the top 6 freight corridors in California. The "Top 6" freight corridors were defined as corridors greater than 50 miles in length, with the highest concentration of goods movement and highest average daily truck vehicle miles traveled.

Additional details will be provided in the draft Assessment that is posted online for public comment.

Exhibit 1. Top 6 Freight Corridors

Priority corridors identified
Ordered by truck volume – 2022 projected

- I-5 from California's Southern border with Mexico to its Northern border with Oregon
- I-15 from San Diego to California's Southeast border with Nevada
- Route 99 from Red Bluff to Bakersfield
- I-10/I-710 from the San Pedro Bay Ports to Los Angeles to California's Southeast border with Arizona
- I-40 from its intersection with I-15 to California's Southeast border with Arizona
- I-80/I-580 and I-880 from the Port of Oakland to San Francisco to California's northeast border with Nevada

4.3 Regional Funding

SACOG serves as the Metropolitan Planning Organization in the Sacramento region. There are several funding programs available from the agency for organizations in their jurisdiction, which consist of regional allocations of federal and state funds.

PCTPA can use funding from the regional program to fund a variety of projects, including EV charging projects and elements of these systems supporting the rollout of EV charging. These grants are available annually for projects demonstrating GHG reductions.

In the 2023 round of funding, Sacramento County successfully secured $3,000,000 for operational improvements at the Jackson and Bradshaw intersection, highlighting the ability to fund operational improvements using regional SACOG funding. PCTPA should consider applying for both the regional program and the climate action program.

4.4 Private Funding

In November 2023, the U.S. Department of Energy announced its intention to provide California with $1.2 billion to partially fund a $12 billion program administered by ARCHES H_2 LLC to develop a H_2 hub in California. Therefore, similar to EV charging, the demand for H_2 fueling is poised to grow broadly and quickly. Therefore, PCTPA may have opportunities to partner with a private developer before or after applying for public funding. The current recommendations keep the sites open to development for a private partner that is interested in an EV charging, H_2 fueling, or mixed-alternative fuel development. This allows PCTPA flexibility to choose a developer with goals that also reflect PCTPA's transportation needs.

5 Recommendations and Conclusions

Based on the traffic data and truck volumes analysis, technology assessment, site selection, and funding considerations, the Draft Feasibility Study recommends PCTPA consider the following:

1. Carrying the three identified sites into the environmental phase to attract a private company to purchase and develop a site for truck alternative fuel purposes.
2. Evaluate some of sites that were determined to be too remote from the interchange as part of a separate I-80 alternative fuel site corridor study.
3. Initiate a Countywide alternative fuel study to identify a coordinated plan of future potential sites that consider proximity and distance needed for hydrogen refueling and electric charging.

6 References

California Transportation Commission (CTC). n.d. *Senate Bill 671 - Top 6 Freight Corridors in California*. Accessed December 2023. https://catc.ca.gov/-/media/ctc-media/documents/programs/sb671/092023-sb-671-top-6-freight-corridors-a11y.pdf.

U.S. Department of Transportation (USDOT). 2023. *Charging and Fueling Infrastructure Grant Program.* August 2. https://www.transportation.gov/rural/grant-toolkit/charging-and-fueling-infrastructure-grant-program.

Appendix
Detailed Site Plans

Appendix A Detailed Site Plans

Conceptual engineering was performed for the selected sites to show feasible layouts for hydrogen truck refueling and battery electric truck charging infrastructure that includes equipment, dwell areas, site access, and parking, and shows turning paths for trucks to reach the various amenities. These are included in the following three layouts for sites 3, 4, and 6.

Roseville Parkway

N

0 80

1" = 80'

GENERAL SHEET NOTES

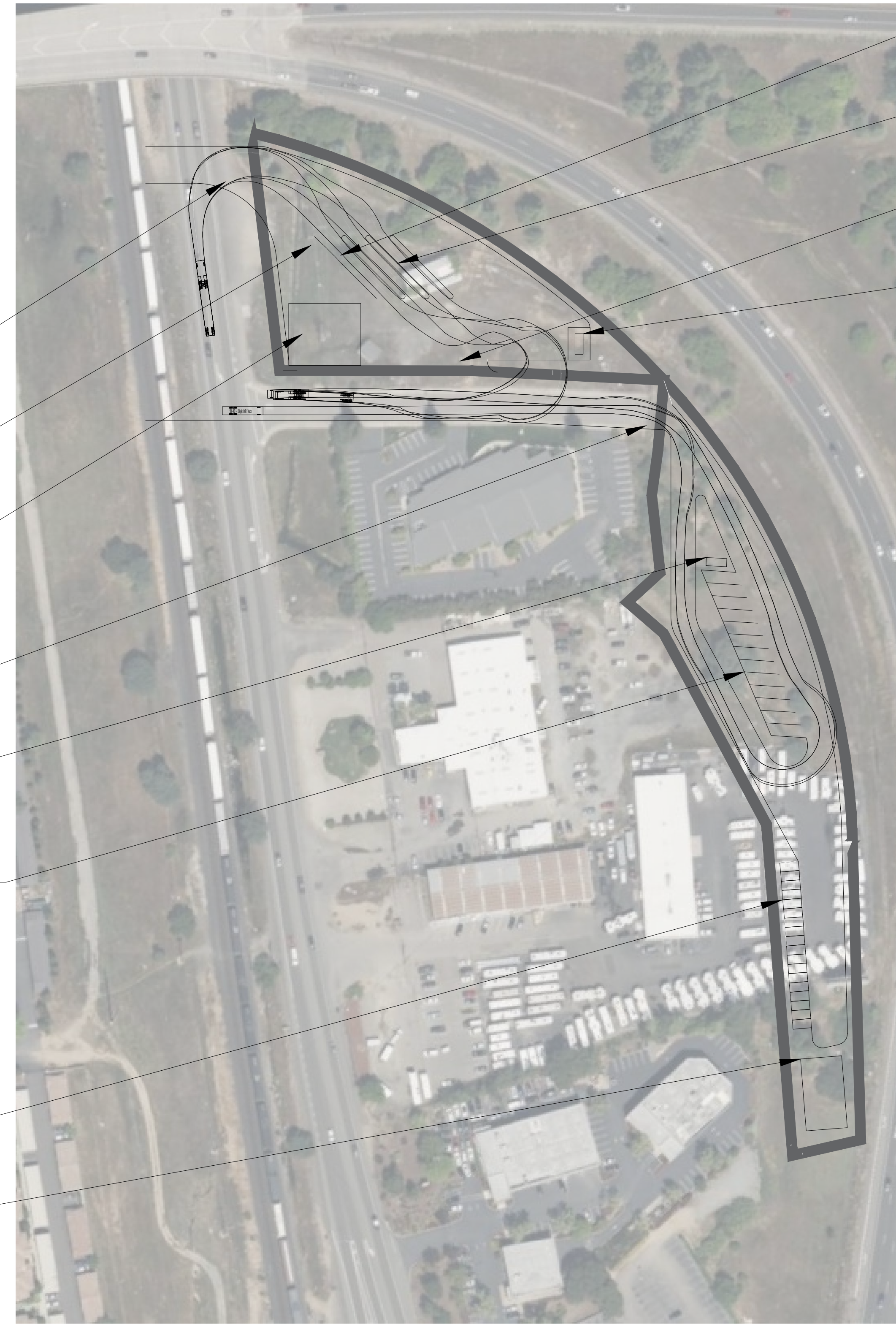
136 PARKING STALLS TOTAL
36 LIGHT DUTY CHARGING STALLS
75MEDIUM DUTY CHARGING STALLS
25 HEAVY DUTY CHARGING STALLS

Jacobs

I-80 / SR 65 Interchange
Alternative Truck Fueling
Feasibility Study - Site Layouts

Location #3 - 14.2 Acre

Taylor Road



0 80
1" = 80'

GENERAL SHEET NOTES

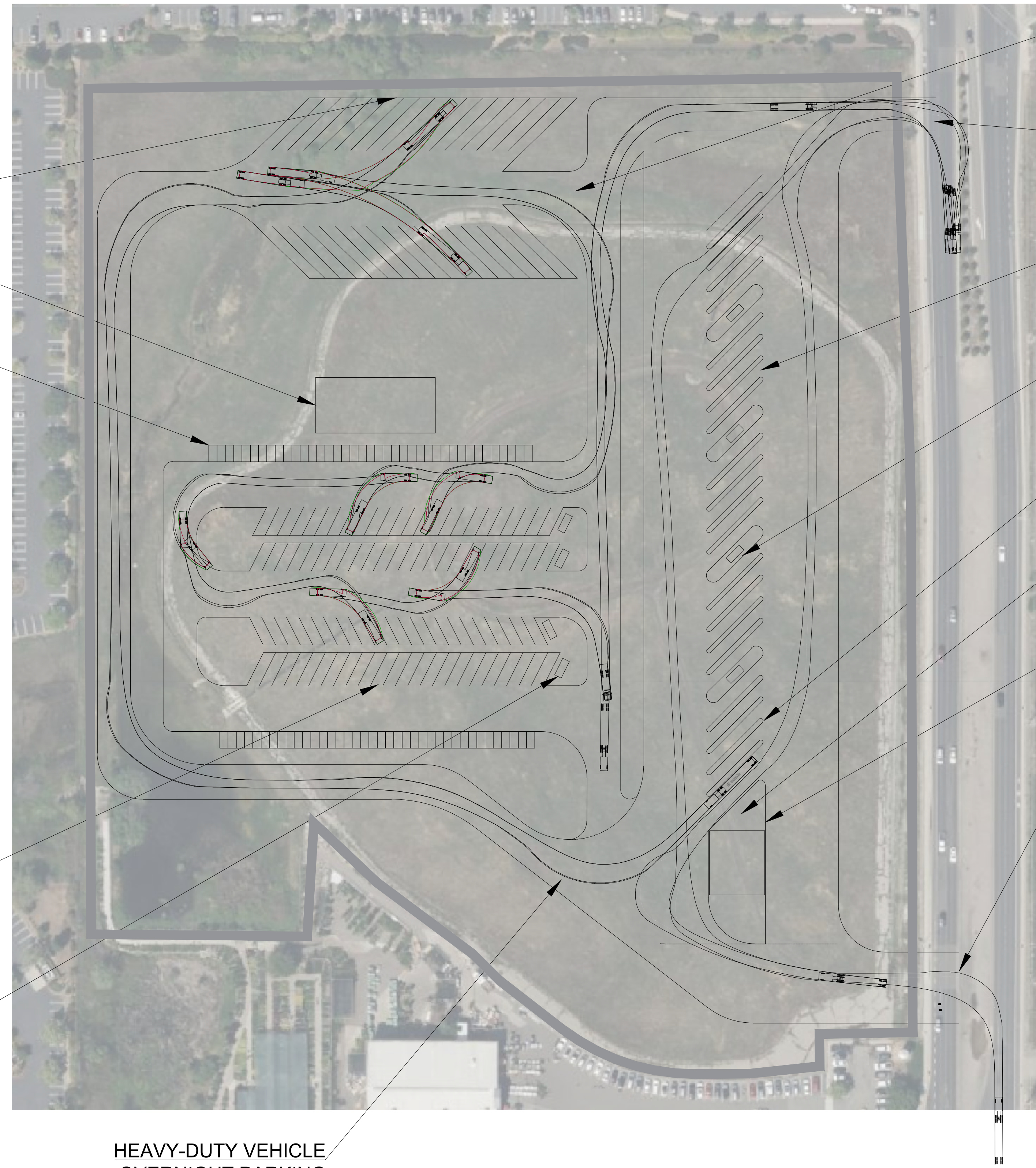
34 PARKING STALLS TOTAL
18 LIGHT DUTY CHARGING STALLS
13 MEDIUM DUTY CHARGING STALLS
3 HEAVY DUTY CHARGING STALLS

Jacobs

I-80 / SR 65 Interchange
Alternative Truck Fueling
Feasibility Study - Site Layouts

Location #4 - 2.8 Acre

Galleria



N
0 80
1" = 80'

GENERAL SHEET NOTES

234 PARKING STALLS TOTAL
77 LIGHT DUTY CHARGING STALLS
99 MEDIUM DUTY CHARGING STALLS
25 HEAVY DUTY CHARGING STALLS
33 HEAVY DUTY OVERNIGHT PARKING STALLS

Jacobs

I-80 / SR 65 Interchange
Alternative Truck Fueling
Feasibility Study - Site Layouts

Location #6 - 20.0 Acre