KINGS-TULARE COUNTY
CROSS-VALLEY CORRIDOR
PHASE 1 OPERATIONS PLAN

PHASED SERVICE AND OPERATIONS PLAN

KCAG TCAG ARUP

May 30, 2024

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SUMMARY

This document establishes and recommends a phased service implementation and capital improvements plan for the Cross Valley Corridor. The vision delivers fast, attractive buses operating every 30 minutes 7-days a week, initially spanning the Valley from Lindsay to NAS Lemoore.

The bus service is proposed to be delivered in four increasing and intensifying service plans. The bus concept is designed to eventually transition to a rail service, as outlined in the Cross Valley Corridor Study (2018) and the 2023 Draft State Rail Plan and is consistent with those studies.

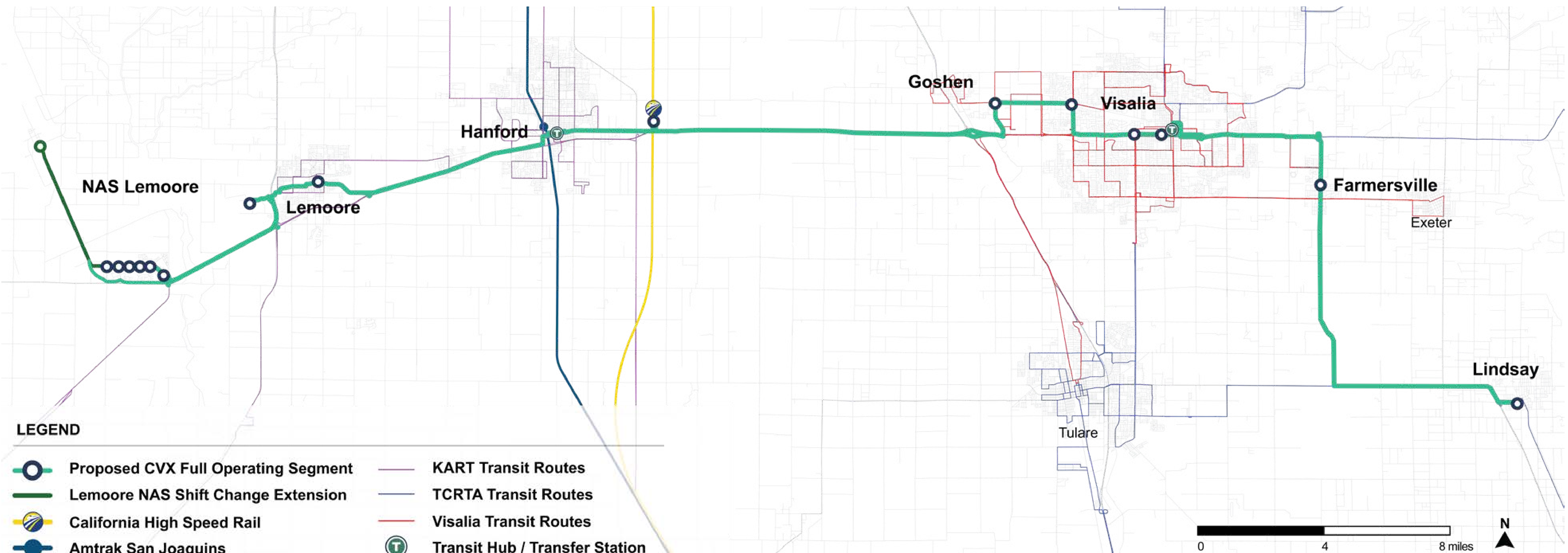
SUMMARY

This report summarizes the recommended incremental implementation of the Cross Valley Corridor bus service, branded as the "Cross Valley Express" (CVX), in four phases:

For each phase, proposed detailed routing and schedules are included.

- **Phase 1A** – Implementing the recently-awarded Transit and Intercity Rail Capital Program (TIRCP) grant to expand existing bus service between Hanford and Visalia
- **Phase 1B** – Improving the frequency of service between Hanford and Visalia to half-hourly.
- **Phase 1C** – Expanding service geographically to operate from Lindsay to Naval Air Station Lemoore (NASL) with half-hourly service and an enhanced span-of-service.
- **Phase 2** – Rerouting the Phase 1C service to serve High Speed Rail (HSR) at the Kings-Tulare Station.

Figure 1 - CVX Full Operating Segment Route



BACKGROUND

The Cross Valley Corridor Plan (Mott McDonald for TCAG, March 2018) included a transit service phasing plan. The Phase 1 Bus Service plan outlined a coordinated bus service coincident with the opening of high-speed rail (HSR), effectively extending the reach of HSR to Huron and Porterville via Hanford and Visalia. As the Cross Valley Corridor Phase 1 Operations Plan has proceeded, and as funding has been identified, the stakeholders in the service chose to incrementally implement the Phase 1 Bus Service, both in service coverage and in service frequency. The consultant team, working with the transit operators, developed a phasing plan that increases service over four to five years within an initial 62-mile Lindsay to NAS Lemoore corridor, providing an effective connecting service that is ready when HSR begins service.

In July 2022, the California State Transportation Agency awarded the fifth round of selected projects for the Transit and Intercity Rail Capital Program. Among these projects was an award of $33.8 million to the Tulare County Regional Transit Agency (TCRTA), Kings Area Rural Transit (KART), Visalia Transit and San Joaquin Joint Powers Authority (SJJPA). These funds are defined for an initial phase of the CVX implementation, including transit centers in Visalia and Lindsay, 14 zero-emission buses and 16 zero emission micro-transit vehicles. The service enhancements include the addition of three daily roundtrips between Hanford and Visalia operated by Visalia Transit, doubling the three daily roundtrips currently operated by KART on weekdays. This funding is the catalyst for implementing Phase 1A services.

VISION

The 2018 Cross Valley Corridor study identified an paramount vision for the corridor:

Promote a safe, affordable, and efficient system that increases transportation options while utilizing existing infrastructure, enhances the environment and livability of the region, and promotes economic development through a well-integrated corridor.

SERVICE PRINCIPLES

As part of the development of the Phase 1 Operating Plan, a set of service principles and criteria were developed and approved by TCAG. These include:

Service Scope and Implementation – Design and deliver an initial Phase 1 Bus Service that is attractive to passengers, easily understood, legible, connects effectively with the Kings-Tulare High Speed Rail Station, and provides transportation benefits to passengers throughout the corridor. The initial service need not operate across the full 85-mile-long corridor but may be limited to the most operationally and financially feasible segment.

Service Vision – Deliver a high quality, competitive transit service with 30-minute service frequencies across the entire initial service corridor, operating from 5:00am to 11:00pm. During a start-up period of up to 16 months, higher-frequency service may focus on Hanford and Visalia to allow operations and technologies to be tested and to mature.

Quality Service – Provide an “express” service using limited stops, low floor buses, consistent branding and wayfinding, appropriate streets and routings, and transit technology; including transit signal priority and intersection design to reduce bus travel time and improve reliability.

Fast Speeds – Achieve an average scheduled bus speed of at least 32 miles per hour (mph). Allow for a one-way scheduled running time for the initial CVC bus service of no more than 90 minutes.

Plan for Transition to Rail – Ensure the CVC bus route largely follows the identified future rail route, and generally stops at future rail stations, allowing for a seamless transition to a rail service.

Quality Vehicles – Procure and operate buses that are comfortable, allow fast, easy boarding (low floor), have space for bicycles, luggage, wheelchairs, strollers, and have adequate seating capacity. Buses will be zero-emission. Fares will be vended and collected away from the vehicle and boarding will be all-door and unencumbered.

Signature Transit Service – Design and operate the CVC service to be recognized by the public as an important coherent regional service and asset. Collaborate with existing transit operators to ensure the CVC service is an integral part of the overall transit network, design the CVC services to enable connecting passengers from local transit routes, and retain existing transit agencies to operate CVC services.   Define services connecting key travel generators not directly along the CVC corridor (Tulare, Corcoran, Porterville) that enhance regional mobility and HSR access.

Effective & Efficient – Design and operate a service that is effective and efficient, and is a good value for money.

Detailed service and design criteria provided more definition, protocols and capital investment concepts leading to safe and reliable operations, expanded explanations of service quality, and a discussion of fares and fare collection.

Performance metrics were also considered, with cost targets of not more than $150 per vehicle hour and gross operating costs of $6 million annually, along with effectiveness targets for passengers and farebox recovery.

02

PHASED SERVICE IMPLEMENTATION

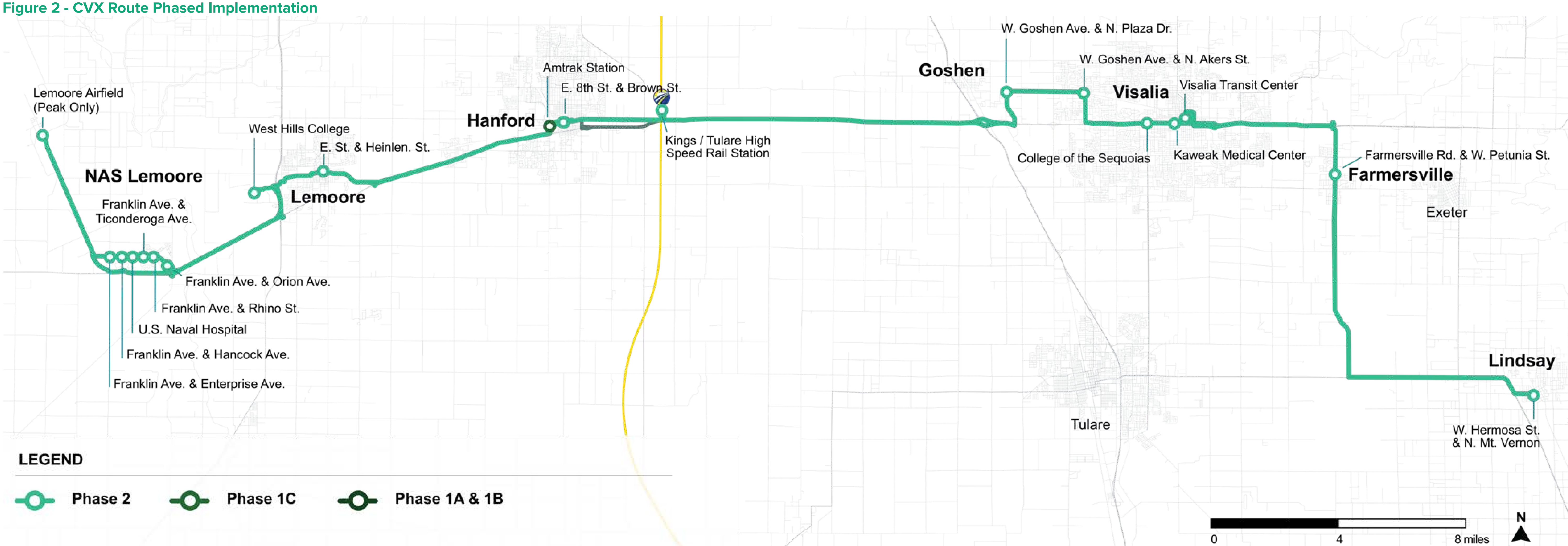
This service plan adopts a phased, incremental approach to deliver the Cross Valley Corridor Plan's recommended Phase 1 Bus Service. The proposed bus service expands from the existing Hanford-Visalia service into a major corridor system spanning from NAS Lemoore to Lindsay. Eventually, bus service could be provided across the entire rail corridor from Porterville to Huron.

DELIVERY APPROACH

The approach for the Phase 1 Operating Plan adopts a phased implementation, starting with increasing service on the existing KART Route 15 between Hanford and Visalia (Phase 1A), then increasing service on that route to every 30 minutes (Phase 1B), and then extending the route to NAS Lemoore and Lindsay and enhancing the span-of-service to about 16 hours daily (Phase 1C). In Phase 2 – coincident with the start of high-speed rail service at the Kings-Tulare Station – the Phase 1C route is altered to serve the HSR station while service to the Hanford Amtrak station is discontinued.

Phase 3 – which is not detailed in this report – would extend service to Porterville. This would increase service costs by about 15% from Phase 2 levels. Phase 4, which would extend service to Huron, would require a further approximately 15% increase in costs and require significant coordination with NAS Lemoore due to potential security protocols with through-riding passengers.

Figure 2 - CVX Route Phased Implementation



PHASE 1A

In this phase, the CVX route (branded as Route 15) extends between the existing Hanford Transit Center and the Visalia Transit Center. The only other stops are a stop in each direction near the College of the Sequoias and near the Kaweah Health Medical Center in western downtown Visalia.

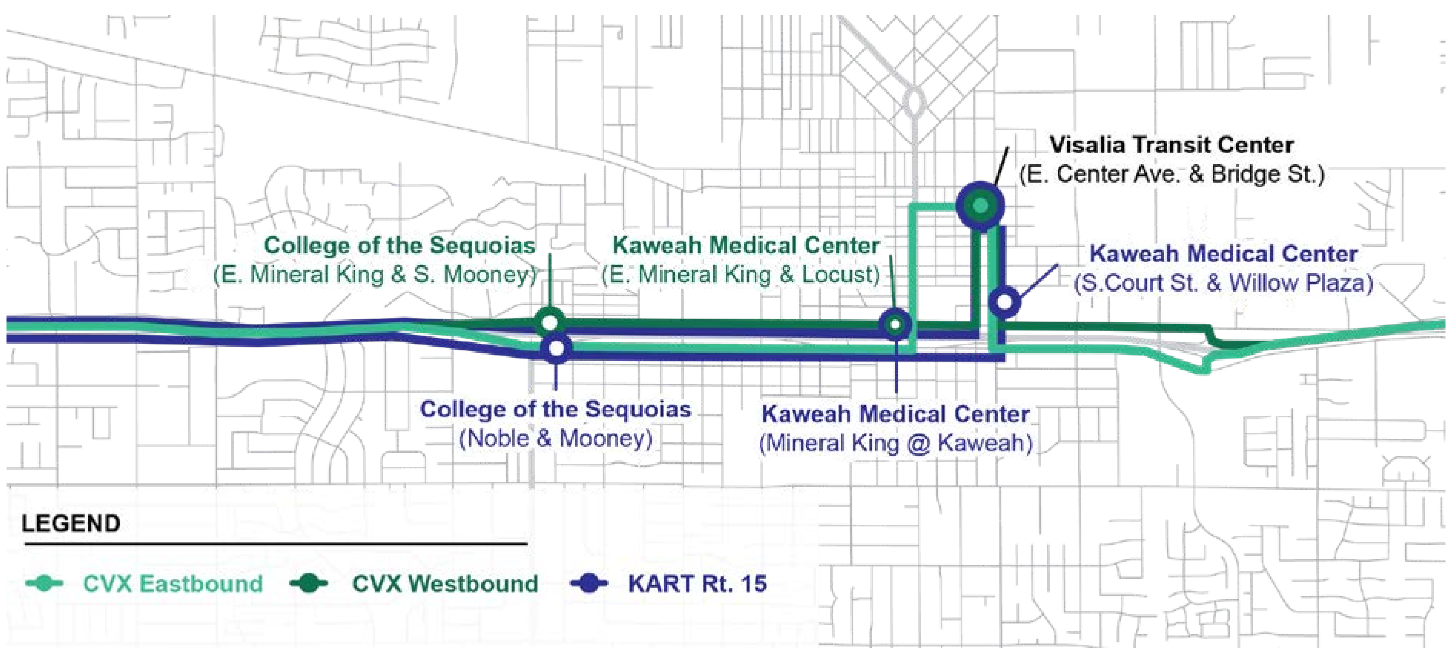
Routing

This route differs from the existing KART Route 15 in two minor ways, shown in Figure 2:

- Westbound, an additional stop is made at the existing Visalia Transit stop at Mineral King & Mooney, to serve COS students and other Hanford-bound passengers generated by the employment centers in the area.
- Eastbound, the existing Visalia Transit stop at Court/Willow is served in order to serve the Kaweah Health Medical Center (as well as the Visalia Convention Center and other destinations in southwest downtown Visalia). This shifts the existing route off of Noble Avenue and Santa Fe Street to instead travel north on Court Street and east on Oak Avenue to the Visalia Transit Center.

These stops will better serve Visalia activity centers, Kings County residents and Amtrak passengers traveling to these activity centers in Visalia and will better align with subsequent phases.

Figure 3 - CVX and KART Route 15 Routing



Running Time

The running time between stops is based on the current KART Route 15 schedule. The minor stop changes will add roughly 1 minute of travel time in each direction but can be accommodated within the existing 65-minute round trip schedule time.

Schedule

A proposed Phase 1A weekday and weekend schedule is shown in Table 1. This schedule serves San Joaquin train schedule times in Hanford, as well as provides convenient connections at both transit centers. The existing KART Route 15 first and last trips would continue to be operated, consisting of commute period round trips scheduled to best serve commuters living in Hanford and working in Visalia). The existing mid-day KART Route 15 round trip (departing eastbound from Hanford at 11:15 AM) would be shifted 45 minutes ahead to 10:30 AM. Three new daily roundtrips would be operated by Visalia Transit. One each would operate in the AM and PM commute periods, scheduled to serve Visalia residents traveling to Hanford (or transferring in Hanford to KART Route 20 to/from Lemoore). The third round-trip trip would depart Visalia at 1:45 PM and depart Hanford at 2:20 PM. Together, the two midday runs would expand travel options over the middle of the day. An additional (fourth) Visalia Transit trip would be operated in the evening, timed to serve the 7:39 PM San Joaquins southbound arrival in Hanford.

It is proposed that service also be provided on weekends and holidays, consisting of the existing Route 15 weekday schedule of three roundtrips, as shown in Table 2. As KART does not operate on Sundays, all weekend/holiday service would be operated by Visalia Transit to minimize administrative costs associated with establishing Sunday KART service.

Cost

Based on a blended hourly cost of $110 per hour, total weekday cost (including current KART service) would be about $825 per day, and weekend service would be about $440 per day, resulting in $260,000 in annual costs

Table 1 - CVX Phase 1A Weekday, Weekend, and Holiday Schedules

Weekday

Monday through Friday

Eastbound				Westbound				Amtrak Connection	
HANFORD	VISALIA			VISALIA			HANFORD	SAN JOAQUINS SERVICE	
① Hanford Transit Center /Amtrak	② College of the Sequoias	③ Kaweah Medical Center EB	④ Visalia Transit Center	④ Visalia Transit Center	③ Kaweah Medical Center WB	② College of the Sequoias	① Hanford Transit Center /Amtrak	Northbound	Southbound
								5:34AM	
				7:15AM	7:18AM	7:19AM	7:43AM		
7:15AM	7:40AM	7:44AM	7:50AM	7:50AM	7:53AM	7:54AM	8:18AM		
7:46AM	8:11AM	8:15AM	8:21AM					9:34AM	
									10:24AM
10:30AM	10:55AM	10:59AM	11:05AM	11:05AM	11:08AM	11:09AM	11:33AM		12:24PM
12:10PM	-	-	12:30PM	1:00PM	-	-	1:30PM	1:39PM	
				1:45PM	1:48PM	1:49PM	2:13PM		2:24PM
2:21PM	2:46PM	2:50PM	2:56PM						4:24PM
				4:35PM	4:38PM	4:39PM	5:03PM	5:39PM	
4:25PM	4:50PM	4:54PM	5:00PM	5:00PM	5:03PM	5:04PM	5:28PM		
5:06PM	5:31PM	5:35PM	5:41PM						6:24PM
				7:00PM	7:03PM	7:04PM	7:28PM	7:39PM	
7:36PM	8:01PM	8:05PM	8:11PM						10:24PM

Weekend & Holiday

Saturday, Sunday and Holidays

Eastbound				Westbound				Amtrak Connection	
HANFORD	VISALIA			VISALIA			HANFORD	SAN JOAQUINS SERVICE	
① Hanford Transit Center /Amtrak	② College of the Sequoias	③ Kaweah Medical Center EB	④ Visalia Transit Center	④ Visalia Transit Center	③ Kaweah Medical Center WB	② College of the Sequoias	① Hanford Transit Center /Amtrak	Northbound	Southbound
								5:34AM	
				8:50AM	8:50AM	8:51AM	9:18AM	9:34AM	
9:31AM	9:50AM	9:51AM	10:05AM						10:24AM
									12:24PM
12:10PM	-	-	12:30PM						
				1:00PM	-	-	1:30PM		
								1:39PM	
				1:45PM	1:45PM	1:46PM	2:13PM		2:24PM
2:21PM	2:40PM	2:41PM	2:55PM					3:39PM	
									4:24PM
								5:39PM	
									6:24PM
				7:00PM	7:00PM	7:01PM	7:28PM		
								7:39PM	
7:36PM	7:55PM	7:56PM	8:10PM						
									10:24PM

Table 2 - CVX Phase 1A Vehicle Blocking

Weekday

		HANFORD	VISALIA			VISALIA			HANFORD	
	Block #	Hanford Transit Center /Amtrak	College of the Sequoias	Kaweah Medical Center EB	Visalia Transit Center	Visalia Transit Center	Kaweah Medical Center WB	College of the Sequoias	Hanford Transit Center /Amtrak	Hours
Amtrak		12:10 PM	-	-	12:30PM	1:00PM	-	-	1:30PM	
KART	1	7:15 AM	7:40AM	7:44AM	7:50AM	7:50AM	7:53AM	7:54AM	8:18AM	1.00
KART	2	10:30AM	10:55AM	10:59AM	11:05AM	11:05AM	11:08AM	11:09AM	11:33AM	1.00
KART	3	4:25PM	4:50PM	4:54PM	5:00PM	5:00PM	5:03PM	5:04PM	5:28PM	1.00
Visalia	4					7:15AM	7:18AM	7:19AM	7:43AM	
Visalia	4	7:46AM	8:11AM	8:15AM	8:21AM					1.00
Visalia	5					1:45PM	1:48PM	1:49PM	2:13PM	
Visalia	5	2:21PM	2:46PM	2:50PM	2:56PM					1.00
Visalia	6					4:35PM	4:38PM	4:39PM	5:03PM	
Visalia	6	5:06PM	5:31PM	5:35PM	5:41PM					1.00
Visalia	7					7:00PM	7:03PM	7:04PM	7:28PM	
Visalia	7	7:36PM	8:01PM	8:05PM	8:11PM					1.00

KART	3.0
Visalia	4.5
TOTAL	7.5

Weekend & Holiday

		HANFORD	VISALIA			VISALIA			HANFORD	
	Block #	Hanford Transit Center /Amtrak	College of the Sequoias	Kaweah Medical Center EB	Visalia Transit Center	Visalia Transit Center	Kaweah Medical Center WB	College of the Sequoias	Hanford Transit Center /Amtrak	Hours
Amtrak		12:10 PM	-	-	12:30 PM	1:00 PM	-	-	1:30 PM	
Visalia	1					8:50 AM	8:50 AM	8:51 AM	9:11 AM	
Visalia	1	9:31 AM	9:50 AM	9:51 AM	9:52 AM					1.25
Visalia	2					1:45 PM	1:45 PM	1:46 PM	2:06 PM	
Visalia	2	2:21 PM	2:40 PM	2:41 PM	2:42 PM					1.25
Visalia	3					7:00 PM	7:00 PM	7:01 PM	7:21 PM	
Visalia	3	7:36 PM	7:55 PM	7:56 PM	7:57 PM					1.00

KART	3.5
TOTAL	3.5

PHASE 1B

This phase expands the service frequency and span of service from Phase 1A and rebrands the service as CVX – Cross Valley Express. Note that this phase assumes that the Hanford Transit Center has yet to be completed.

Routing

The route is unchanged from Phase 1A.

Schedule

The 30-minute schedule assumes fully electric bus operation, which creates constraints on the schedule and requires at least 15 minutes of layover in Visalia to allow for opportunity charging and ensure all-day bus operation. The Phase 1B schedule is shown in Table 4.

An alternative hourly schedule was considered and rejected as it resulted in severe inefficiencies. The round-trip running time between Hanford and Visalia is 65 minutes plus layover, resulting in a total cycle time of about 90 minutes. Hourly service could be provided with two buses, but those schedules would have layovers of nearly 30 minutes at each terminal. As a result, the recommendation is to provide a three-bus, 30-minute schedule with layovers that are more reasonable (10 minutes in Hanford, 15 minutes in Visalia).

Key service connections at both the Hanford and Visalia transit centers, shown in Table 3, are provided as follows:

- In Hanford, the key connection is with KART Route 20 (Lemoore), which departs the transit center at 5 minutes and 35 minutes past the hour. Route 20 currently returns at 15 and 45 minutes past the hour, missing the CVX connection by 5 minutes. A possible approach is to split Route 20 layover (which is currently taken at Hanford TC) with a layover at West Hills College (10 minutes each) allowing for a better connection time to CVX eastbound. Making convenient timed connections is important for the CVX service to benefit Lemoore (and potentially NAS Lemoore, with any expansion of Route 20). In addition, the local Hanford routes (1,3, 4, 5, 9) all arrive/depart at 0 and 30 minutes past the hour.
- In Visalia, the regional benefit of CVX service is maximized by providing good connections with VT Route 11X (to Tulare), arriving at 15 and 45 after the hour and departing at 0 and 30 after the hour, as well as Route 9 (serving Farmersville and Exeter). Route 9 departs every 45 minutes at 0, 15, 30 and 45 past the hour (depending on the hour), and arrives at 2, 17, 32 and 47 past the hour. In addition, many of the other VT routes depart at 0 and 30 past the hour (1, 2, 4, 5, 6).

Table 3 - Hanford & Visalia Transit Center Connections

Hanford Transit Center						Visalia Transit Center					
CVX	**Rt. 20**	**Local Hanford**	**Local Hanford**	**Rt. 20**	**CVX**	**CVX**	**Rt. 11X**	**Local Visalia**	**Local Visalia**	**Rt. 11X**	**CVX**
Arrive	Leave	Leave	Arrive	Arrive	Leave	Arrive	Leave	Leave	Arrive	Arrive	Leave
0:00	0:05	0:00	0:00	0:55	0:10	0:15	0:30	0:30	0:30	0:30	0:30
0:30	0:35	0:30	0:30	0:25	0:40	0:45	0:00	0:00	0:00	0:00	0:00

Note: Some routes leave at 0:15/0:45; Visalia local transit arrive times vary

Three buses would be operated on weekdays, each making a 90-minute roundtrip cycle (including layover and charging time). On weekdays, two buses would be operated by KART and one by Visalia Transit, as shown in Table 5. Service would be provided every half-hour from approximately 6 AM to 7 PM, with one additional run (operated by Visalia Transit) in the evening to serve the 10:24 San Joaquin southbound arrival.

Three buses would also operate on weekends and holidays, at 30-minute frequency. All buses would be operated by Visalia Transit, as Visalia Transit currently operates on Sundays while KART does not.

Cost

Based on a blended hourly cost of $110 per hour, the total weekday cost (including current KART service) would be about $4,700 per day, and weekend service would be about $4,100 per day. Total annual costs would be about $1.6 million.

Table 4 - CVX Phase 1B Weekday, Weekend, and Holiday Schedules

Weekday

Eastbound: HANFORD (1) Hanford Transit Center /Amtrak	Eastbound: VISALIA (2) College of the Sequoias	Eastbound: VISALIA (3) Kaweah Medical Center EB	Eastbound: VISALIA (4) Visalia Transit Center	Westbound: VISALIA (4) Visalia Transit Center	Westbound: VISALIA (3) Kaweah Medical Center WB	Westbound: VISALIA (2) College of the Sequoias	Westbound: HANFORD (1) Hanford Transit Center /Amtrak	Amtrak Connection: SAN JOAQUINS SERVICE Northbound	Amtrak Connection: SAN JOAQUINS SERVICE Southbound
								5:34AM	
				6:00AM	6:01AM	6:03AM	6:30AM		
5:40AM	5:58AM	6:00AM	6:15AM	6:30AM	6:31AM	6:33AM	7:00AM		
6:10AM	6:28AM	6:30AM	6:45AM	7:00AM	7:01AM	7:03AM	7:30AM		
6:40AM	6:58AM	7:00AM	7:15AM	7:30AM	7:31AM	7:33AM	8:00AM		
7:10AM	7:28AM	7:30AM	7:45AM	8:00AM	8:01AM	8:03AM	8:30AM		
7:40AM	7:58AM	8:00AM	8:15AM	8:30AM	8:31AM	8:33AM	9:00AM		
8:10AM	8:28AM	8:30AM	8:45AM	9:00AM	9:01AM	9:03AM	9:30AM	9:34AM	
8:40AM	8:58AM	9:00AM	9:15AM	9:30AM	9:31AM	9:33AM	10:00AM		10:24AM
9:10AM	9:28AM	9:30AM	9:45AM	10:00AM	10:01AM	10:03AM	10:30AM		
9:40AM	9:58AM	10:00AM	10:15AM	10:30AM	10:31AM	10:33AM	11:00AM		
10:10AM	10:28AM	10:30AM	10:45AM	11:00AM	11:01AM	11:03AM	11:30AM		
10:40AM	10:58AM	11:00AM	11:15AM	11:30AM	11:31AM	11:33AM	12:00PM		12:24PM
11:10AM	11:28AM	11:30AM	11:45AM	12:00PM	12:01PM	12:03PM	12:30PM		
11:40AM	11:58AM	12:00PM	12:15PM	12:30PM	12:31PM	12:33PM	1:00PM		
12:10PM	12:28PM	12:30PM	12:45PM	1:00PM	1:01PM	1:03PM	1:30PM	1:39PM	
12:40PM	12:58PM	1:00PM	1:15PM	1:30PM	1:31PM	1:33PM	2:00PM		2:24PM
1:10PM	1:28PM	1:30PM	1:45PM	2:00PM	2:01PM	2:03PM	2:30PM		
1:40PM	1:58PM	2:00PM	2:15PM	2:30PM	2:31PM	2:33PM	3:00PM		
2:10PM	2:28PM	2:30PM	2:45PM	3:00PM	3:01PM	3:03PM	3:30PM	3:39PM	
2:40PM	2:58PM	3:00PM	3:15PM	3:30PM	3:31PM	3:33PM	4:00PM		4:24PM
3:10PM	3:28PM	3:30PM	3:45PM	4:00PM	4:01PM	4:03PM	4:30PM		
3:40PM	3:58PM	4:00PM	4:15PM	4:30PM	4:31PM	4:33PM	5:00PM		
4:10PM	4:28PM	4:30PM	4:45PM	5:00PM	5:01PM	5:03PM	5:30PM	5:39PM	
4:40PM	4:58PM	5:00PM	5:15PM	5:30PM	5:31PM	5:33PM	6:00PM		6:24PM
5:10PM	5:28PM	5:30PM	5:45PM	6:00PM	6:01PM	6:03PM	6:30PM		
5:40PM	5:58PM	6:00PM	6:15PM	6:30PM	6:31PM	6:33PM	7:00PM		
6:10PM	6:28PM	6:30PM	6:45PM	7:00PM	7:01PM	7:03PM	7:30PM	7:39PM	
6:40PM	6:58PM	7:00PM	7:15PM						
				9:45PM	9:46PM	9:48PM	10:15PM		10:24PM
10:40PM	10:58PM	11:00PM	11:15PM						

Weekend & Holiday

Eastbound: HANFORD (1) Hanford Transit Center /Amtrak	Eastbound: VISALIA (2) College of the Sequoias	Eastbound: VISALIA (3) Kaweah Medical Center EB	Eastbound: VISALIA (4) Visalia Transit Center	Westbound: VISALIA (4) Visalia Transit Center	Westbound: VISALIA (3) Kaweah Medical Center WB	Westbound: VISALIA (2) College of the Sequoias	Westbound: HANFORD (1) Hanford Transit Center /Amtrak	Amtrak Connection: SAN JOAQUINS SERVICE Northbound	Amtrak Connection: SAN JOAQUINS SERVICE Southbound
								5:34AM	
				7:30AM	7:31AM	7:33AM	8:00AM		
				8:00AM	8:01AM	8:03AM	8:30AM		
				8:30AM	8:31AM	8:33AM	9:00AM		
8:10AM	8:28AM	8:30AM	8:45AM	9:00AM	9:01AM	9:03AM	9:30AM	9:34AM	
8:40AM	8:58AM	9:00AM	9:15AM	9:30AM	9:31AM	9:33AM	10:00AM		10:24AM
9:10AM	9:28AM	9:30AM	9:45AM	10:00AM	10:01AM	10:03AM	10:30AM		
9:40AM	9:58AM	10:00AM	10:15AM	10:30AM	10:31AM	10:33AM	11:00AM		
10:10AM	10:28AM	10:30AM	10:45AM	11:00AM	11:01AM	11:03AM	11:30AM		
10:40AM	10:58AM	11:00AM	11:15AM	11:30AM	11:31AM	11:33AM	12:00PM		12:24PM
11:10AM	11:28AM	11:30AM	11:45AM	12:00PM	12:01PM	12:03PM	12:30PM		
11:40AM	11:58AM	12:00PM	12:15PM	12:30PM	12:31PM	12:33PM	1:00PM		
12:10PM	12:28PM	12:30PM	12:45PM	1:00PM	1:01PM	1:03PM	1:30PM	1:39PM	
12:40PM	12:58PM	1:00PM	1:15PM	1:30PM	1:31PM	1:33PM	2:00PM		2:24PM
1:10PM	1:28PM	1:30PM	1:45PM	2:00PM	2:01PM	2:03PM	2:30PM		
1:40PM	1:58PM	2:00PM	2:15PM	2:30PM	2:31PM	2:33PM	3:00PM		
2:10PM	2:28PM	2:30PM	2:45PM	3:00PM	3:01PM	3:03PM	3:30PM	3:39PM	
2:40PM	2:58PM	3:00PM	3:15PM	3:30PM	3:31PM	3:33PM	4:00PM		4:24PM
3:10PM	3:28PM	3:30PM	3:45PM	4:00PM	4:01PM	4:03PM	4:30PM		
3:40PM	3:58PM	4:00PM	4:15PM	4:30PM	4:31PM	4:33PM	5:00PM		
4:10PM	4:28PM	4:30PM	4:45PM	5:00PM	5:01PM	5:03PM	5:30PM	5:39PM	
4:40PM	4:58PM	5:00PM	5:15PM	5:30PM	5:31PM	5:33PM	6:00PM		6:24PM
5:10PM	5:28PM	5:30PM	5:45PM	6:00PM	6:01PM	6:03PM	6:30PM		
5:40PM	5:58PM	6:00PM	6:15PM	6:30PM	6:31PM	6:33PM	7:00PM		
6:10PM	6:28PM	6:30PM	6:45PM	7:00PM	7:01PM	7:03PM	7:30PM	7:39PM	
6:40PM	6:58PM	7:00PM	7:15PM						
				9:45PM	9:46PM	9:48PM	10:15PM		
									10:24PM
10:40PM	10:58PM	11:00PM	11:15PM						

Table 5 - CVX Phase 1B Vehicle Blocking

Weekday

	Block #	Hanford Transit Center /Amtrak	Visalia Transit Center	Visalia Transit Center	Hanford Transit Center /Amtrak	Hours
Visalia	1			6:00AM	6:30AM	
		6:40AM	7:15AM	7:30AM	8:00AM	
		8:10AM	8:45AM	9:00AM	9:30AM	
		9:40AM	10:15AM	10:30AM	11:00AM	
		11:10AM	11:45AM	12:00PM	12:30PM	
		12:40PM	1:15PM	1:30PM	2:00PM	
		2:10PM	2:45PM	3:00PM	3:30PM	
		2:40PM	3:15PM	3:30PM	4:00PM	
		3:40PM	4:15PM	4:30PM	5:00PM	
		5:10PM	5:45PM	6:00PM	6:30PM	
		6:40PM	7:15PM			13.5
KART	2	5:40AM	6:15AM	6:30AM	7:00AM	
		7:10AM	7:45AM	8:00AM	8:30AM	
		8:40AM	9:15AM	9:30AM	10:00AM	
		10:10AM	10:45AM	11:00AM	11:30AM	
		11:40PM	12:15PM	12:30PM	1:00PM	
		1:10PM	1:45PM	2:00PM	2:30PM	
		2:40PM	3:15PM	3:30PM	4:00PM	
		4:10PM	4:45PM	5:00PM	5:30PM	
		5:40PM	6:15PM	6:30PM	7:00PM	13.5
	3	6:10AM	6:45AM	7:00AM	7:30AM	
		7:40AM	8:15AM	8:30AM	9:00AM	
		9:10AM	9:45AM	10:00AM	10:30AM	
		10:40AM	11:15AM	11:30AM	12:00PM	
		12:10PM	12:45PM	1:00PM	1:30PM	
		12:40PM	1:15PM	1:30PM	2:00PM	
		1:40PM	2:15PM	2:30PM	3:00PM	
		3:10PM	3:45PM	4:00PM	4:30PM	
		4:40PM	5:15PM	5:30PM	6:00PM	
		6:10PM	6:45PM	7:00PM	7:30PM	13.50
Visalia	4			9:45PM	10:15PM	2.00
		10:40PM	11:15PM			

KART	15.50
Visalia	27.00
TOTAL	42.50

Weekend & Holiday

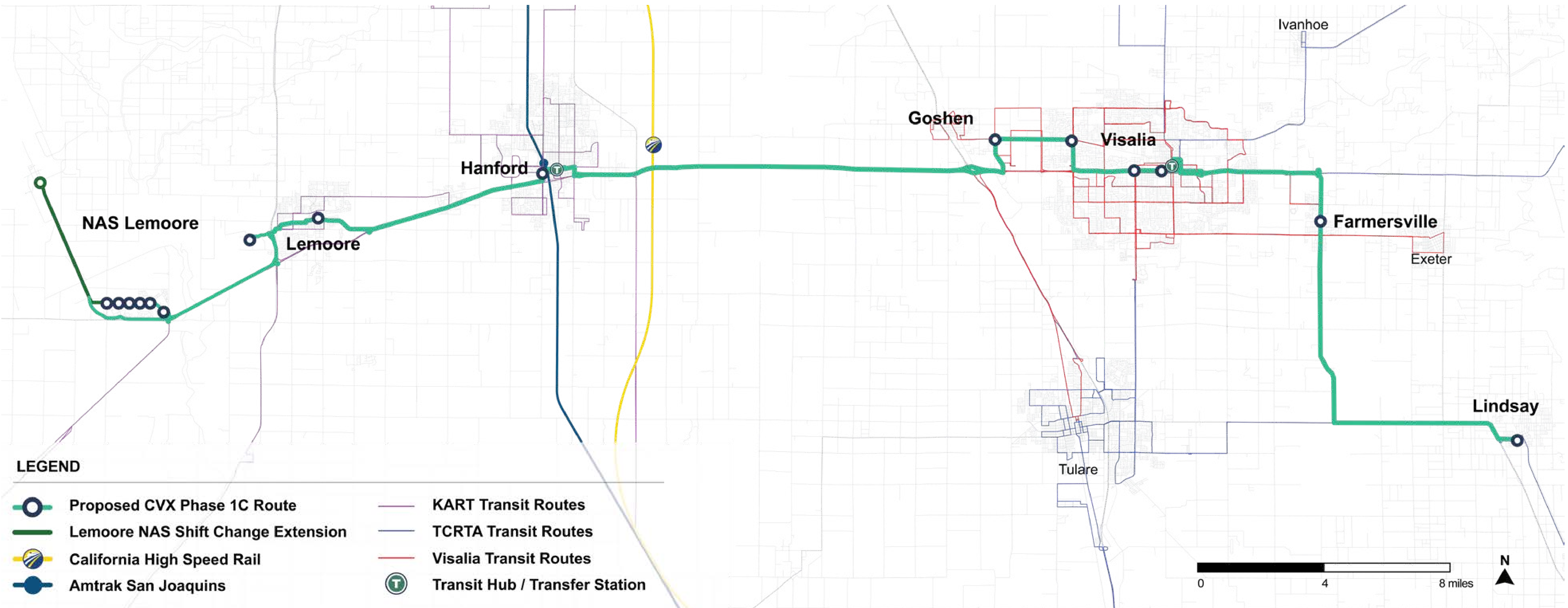
	Block #	Hanford Transit Center /Amtrak	Visalia Transit Center	Visalia Transit Center	Hanford Transit Center /Amtrak	Hours
Visalia	1			7:30AM	8:00AM	
		8:10AM	8:45AM	9:00AM	9:30AM	
		9:40AM	10:15AM	10:30AM	11:00AM	
		11:10AM	11:45AM	12:00PM	12:30PM	
		12:40PM	1:15PM	1:30PM	2:00PM	
		2:10PM	2:45PM	3:00PM	3:30PM	
		3:40PM	4:15PM	4:30PM	5:00PM	
		5:10PM	5:45PM	6:00PM	6:30PM	
		6:40PM	7:15PM			12.00
Visalia	2			8:00AM	8:30AM	
		8:40AM	9:15AM	9:30AM	10:00AM	
		10:10AM	10:45AM	11:00AM	11:30AM	
		11:40AM	12:15PM	12:30PM	1:00PM	
		1:10PM	1:45PM	2:00PM	2:30PM	
		2:40PM	3:15PM	3:30PM	4:00PM	
		4:10PM	4:45PM	5:00PM	5:30PM	
		5:40PM	6:15PM	6:30PM	7:00PM	11.50
	3			8:30AM	9:00AM	
		9:10AM	9:45AM	10:00AM	10:30AM	
		10:40AM	11:15AM	11:30AM	12:00PM	
		12:10PM	12:45PM	1:00PM	1:30PM	
		1:40PM	2:15PM	2:30PM	3:00PM	
		3:10PM	3:45PM	4:00PM	4:30PM	
		4:40PM	5:15PM	5:30PM	6:00PM	
		6:10PM	6:45PM	7:00PM	7:30PM	11.50
Visalia	4			9:45PM	10:15PM	2.00
		10:40PM	11:15PM			

Visalia	37.00
TOTAL	37.00

PHASE 1C

Phase 1C expands on CVX Phase 1B, extending the route westward to Lemoore and NAS Lemoore as well as eastward to Farmersville and Lindsay. Phase 1C is intended for implementation after completion of the new Hanford Transit Center (along the north side of 7th Street between Harris Street and Brown Street) but prior to the start of high speed rail service. Phase 1C continues all-electric bus operation, which requires an uncommon approach to layover and vehicle assignments. Figure 4 provides an overview of the route.

Figure 4 - CVX Phase 1C route



Routing

The route is extended west of Hanford to serve Lemoore (with stops at the Lemoore Depot and at West Hills College) and Naval Air Station Lemoore (NAS), routed to a new hub for the Visalia Industrial Area at W Goshen and Plaza, and extended to transit centers in Farmersville and Lindsay. Other elements of this routing are as follows:

- Service is provided between Lindsay and NAS Lemoore, including service to northwest Visalia (Goshen Avenue), Lemoore and West Hills College.
- NAS Lemoore service operates on Franklin Avenue within the base, but during peak weekday-only shift time service is provided to NAS Airfield Gate. In the morning, westbound buses would bypass the Administrative Area via the Reeves Bypass to serve a drop-off circle just outside (and to the west) of the Airfield Gate, before returning to the Administrative Area via the Reeves Gate. Afternoon services to the Airfield Gate would pass through the Administrative Area in both directions.
- Hanford Amtrak station is served. The westbound route uses a stop on the west side of Santa Fe Avenue. The existing Hanford Transit Center site is assumed to be unavailable for a bus stop.

Routing was developed to minimize bus running time between stops, to avoid operations adjacent to residences as much as possible, and to minimize bus turns.

Running Time

Realistic running times were developed as follows:

1. Google Maps running times were used as an initial approximation of travel times. Travel times during potential peak traffic conditions (AM and PM commute periods) were reviewed.
2. Stop-to-stop running times were validated in the field, using a 45 foot bus and stopping for virtual passengers.
3. The appropriate locations for Transit Signal Priority (TSP) at existing signals were identified, focusing on the intersections with greater overall traffic volumes and delays. The locations of TSP signals are shown in Figure 6, indicating a total of 30 individual intersections. An average transit travel time savings of 0.5 minutes per TSP was applied, based on typical observed benefits of TSP. Especially important is TSP along Mineral King and Noble to allow buses to effectively use the freeway between stops saving at least ten minutes.
4. Boarding/alighting time of 1 minute was assumed for most stops, with 2 minutes at transit centers.

The resulting round-trip running time (excluding layover and charging time) is 240 minutes (or 4 hours) for the basic route.

Schedule

Schedule parameters for this phase are as follows:

- Weekday span of service generally from 6 AM to Midnight.
- Weekend/Holiday span of service generally from 7 AM to Midnight.
- Half-hourly service is provided throughout the operating day from roughly 6 AM to 7 PM, with hourly service until midnight.
- Weekday and weekend/holiday midday service limited to hourly frequency after about 8:00 PM.
- The West Hills College stop is not served prior to 7 AM or after 9 PM on weekdays nor at any times on weekends.
- Some trips will be operated by KART (from the existing operations base in Hanford) while the remaining runs will be operated by Visalia Transit (from the existing operations base in Visalia) In setting the start and end times for specific trips and blocks, consideration was given to start and end trips and blocks close to the respective operations base, to minimize deadhead travel.

The schedules and vehicle blocking for Phase 1C weekday and weekend/holiday service is shown in the following pages.

Interim Service

As Phase 1C is implemented, and based on service agreements and funding commitments, some or all of the Phase 1C route could be initially operated. In all cases, Tulare County connections to the Amtrak and High Speed Rail service would be a paramount priority; should this shorten Phase 1C service be pursued, it will be considered a “pilot” phase.

Vehicle Assignment and Blocking

Vehicle schedules assume a 120 minute running time in each direction and typically assume an additional 10% of running time at each terminal for recovery (accommodating variations in the schedule) and relief (allowing drivers to have a short break). Using this formula, the 240 minute round trip time increases to 264 minutes. Since the service operates every 30 minutes, a total of nine buses would be required for service (264/30 = 9 buses).

However, the anticipated range for the electric buses is about 200 miles, which means that each bus could – at most – only make two round trips (124 miles for each round trip). The consulting team considered the feasibility of "swapping" the entire bus fleet after two round trips with a "fresh" bus. This results in an increase in the fleet from about 11 buses to at least 15 buses. This strategy was then compared with simply adding a 10th bus into the vehicle rotation and increasing the enroute charging time, allowing each bus to "top-off" after each trip and essentially eliminating the range concern with this route.

As a result of this analysis, the schedule uses a 10th bus for about eight hours during the operating day. Between about 1000 AM and 500 PM most of the 10 buses have several 50 minute layovers at NAS Lemoore which allows the buses to complete the entire duty cycle. This strategy increases driver time and potentially cost; however, a modern e-scheduling system can likely integrate these breaks with driver lunch periods to achieve reasonable efficiencies.

Cost

Based on a blended hourly cost of $110 per hour, the total weekday cost (including current KART service) would be about $17,000 daily (weekends are slightly less, but the difference is negligible). Total annual operating costs would be about $6 million.

Table 6 - CVX Phase 1C Weekday Schedule

Schedule

Monday through Friday

Eastbound

NAS LEMOORE			LEMOORE		HANFORD		VISALIA					FARMERSVILLE	LINDSAY
1 Airfield Gate	2 Franklin & Enterprise	3 East Gate	4 West Hills	5 Train Station	6 Amtrak	7 Transit Center	8 Goshen & N. Plaza	9 Goshen & N. Akers	10 College of the Sequoias	11 Kaweah Medical Center EB	12 Transit Center	13 Transit Center	14 Transit Center (Arr)
	6:13 AM	6:21 AM		6:33 AM	6:48 AM	6:52 AM	7:11 AM	7:17 AM	7:22 AM	7:24 AM	7:29 AM	7:41 AM	8:06 AM
	6:43 AM	6:51 AM		7:03 AM	7:18 AM	7:22 AM	7:41 AM	7:47 AM	7:52 AM	7:54 AM	7:59 AM	8:11 AM	8:36 AM
	7:13 AM	7:21 AM		7:33 AM	7:48 AM	7:52 AM	8:11 AM	8:17 AM	8:22 AM	8:24 AM	8:29 AM	8:41 AM	9:06 AM
	7:37 AM	7:45 AM	7:55 AM	8:03 AM	8:18 AM	8:22 AM	8:41 AM	8:47 AM	8:52 AM	8:54 AM	8:59 AM	9:11 AM	9:36 AM
	8:07 AM	8:15 AM	8:25 AM	8:33 AM	8:48 AM	8:52 AM	9:11 AM	9:17 AM	9:22 AM	9:24 AM	9:29 AM	9:41 AM	10:06 AM
	8:37 AM	8:45 AM	8:55 AM	9:03 AM	9:18 AM	9:22 AM	9:41 AM	9:47 AM	9:52 AM	9:54 AM	9:59 AM	10:11 AM	10:36 AM
	9:07 AM	9:15 AM	9:25 AM	9:33 AM	9:48 AM	9:52 AM	10:11 AM	10:17 AM	10:22 AM	10:24 AM	10:29 AM	10:41 AM	11:06 AM
	9:37 AM	9:45 AM	9:55 AM	10:03 AM	10:18 AM	10:22 AM	10:41 AM	10:47 AM	10:52 AM	10:54 AM	10:59 AM	11:11 AM	11:36 AM
	10:07 AM	10:15 AM	10:25 AM	10:33 AM	10:48 AM	10:52 AM	11:11 AM	11:17 AM	11:22 AM	11:24 AM	11:29 AM	11:41 AM	12:06 PM
	10:37 AM	10:45 AM	10:55 AM	11:03 AM	11:18 AM	11:22 AM	11:41 AM	11:47 AM	11:52 AM	11:54 AM	11:59 AM	12:11 PM	12:36 PM
	11:07 AM	11:15 AM	11:25 AM	11:33 AM	11:48 AM	11:52 AM	12:11 PM	12:17 PM	12:22 PM	12:24 PM	12:29 PM	12:41 PM	1:06 PM
	11:37 AM	11:45 AM	11:55 AM	12:03 PM	12:18 PM	12:22 PM	12:41 PM	12:47 PM	12:52 PM	12:54 PM	12:59 PM	1:11 PM	1:36 PM
	12:07 PM	12:15 PM	12:25 PM	12:33 PM	12:48 PM	12:52 PM	1:11 PM	1:17 PM	1:22 PM	1:24 PM	1:29 PM	1:41 PM	2:06 PM
	12:37 PM	12:45 PM	12:55 PM	1:03 PM	1:18 PM	1:22 PM	1:41 PM	1:47 PM	1:52 PM	1:54 PM	1:59 PM	2:11 PM	2:36 PM
	1:07 PM	1:15 PM	1:25 PM	1:33 PM	1:48 PM	1:52 PM	2:11 PM	2:17 PM	2:22 PM	2:24 PM	2:29 PM	2:41 PM	3:06 PM
	1:37 PM	1:45 PM	1:55 PM	2:03 PM	2:18 PM	2:22 PM	2:41 PM	2:47 PM	2:52 PM	2:54 PM	2:59 PM	3:11 PM	3:36 PM
	2:07 PM	2:15 PM	2:25 PM	2:33 PM	2:48 PM	2:52 PM	3:11 PM	3:17 PM	3:22 PM	3:24 PM	3:29 PM	3:41 PM	4:06 PM
2:30 PM	2:37 PM	2:45 PM	2:55 PM	3:03 PM	3:18 PM	3:22 PM	3:41 PM	3:47 PM	3:52 PM	3:54 PM	3:59 PM	4:11 PM	4:36 PM
3:00 PM	3:07 PM	3:15 PM	3:25 PM	3:33 PM	3:48 PM	3:52 PM	4:11 PM	4:17 PM	4:22 PM	4:24 PM	4:29 PM	4:41 PM	5:06 PM
3:30 PM	3:37 PM	3:45 PM	3:55 PM	4:03 PM	4:18 PM	4:22 PM	4:41 PM	4:47 PM	4:52 PM	4:54 PM	4:59 PM	5:11 PM	5:36 PM
	4:07 PM	4:15 PM	4:25 PM	4:33 PM	4:48 PM	4:52 PM	5:11 PM	5:17 PM	5:22 PM	5:24 PM	5:29 PM	5:41 PM	6:06 PM
	4:37 PM	4:45 PM	4:55 PM	5:03 PM	5:18 PM	5:22 PM	5:41 PM	5:47 PM	5:52 PM	5:54 PM	5:59 PM	6:11 PM	6:36 PM
	5:07 PM	5:15 PM	5:25 PM	5:33 PM	5:48 PM	5:52 PM	6:11 PM	6:17 PM	6:22 PM	6:24 PM	6:29 PM	6:41 PM	7:06 PM
	5:37 PM	5:45 PM	5:55 PM	6:03 PM	6:18 PM	6:22 PM	6:41 PM	6:47 PM	6:52 PM	6:54 PM	6:59 PM	7:11 PM	7:36 PM
	6:07 PM	6:15 PM	6:25 PM	6:33 PM	6:48 PM	6:52 PM	7:11 PM	7:17 PM	7:22 PM	7:24 PM	7:29 PM	7:41 PM	8:06 PM
	6:37 PM	6:45 PM	6:55 PM	7:03 PM	7:18 PM	7:22 PM	7:41 PM	7:47 PM	7:52 PM	7:54 PM	7:59 PM	8:11 PM	8:36 PM
	7:07 PM	7:15 PM		7:33 PM	7:48 PM	7:52 PM	8:11 PM	8:17 PM	8:22 PM	8:24 PM	8:29 PM		
	7:37 PM	7:45 PM		8:03 PM	8:18 PM	8:22 PM	8:41 PM	8:47 PM	8:52 PM	8:54 PM	8:59 PM	9:11 PM	9:36 PM
	8:37 PM	8:45 PM		9:03 PM	9:18 PM	9:22 PM	9:41 PM	9:47 PM	9:52 PM	9:54 PM	9:59 PM	10:11 PM	10:36 PM
	9:37 PM	9:45 PM	9:55 PM	10:03 PM	10:18 PM	10:22 PM	10:41 PM	10:47 PM	10:52 PM	10:54 PM	10:59 PM	11:11 PM	11:36 PM
	10:43 PM	10:51 PM		11:03 PM	11:18 PM	11:22 PM	11:41 PM	11:47 PM	11:52 PM	11:54 PM	11:59 PM		

Schedule

Monday through Friday

Westbound

LINDSAY	FARMERSVILLE	VISALIA					HANFORD		LEMOORE		NAS LEMOORE		
1 Transit Center (Arr)	2 Transit Center	3 Transit Center	4 Kaweah Medical Center WB	5 College of the Sequoias	6 Goshen & N. Akers	7 Goshen & N. Plaza	8 Transit Center	9 Amtrak	10 Train Station	11 West Hills	12 East Gate	13 Franklin & Enterprise	14 Airfield Gate
							6:00 AM	6:04 AM	6:19 AM				6:39 AM
							6:30 AM	6:34 AM	6:49 AM				7:09 AM
		6:23 AM	6:28 AM	6:30 AM	6:35 AM	6:41 AM	7:00 AM	7:04 AM	7:19 AM				7:39 AM
		6:53 AM	6:58 AM	7:00 AM	7:05 AM	7:11 AM	7:30 AM	7:34 AM	7:49 AM	7:57 AM			8:16 AM
6:46 AM	7:11 AM	7:23 AM	7:28 AM	7:30 AM	7:35 AM	7:41 AM	8:00 AM	8:04 AM	8:19 AM	8:27 AM	8:37 AM	8:46 AM	
7:16 AM	7:41 AM	7:53 AM	7:58 AM	8:00 AM	8:05 AM	8:11 AM	8:30 AM	8:34 AM	8:49 AM	8:57 AM	9:07 AM	9:16 AM	
7:46 AM	8:11 AM	8:23 AM	8:28 AM	8:30 AM	8:35 AM	8:41 AM	9:00 AM	9:04 AM	9:19 AM	9:27 AM	9:37 AM	9:46 AM	
8:16 AM	8:41 AM	8:53 AM	8:58 AM	9:00 AM	9:05 AM	9:11 AM	9:30 AM	9:34 AM	9:49 AM	9:57 AM	10:07 AM	10:16 AM	
8:46 AM	9:11 AM	9:23 AM	9:28 AM	9:30 AM	9:35 AM	9:41 AM	10:00 AM	10:04 AM	10:19 AM	10:27 AM	10:37 AM	10:46 AM	
9:16 AM	9:41 AM	9:53 AM	9:58 AM	10:00 AM	10:05 AM	10:11 AM	10:30 AM	10:34 AM	10:49 AM	10:57 AM	11:07 AM	11:16 AM	
9:46 AM	10:11 AM	10:23 AM	10:28 AM	10:30 AM	10:35 AM	10:41 AM	11:00 AM	11:04 AM	11:19 AM	11:27 AM	11:37 AM	11:46 AM	
10:16 AM	10:41 AM	10:53 AM	10:58 AM	11:00 AM	11:05 AM	11:11 AM	11:30 AM	11:34 AM	11:49 AM	11:57 AM	12:07 PM	12:16 PM	
10:46 AM	11:11 AM	11:23 AM	11:28 AM	11:30 AM	11:35 AM	11:41 AM	12:00 PM	12:04 PM	12:19 PM	12:27 PM	12:37 PM	12:46 PM	
11:16 AM	11:41 AM	11:53 AM	11:58 AM	12:00 PM	12:05 PM	12:11 PM	12:30 PM	12:34 PM	12:49 PM	12:57 PM	1:07 PM	1:16 PM	
11:46 AM	12:11 PM	12:23 PM	12:28 PM	12:30 PM	12:35 PM	12:41 PM	1:00 PM	1:04 PM	1:19 PM	1:27 PM	1:37 PM	1:46 PM	
12:16 PM	12:41 PM	12:53 PM	12:58 PM	1:00 PM	1:05 PM	1:11 PM	1:30 PM	1:34 PM	1:49 PM	1:57 PM	2:07 PM	2:16 PM	
12:46 PM	1:11 PM	1:23 PM	1:28 PM	1:30 PM	1:35 PM	1:41 PM	2:00 PM	2:04 PM	2:19 PM	2:27 PM	2:37 PM	2:46 PM	
1:16 PM	1:41 PM	1:53 PM	1:58 PM	2:00 PM	2:05 PM	2:11 PM	2:30 PM	2:34 PM	2:49 PM	2:57 PM	3:07 PM	3:16 PM	
1:46 PM	2:11 PM	2:23 PM	2:28 PM	2:30 PM	2:35 PM	2:41 PM	3:00 PM	3:04 PM	3:19 PM	3:27 PM	3:37 PM	3:46 PM	
2:16 PM	2:41 PM	2:53 PM	2:58 PM	3:00 PM	3:05 PM	3:11 PM	3:30 PM	3:34 PM	3:49 PM	3:57 PM	4:07 PM	4:16 PM	
2:46 PM	3:11 PM	3:23 PM	3:28 PM	3:30 PM	3:35 PM	3:41 PM	4:00 PM	4:04 PM	4:19 PM	4:27 PM	4:37 PM	4:46 PM	
3:16 PM	3:41 PM	3:53 PM	3:58 PM	4:00 PM	4:05 PM	4:11 PM	4:30 PM	4:34 PM	4:49 PM	4:57 PM	5:07 PM	5:16 PM	
3:46 PM	4:11 PM	4:23 PM	4:28 PM	4:30 PM	4:35 PM	4:41 PM	5:00 PM	5:04 PM	5:19 PM	5:27 PM	5:37 PM	5:46 PM	
4:16 PM	4:41 PM	4:53 PM	4:58 PM	5:00 PM	5:05 PM	5:11 PM	5:30 PM	5:34 PM	5:49 PM	5:57 PM	6:07 PM	6:16 PM	
4:46 PM	5:11 PM	5:23 PM	5:28 PM	5:30 PM	5:35 PM	5:41 PM	6:00 PM	6:04 PM	6:19 PM	6:27 PM	6:37 PM	6:46 PM	
5:16 PM	5:41 PM	5:53 PM	5:58 PM	6:00 PM	6:05 PM	6:11 PM	6:30 PM	6:34 PM	6:49 PM	6:57 PM	7:07 PM	7:16 PM	
5:46 PM	6:11 PM	6:23 PM	6:28 PM	6:30 PM	6:35 PM	6:41 PM	7:00 PM	7:04 PM	7:19 PM	7:27 PM	7:37 PM	7:46 PM	
6:16 PM	6:41 PM	6:53 PM	6:58 PM	7:00 PM	7:05 PM	7:11 PM	7:30 PM	7:34 PM	7:49 PM		8:01 PM	8:09 PM	
6:46 PM	7:11 PM	7:23 PM	7:28 PM	7:30 PM	7:35 PM	7:41 PM	8:00 PM	8:04 PM	8:19 PM		8:31 PM	8:39 PM	
7:16 PM	7:41 PM	7:53 PM	7:58 PM	8:00 PM	8:05 PM	8:11 PM	8:30 PM	8:34 PM	8:49 PM		9:01 PM	9:09 PM	
7:46 PM	8:11 PM	8:23 PM	8:28 PM	8:30 PM	8:35 PM	8:41 PM	9:00 PM	9:04 PM	9:19 PM		9:31 PM	9:37 PM	
8:46 PM	9:11 PM	9:23 PM	9:28 PM	9:30 PM	9:35 PM	9:41 PM	10:00 PM	10:04 PM	10:19 PM		10:31 PM	10:39 PM	
9:46 PM	10:11 PM	10:23 PM	10:28 PM	10:30 PM	10:35 PM	10:41 PM	11:00 PM						
10:46 PM	11:11 PM	11:23 PM	11:28 PM	11:30 PM	11:35 PM	11:41 PM	0:00 AM						

Table 6 - CVX Phase 1C Weekday Blocking

Blocking

Monday through Friday	Weekday Totals	Distance Travelled	Vehicle Hours
		4,454 miles	154h 05m

Eastbound

Block	Number	NAS LEMOORE: 1 Airfield Gate	NAS LEMOORE: 2 Franklin & Enterprise	NAS LEMOORE: 3 East Gate	LEMOORE: 4 West Hills	LEMOORE: 5 Train Station	HANFORD: 6 Amtrak	HANFORD: 7 Transit Center	VISALIA: 8 Goshen & N. Plaza	VISALIA: 9 Goshen & N. Akers	VISALIA: 10 College of the Sequoias	VISALIA: 11 Kaweah Medical Center EB	VISALIA: 12 Transit Center	FARMERSVILLE: 13 Transit Center	LINDSAY: 14 Transit Center (Arr)
1	7		9:07 AM	9:15 AM	9:25 AM	9:33 AM	9:48 AM	9:52 AM	10:11 AM	10:17 AM	10:22 AM	10:24 AM	10:29 AM	10:41 AM	11:06 AM
	17		2:07 PM	2:15 PM	2:25 PM	2:33 PM	2:48 PM	2:52 PM	3:11 PM	3:17 PM	3:22 PM	3:24 PM	3:29 PM	3:41 PM	4:06 PM
2	1		6:13 AM	6:21 AM		6:33 AM	6:48 AM	6:52 AM	7:11 AM	7:17 AM	7:22 AM	7:24 AM	7:29 AM	7:41 AM	8:06 AM
	11		11:07 AM	11:15 AM	11:25 AM	11:33 AM	11:48 AM	11:52 AM	12:11 PM	12:17 PM	12:22 PM	12:24 PM	12:29 PM	12:41 PM	1:06 PM
	21		4:07 PM	4:15 PM	4:25 PM	4:33 PM	4:48 PM	4:52 PM	5:11 PM	5:17 PM	5:22 PM	5:24 PM	5:29 PM	5:41 PM	6:06 PM
	29		8:37 PM	8:45 PM		9:03 PM	9:18 PM	9:22 PM	9:41 PM	9:47 PM	9:52 PM	9:54 PM	9:59 PM	10:11 PM	10:36 PM
3	3		7:13 AM	7:21 AM		7:33 AM	7:48 AM	7:52 AM	8:11 AM	8:17 AM	8:22 AM	8:24 AM	8:29 AM	8:41 AM	9:06 AM
	13		12:07 PM	12:15 PM	12:25 PM	12:33 PM	12:48 PM	12:52 PM	1:11 PM	1:17 PM	1:22 PM	1:24 PM	1:29 PM	1:41 PM	2:06 PM
	23		5:07 PM	5:15 PM	5:25 PM	5:33 PM	5:48 PM	5:52 PM	6:11 PM	6:17 PM	6:22 PM	6:24 PM	6:29 PM	6:41 PM	7:06 PM
4	5		8:07 AM	8:15 AM	8:25 AM	8:33 AM	8:48 AM	8:52 AM	9:11 AM	9:17 AM	9:22 AM	9:24 AM	9:29 AM	9:41 AM	10:06 AM
	15		1:07 PM	1:15 PM	1:25 PM	1:33 PM	1:48 PM	1:52 PM	2:11 PM	2:17 PM	2:22 PM	2:24 PM	2:29 PM	2:41 PM	3:06 PM
	25		6:07 PM	6:15 PM	6:25 PM	6:33 PM	6:48 PM	6:52 PM	7:11 PM	7:17 PM	7:22 PM	7:24 PM	7:29 PM	7:41 PM	8:06 PM
5	2		6:43 AM	6:51 AM		7:03 AM	7:18 AM	7:22 AM	7:41 AM	7:47 AM	7:52 AM	7:54 AM	7:59 AM	8:11 AM	8:36 AM
	12		11:37 AM	11:45 AM	11:55 AM	12:03 PM	12:18 PM	12:22 PM	12:41 PM	12:47 PM	12:52 PM	12:54 PM	12:59 PM	1:11 PM	1:36 PM
	22		4:37 PM	4:45 PM	4:55 PM	5:03 PM	5:18 PM	5:22 PM	5:41 PM	5:47 PM	5:52 PM	5:54 PM	5:59 PM	6:11 PM	6:36 PM
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	14		12:37 PM	12:45 PM	12:55 PM	1:03 PM	1:18 PM	1:22 PM	1:41 PM	1:47 PM	1:52 PM	1:54 PM	1:59 PM	2:11 PM	2:36 PM
	24		5:37 PM	5:45 PM	5:55 PM	6:03 PM	6:18 PM	6:22 PM	6:41 PM	6:47 PM	6:52 PM	6:54 PM	6:59 PM	7:11 PM	7:36 PM
7	8		9:37 AM	9:45 AM	9:55 AM	10:03 AM	10:18 AM	10:22 AM	10:41 AM	10:47 AM	10:52 AM	10:54 AM	10:59 AM	11:11 AM	11:36 AM
	18	2:30 PM	2:37 PM	2:45 PM	2:55 PM	3:03 PM	3:18 PM	3:22 PM	3:41 PM	3:47 PM	3:52 PM	3:54 PM	3:59 PM	4:11 PM	4:36 PM
	27		7:07 PM	7:15 PM		7:33 PM	7:48 PM	7:52 PM	8:11 PM	8:17 PM	8:22 PM	8:24 PM	8:29 PM		
8	6		8:37 AM	8:45 AM	8:55 AM	9:03 AM	9:18 AM	9:22 AM	9:41 AM	9:47 AM	9:52 AM	9:54 AM	9:59 AM	10:11 AM	10:36 AM
	16		1:37 PM	1:45 PM	1:55 PM	2:03 PM	2:18 PM	2:22 PM	2:41 PM	2:47 PM	2:52 PM	2:54 PM	2:59 PM	3:11 PM	3:36 PM
	26		6:37 PM	6:45 PM	6:55 PM	7:03 PM	7:18 PM	7:22 PM	7:41 PM	7:47 PM	7:52 PM	7:54 PM	7:59 PM	8:11 PM	8:36 PM
	31		10:43 PM	10:51 PM		11:03 PM	11:18 PM	11:22 PM	11:41 PM	11:47 PM	11:52 PM	11:54 PM	11:59 PM		
9	10		10:37 AM	10:45 AM	10:55 AM	11:03 AM	11:18 AM	11:22 AM	11:41 AM	11:47 AM	11:52 AM	11:54 AM	11:59 AM	12:11 PM	12:36 PM
	20	3:30 PM	3:37 PM	3:45 PM	3:55 PM	4:03 PM	4:18 PM	4:22 PM	4:41 PM	4:47 PM	4:52 PM	4:54 PM	4:59 PM	5:11 PM	5:36 PM
10	9		10:07 AM	10:15 AM	10:25 AM	10:33 AM	10:48 AM	10:52 AM	11:11 AM	11:17 AM	11:22 AM	11:24 AM	11:29 AM	11:41 AM	12:06 PM
	19	3:00 PM	3:07 PM	3:15 PM	3:25 PM	3:33 PM	3:48 PM	3:52 PM	4:11 PM	4:17 PM	4:22 PM	4:24 PM	4:29 PM	4:41 PM	5:06 PM
	28		7:37 PM	7:45 PM		8:03 PM	8:18 PM	8:22 PM	8:41 PM	8:47 PM	8:52 PM	8:54 PM	8:59 PM	9:11 PM	9:36 PM

Blocking

Monday through Friday

Westbound

Block	Number	LINDSAY: 1 Transit Center (Arr)	FARMERSVILLE: 2 Transit Center	VISALIA: 3 Transit Center	VISALIA: 4 Kaweah Medical Center EB	VISALIA: 5 College of the Sequoias	VISALIA: 6 Goshen & N. Akers	VISALIA: 7 Goshen & N. Plaza	HANFORD: 8 Transit Center	HANFORD: 9 Amtrak	LEEMORE: 10 Train Station	LEEMORE: 11 West Hills	NAS LEMOORE: 12 East Gate	NAS LEMOORE: 13 Franklin & Enterprise	NAS LEMOORE: 14 Airfield Gate
1	36	6:46 AM	7:11 AM	7:23 AM	7:28 AM	7:30 AM	7:35 AM	7:41 AM	8:00 AM	8:04 AM	8:19 AM	8:27 AM	8:37 AM	8:46 AM	
	45	11:16 AM	11:41 AM	11:53 AM	11:58 AM	12:00 PM	12:05 PM	12:11 PM	12:30 PM	12:34 PM	12:49 PM	12:57 PM	1:07 PM	1:16 PM	
	55	4:16 PM	4:41 PM	4:53 PM	4:58 PM	5:00 PM	5:05 PM	5:11 PM	5:30 PM	5:34 PM	5:49 PM	5:57 PM	6:07 PM	6:16 PM	
2	39	8:16 AM	8:41 AM	8:53 AM	8:58 AM	9:00 AM	9:05 AM	9:11 AM	9:30 AM	9:34 AM	9:49 AM	9:57 AM	10:07 AM	10:16 AM	
	49	1:16 PM	1:41 PM	1:53 PM	1:58 PM	2:00 PM	2:05 PM	2:11 PM	2:30 PM	2:34 PM	2:49 PM	2:57 PM	3:07 PM	3:16 PM	
	59	6:16 PM	6:41 PM	6:53 PM	6:58 PM	7:00 PM	7:05 PM	7:11 PM	7:30 PM	7:34 PM	7:49 PM		8:01 PM	8:09 PM	
	65	10:46 PM	11:11 PM	11:23 PM	11:28 PM	11:30 PM	11:35 PM	11:41 PM							
3	32								6:00 AM	6:04 AM	6:19 AM				6:39 AM
	41	9:16 AM	9:41 AM	9:53 AM	9:58 AM	10:00 AM	10:05 AM	10:11 AM	10:30 AM	10:34 AM	10:49 AM	10:57 AM	11:07 AM	11:16 AM	
	51	2:16 PM	2:41 PM	2:53 PM	2:58 PM	3:00 PM	3:05 PM	3:11 PM	3:30 PM	3:34 PM	3:49 PM	3:57 PM	4:07 PM	4:16 PM	
	61	7:16 PM	7:41 PM	7:53 PM	7:58 PM	8:00 PM	8:05 PM	8:11 PM	8:30 PM	8:34 PM	8:49 PM		9:01 PM	9:09 PM	
4	34			6:23 AM	6:28 AM	6:30 AM	6:35 AM	6:41 AM	7:00 AM	7:04 AM	7:19 AM				7:39 AM
	43	10:16 AM	10:41 AM	10:53 AM	10:58 AM	11:00 AM	11:05 AM	11:11 AM	11:30 AM	11:34 AM	11:49 AM	11:57 AM	12:07 PM	12:16 PM	
	53	3:16 PM	3:41 PM	3:53 PM	3:58 PM	4:00 PM	4:05 PM	4:11 PM	4:30 PM	4:34 PM	4:49 PM	4:57 PM	5:07 PM	5:16 PM	
5	40	8:46 AM	9:11 AM	9:23 AM	9:28 AM	9:30 AM	9:35 AM	9:41 AM	10:00 AM	10:04 AM	10:19 AM	10:27 AM	10:37 AM	10:46 AM	
	50	1:46 PM	2:11 PM	2:23 PM	2:28 PM	2:30 PM	2:35 PM	2:41 PM	3:00 PM	3:04 PM	3:19 PM	3:27 PM	3:37 PM	3:46 PM	
	60	6:46 PM	7:11 PM	7:23 PM	7:28 PM	7:30 PM	7:35 PM	7:41 PM	8:00 PM	8:04 PM	8:19 PM		8:31 PM	8:39 PM	
6	33								6:30 AM	6:34 AM	6:49 AM				7:09 AM
	42	9:46 AM	10:11 AM	10:23 AM	10:28 AM	10:30 AM	10:35 AM	10:41 AM	11:00 AM	11:04 AM	11:19 AM	11:27 AM	11:37 AM	11:46 AM	
	52	2:46 PM	3:11 PM	3:23 PM	3:28 PM	3:30 PM	3:35 PM	3:41 PM	4:00 PM	4:04 PM	4:19 PM	4:27 PM	4:37 PM	4:46 PM	
	62	7:46 PM	8:11 PM	8:23 PM	8:28 PM	8:30 PM	8:35 PM	8:41 PM	9:00 PM	9:04 PM	9:19 PM		9:31 PM	9:37 PM	
7	37	7:16 AM	7:41 AM	7:53 AM	7:58 AM	8:00 AM	8:05 AM	8:11 AM	8:30 AM	8:34 AM	8:49 AM	8:57 AM	9:07 AM	9:16 AM	
	46	11:46 AM	12:11 PM	12:23 PM	12:28 PM	12:30 PM	12:35 PM	12:41 PM	1:00 PM	1:04 PM	1:19 PM	1:27 PM	1:37 PM	1:46 PM	
	56	4:46 PM	5:11 PM	5:23 PM	5:28 PM	5:30 PM	5:35 PM	5:41 PM	6:00 PM	6:04 PM	6:19 PM	6:27 PM	6:37 PM	6:46 PM	
8	35			6:53 AM	6:58 AM	7:00 AM	7:05 AM	7:11 AM	7:30 AM	7:34 AM	7:49 AM	7:57 AM			8:16 AM
	44	10:46 AM	11:11 AM	11:23 AM	11:28 AM	11:30 AM	11:35 AM	11:41 AM	12:00 PM	12:04 PM	12:19 PM	12:27 PM	12:37 PM	12:46 PM	
	54	3:46 PM	4:11 PM	4:23 PM	4:28 PM	4:30 PM	4:35 PM	4:41 PM	5:00 PM	5:04 PM	5:19 PM	5:27 PM	5:37 PM	5:46 PM	
	63	8:46 PM	9:11 PM	9:23 PM	9:28 PM	9:30 PM	9:35 PM	9:41 PM	10:00 PM	10:04 PM	10:19 PM		10:31 PM	10:39 PM	
9	38	7:46 AM	8:11 AM	8:23 AM	8:28 AM	8:30 AM	8:35 AM	8:41 AM	9:00 AM	9:04 AM	9:19 AM	9:27 AM	9:37 AM	9:46 AM	
	48	12:46 PM	1:11 PM	1:23 PM	1:28 PM	1:30 PM	1:35 PM	1:41 PM	2:00 PM	2:04 PM	2:19 PM	2:27 PM	2:37 PM	2:46 PM	
	58	5:46 PM	6:11 PM	6:23 PM	6:28 PM	6:30 PM	6:35 PM	6:41 PM	7:00 PM	7:04 PM	7:19 PM	7:27 PM	7:37 PM	7:46 PM	
10	47	12:16 PM	12:41 PM	12:53 PM	12:58 PM	1:00 PM	1:05 PM	1:11 PM	1:30 PM	1:34 PM	1:49 PM	1:57 PM	2:07 PM	2:16 PM	
	57	5:16 PM	5:41 PM	5:53 PM	5:58 PM	6:00 PM	6:05 PM	6:11 PM	6:30 PM	6:34 PM	6:49 PM	6:57 PM	7:07 PM	7:16 PM	
	64	9:46 PM	10:11 PM	10:23 PM	10:28 PM	10:30 PM	10:35 PM	10:41 PM	11:00 PM						

Battery State Diagram

Monday through Friday

Re-Charging Time

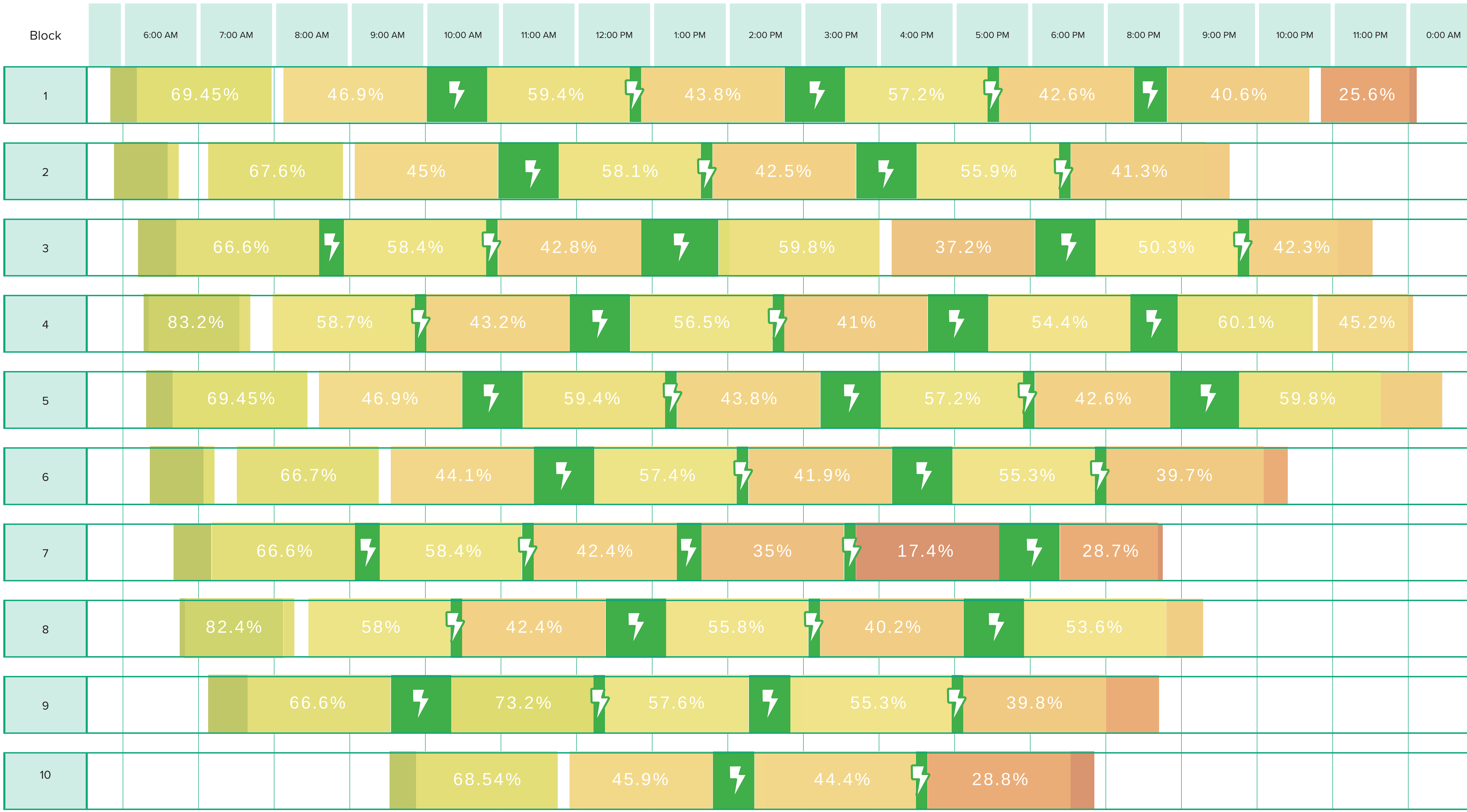

Table 7 - CVX Phase 1C Weekend and Holiday Schedule

Schedule

Saturday, Sunday and Holidays

Eastbound

			HANFORD		VISALIA					FARMERSVILLE	LINDSAY
1 Franklin & Enterprise	2 East Gate	3 Train Station	4 Amtrak	5 Transit Center	6 Goshen & N Plaza	7 Goshen & N Akers	8 College of the Sequoias	9 Kaweah Medical Center EB	10 Transit Center	11 Transit Center	12 Transit Center (Arr)
									6:59 AM	7:11 AM	7:36 AM
			6:48 AM	6:52 AM	7:11 AM	7:17 AM	7:22 AM	7:24 AM	7:29 AM	7:41 AM	8:06 AM
									7:59 AM	8:11 AM	8:36 AM
7:13 AM	7:21 AM	7:33 AM	7:48 AM	7:52 AM	8:11 AM	8:17 AM	8:22 AM	8:24 AM	8:29 AM	8:41 AM	9:06 AM
									8:59 AM	9:11 AM	9:36 AM
8:13 AM	8:21 AM	8:33 AM	8:48 AM	8:52 AM	9:11 AM	9:17 AM	9:22 AM	9:24 AM	9:29 AM	9:41 AM	10:06 AM
8:43 AM	8:51 AM	9:03 AM	9:18 AM	9:22 AM	9:41 AM	9:47 AM	9:52 AM	9:54 AM	9:59 AM	10:11 AM	10:36 AM
9:13 AM	9:21 AM	9:33 AM	9:48 AM	9:52 AM	10:11 AM	10:17 AM	10:22 AM	10:24 AM	10:29 AM	10:41 AM	11:06 AM
9:43 AM	9:51 AM	10:03 AM	10:18 AM	10:22 AM	10:41 AM	10:47 AM	10:52 AM	10:54 AM	10:59 AM	11:11 AM	11:36 AM
10:13 AM	10:21 AM	10:33 AM	10:48 AM	10:52 AM	11:11 AM	11:17 AM	11:22 AM	11:24 AM	11:29 AM	11:41 AM	12:06 PM
10:43 AM	10:51 AM	11:03 AM	11:18 AM	11:22 AM	11:41 AM	11:47 AM	11:52 AM	11:54 AM	11:59 AM	12:11 PM	12:36 PM
11:13 AM	11:21 AM	11:33 AM	11:48 AM	11:52 AM	12:11 PM	12:17 PM	12:22 PM	12:24 PM	12:29 PM	12:41 PM	1:06 PM
11:43 AM	11:51 AM	12:03 PM	12:18 PM	12:22 PM	12:41 PM	12:47 PM	12:52 PM	12:54 PM	12:59 PM	1:11 PM	1:36 PM
12:13 PM	12:21 PM	12:33 PM	12:48 PM	12:52 PM	1:11 PM	1:17 PM	1:22 PM	1:24 PM	1:29 PM	1:41 PM	2:06 PM
12:43 PM	12:51 PM	1:03 PM	1:18 PM	1:22 PM	1:41 PM	1:47 PM	1:52 PM	1:54 PM	1:59 PM	2:11 PM	2:36 PM
1:13 PM	1:21 PM	1:33 PM	1:48 PM	1:52 PM	2:11 PM	2:17 PM	2:22 PM	2:24 PM	2:29 PM	2:41 PM	3:06 PM
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2:13 PM	2:21 PM	2:33 PM	2:48 PM	2:52 PM	3:11 PM	3:17 PM	3:22 PM	3:24 PM	3:29 PM	3:41 PM	4:06 PM
2:43 PM	2:51 PM	3:03 PM	3:18 PM	3:22 PM	3:41 PM	3:47 PM	3:52 PM	3:54 PM	3:59 PM	4:11 PM	4:36 PM
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9:43 PM	9:51 PM	10:03 PM	10:18 PM	10:22 PM	10:41 PM	10:47 PM	10:52 PM	10:54 PM	10:59 PM	11:11 PM	11:36 PM
11:05 PM	11:13 PM	11:25 PM	11:40 PM	11:44 PM	0:00 AM	0:09 AM	0:14 AM	0:16 AM	0:21 AM		

Saturday, Sunday and Holidays

Westbound

LINDSAY	FARMERSVILLE	VISALIA					HANFORD		LEMOORE	NAS LEMOORE	
1 Transit Center	2 Transit Center	3 Transit Center	4 Kaweah Medical Center WB	5 College of the Sequoias	6 Goshen & N Akers	7 Goshen & N Plaza	8 Transit Center	9 Amtrak	10 Train Station	11 East Gate	12 Franklin & Enterprise
7:16 AM	7:41 AM	7:53 AM	7:58 AM	8:00 AM	8:05 AM	8:11 AM	8:30 AM	8:34 AM	8:49 AM	9:01 AM	9:10 AM
7:46 AM	8:11 AM	8:23 AM	8:28 AM	8:30 AM	8:35 AM	8:41 AM	9:00 AM	9:04 AM	9:19 AM	9:31 AM	9:40 AM
8:16 AM	8:41 AM	8:53 AM	8:58 AM	9:00 AM	9:05 AM	9:11 AM	9:30 AM	9:34 AM	9:49 AM	10:01 AM	10:10 AM
8:46 AM	9:11 AM	9:23 AM	9:28 AM	9:30 AM	9:35 AM	9:41 AM	10:00 AM	10:04 AM	10:19 AM	10:31 AM	10:40 AM
9:16 AM	9:41 AM	9:53 AM	9:58 AM	10:00 AM	10:05 AM	10:11 AM	10:30 AM	10:34 AM	10:49 AM	11:01 AM	11:10 AM
9:46 AM	10:11 AM	10:23 AM	10:28 AM	10:30 AM	10:35 AM	10:41 AM	11:00 AM	11:04 AM	11:19 AM	11:31 AM	11:40 AM
10:16 AM	10:41 AM	10:53 AM	10:58 AM	11:00 AM	11:05 AM	11:11 AM	11:30 AM	11:34 AM	11:49 AM	12:01 PM	12:10 PM
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7:46 PM	8:11 PM	8:23 PM	8:28 PM	8:30 PM	8:35 PM	8:41 PM	9:00 PM	9:04 PM	9:19 PM	9:31 PM	9:40 PM
8:16 PM	8:41 PM	8:53 PM	8:58 PM	9:00 PM	9:05 PM	9:11 PM	9:30 PM	9:34 PM			
8:46 PM	9:11 PM	9:23 PM	9:28 PM	9:30 PM	9:35 PM	9:41 PM	10:00 PM	10:04 PM	10:19 PM	10:31 PM	10:40 PM
9:46 PM	10:11 PM	10:23 PM	10:28 PM	10:30 PM	10:35 PM	10:41 PM	11:00 PM				
10:46 PM	11:11 PM	11:23 PM									
11:36 PM	11:44 PM	11:56 PM	0:00 AM	0:03 AM	0:08 AM	0:13 AM	0:29 AM	0:33 AM	0:46 AM		

Blocking

Saturday, Sunday and Holidays

Weekday Totals	Distance Travelled	Vehicle Hours
	4,049 miles	138h 35m

Eastbound

		NAS LEEMORE		LEEMORE	HANFORD		VISALIA					FARMERSVILLE	LINDSAY
Block	Number	1 Franklin & Enterprise	2 East Gate	3 Train Station	4 Amtrak	5 Transit Center	6 Goshen & N. Plaza	7 Goshen & N. Akers	8 College of the Sequoias	9 Kaweah Medical Center EB	10 Transit Center	11 Transit Center	12 Transit Center (Arr)
1	8	9:13 AM	9:21 AM	9:33 AM	9:48 AM	9:52 AM	10:11 AM	10:17 AM	10:22 AM	10:24 AM	10:29 AM	10:41 AM	11:06 AM
	17	1:43 PM	1:51 PM	2:03 PM	2:18 PM	2:22 PM	2:41 PM	2:47 PM	2:52 PM	2:54 PM	2:59 PM	3:11 PM	3:36 PM
	26	6:13 PM	6:21 PM	6:33 PM	6:48 PM	6:52 PM	7:11 PM	7:17 PM	7:22 PM	7:24 PM	7:29 PM	7:41 PM	8:06 PM
	32	11:05 PM	11:13 PM	11:25 PM	11:40 PM	11:44 PM							
2	2				6:48 AM	6:52 AM	7:11 AM	7:17 AM	7:22 AM	7:24 AM	7:29 AM	7:41 AM	8:06 AM
	11	10:43 AM	10:51 AM	11:03 AM	11:18 AM	11:22 AM	11:41 AM	11:47 AM	11:52 AM	11:54 AM	11:59 AM	12:11 PM	12:36 PM
	20	3:13 PM	3:21 PM	3:33 PM	3:48 PM	3:52 PM	4:11 PM	4:17 PM	4:22 PM	4:24 PM	4:29 PM	4:41 PM	5:06 PM
	29	7:43 PM	7:51 PM	8:03 PM	8:18 PM	8:22 PM	8:41 PM	8:47 PM	8:52 PM	8:54 PM	8:59 PM	9:11 PM	9:36 PM
3	4	7:13 AM	7:21 AM	7:33 AM	7:48 AM	7:52 AM	8:11 AM	8:17 AM	8:22 AM	8:24 AM	8:29 AM	8:41 AM	9:06 AM
	13	11:43 AM	11:51 AM	12:03 PM	12:18 PM	12:22 PM	12:41 PM	12:47 PM	12:52 PM	12:54 PM	12:59 PM	1:11 PM	1:36 PM
	22	4:13 PM	4:21 PM	4:33 PM	4:48 PM	4:52 PM	5:11 PM	5:17 PM	5:22 PM	5:24 PM	5:29 PM	5:41 PM	6:06 PM
4	1										6:59 AM	7:11 AM	7:36 AM
	9	9:43 AM	9:51 AM	10:03 AM	10:18 AM	10:22 AM	10:41 AM	10:47 AM	10:52 AM	10:54 AM	10:59 AM	11:11 AM	11:36 AM
	18	2:13 PM	2:21 PM	2:33 PM	2:48 PM	2:52 PM	3:11 PM	3:17 PM	3:22 PM	3:24 PM	3:29 PM	3:41 PM	4:06 PM
	27	6:43 PM	6:51 PM	7:03 PM	7:18 PM	7:22 PM	7:41 PM	7:47 PM	7:52 PM	7:54 PM	7:59 PM	8:11 PM	8:36 PM
5	3										7:59 AM	8:11 AM	8:36 AM
	12	11:13 AM	11:21 AM	11:33 AM	11:48 AM	11:52 AM	12:11 PM	12:17 PM	12:22 PM	12:24 PM	12:29 PM	12:41 PM	1:06 PM
	21	3:43 PM	3:51 PM	4:03 PM	4:18 PM	4:22 PM	4:41 PM	4:47 PM	4:52 PM	4:54 PM	4:59 PM	5:11 PM	5:36 PM
	30	8:43 PM	8:51 PM	9:03 PM	9:18 PM	9:22 PM	9:41 PM	9:47 PM	9:52 PM	9:54 PM	9:59 PM	10:11 PM	10:36 PM
6	10	10:13 AM	10:21 AM	10:33 AM	10:48 AM	10:52 AM	11:11 AM	11:17 AM	11:22 AM	11:24 AM	11:29 AM	11:41 AM	12:06 PM
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	28	7:13 PM	7:21 PM	7:33 PM	7:48 PM	7:52 PM	8:11 PM	8:17 PM	8:22 PM	8:24 PM	8:29 PM		
7	6	8:13 AM	8:21 AM	8:33 AM	8:48 AM	8:52 AM	9:11 AM	9:17 AM	9:22 AM	9:24 AM	9:29 AM	9:41 AM	10:06 AM
	15	12:43 PM	12:51 PM	1:03 PM	1:18 PM	1:22 PM	1:41 PM	1:47 PM	1:52 PM	1:54 PM	1:59 PM	2:11 PM	2:36 PM
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8	7	8:43 AM	8:51 AM	9:03 AM	9:18 AM	9:22 AM	9:41 AM	9:47 AM	9:52 AM	9:54 AM	9:59 AM	10:11 AM	10:36 AM
	16	1:13 PM	1:21 PM	1:33 PM	1:48 PM	1:52 PM	2:11 PM	2:17 PM	2:22 PM	2:24 PM	2:29 PM	2:41 PM	3:06 PM
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	31	9:43 PM	9:51 PM	10:03 PM	10:18 PM	10:22 PM	10:41 PM	10:47 PM	10:52 PM	10:54 PM	10:59 PM	11:11 PM	11:36 PM

Blocking

Saturday, Sunday and Holidays

Westbound

		LINDSAY	FARMERSVILLE	VISALIA					HANFORD		LEEMORE	NAS LEMOORE	
Block	Number	1 Transit Center (Arr)	2 Transit Center	3 Transit Center	4 Kaweah Medical Center EB	5 College of the Sequoias	6 Goshen & N. Akers	7 Goshen & N. Plaza	8 Transit Center	9 Amtrak	10 Train Station	11 East Gate	12 Franklin & Enterprise
1	33	7:16 AM	7:41 AM	7:53 AM	7:58 AM	8:00 AM	8:05 AM	8:11 AM	8:30 AM	8:34 AM	8:49 AM	9:01 AM	9:10 AM
	42	11:46 AM	12:11 PM	12:23 PM	12:28 PM	12:30 PM	12:35 PM	12:41 PM	1:00 PM	1:04 PM	1:19 PM	1:31 PM	1:40 PM
	51	4:16 PM	4:41 PM	4:53 PM	4:58 PM	5:00 PM	5:05 PM	5:11 PM	5:30 PM	5:34 PM	5:49 PM	6:01 PM	6:10 PM
	60	8:46 PM	9:11 PM	9:23 PM	9:28 PM	9:30 PM	9:35 PM	9:41 PM	10:00 PM	10:04 PM	10:19 PM	10:31 PM	10:40 PM
2	36	8:46 AM	9:11 AM	9:23 AM	9:28 AM	9:30 AM	9:35 AM	9:41 AM	10:00 AM	10:04 AM	10:19 AM	10:31 AM	10:40 AM
	45	1:16 PM	1:41 PM	1:53 PM	1:58 PM	2:00 PM	2:05 PM	2:11 PM	2:30 PM	2:34 PM	2:49 PM	3:01 PM	3:10 PM
	54	5:46 PM	6:11 PM	6:23 PM	6:28 PM	6:30 PM	6:35 PM	6:41 PM	7:00 PM	7:04 PM	7:19 PM	7:31 PM	7:40 PM
3	38	9:46 AM	10:11 AM	10:23 AM	10:28 AM	10:30 AM	10:35 AM	10:41 AM	11:00 AM	11:04 AM	11:19 AM	11:31 AM	11:40 AM
	47	2:16 PM	2:41 PM	2:53 PM	2:58 PM	3:00 PM	3:05 PM	3:11 PM	3:30 PM	3:34 PM	3:49 PM	4:01 PM	4:10 PM
	56	6:46 PM	7:11 PM	7:23 PM	7:28 PM	7:30 PM	7:35 PM	7:41 PM	8:00 PM	8:04 PM	8:19 PM	8:31 PM	8:40 PM
4	34	7:46 AM	8:11 AM	8:23 AM	8:28 AM	8:30 AM	8:35 AM	8:41 AM	9:00 AM	9:04 AM	9:19 AM	9:31 AM	9:40 AM
	43	12:16 PM	12:41 PM	12:53 PM	12:58 PM	1:00 PM	1:05 PM	1:11 PM	1:30 PM	1:34 PM	1:49 PM	2:01 PM	2:10 PM
	52	4:46 PM	5:11 PM	5:23 PM	5:28 PM	5:30 PM	5:35 PM	5:41 PM	6:00 PM	6:04 PM	6:19 PM	6:31 PM	6:40 PM
	61	9:46 PM	10:11 PM	10:23 PM	10:28 PM	10:30 PM	10:35 PM	10:41 PM	11:00 PM				
5	37	9:16 AM	9:41 AM	9:53 AM	9:58 AM	10:00 AM	10:05 AM	10:11 AM	10:30 AM	10:34 AM	10:49 AM	11:01 AM	11:10 AM
	46	1:46 PM	2:11 PM	2:23 PM	2:28 PM	2:30 PM	2:35 PM	2:41 PM	3:00 PM	3:04 PM	3:19 PM	3:31 PM	3:40 PM
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	62	10:46 PM	11:11 PM	11:23 PM									
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	44	12:46 PM	1:11 PM	1:23 PM	1:28 PM	1:30 PM	1:35 PM	1:41 PM	2:00 PM	2:04 PM	2:19 PM	2:31 PM	2:40 PM
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7	40	10:46 AM	11:11 AM	11:23 AM	11:28 AM	11:30 AM	11:35 AM	11:41 AM	12:00 PM	12:04 PM	12:19 PM	12:31 PM	12:40 PM
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8	41	11:16 AM	11:41 AM	11:53 AM	11:58 AM	12:00 PM	12:05 PM	12:11 PM	12:30 PM	12:34 PM	12:49 PM	1:01 PM	1:10 PM
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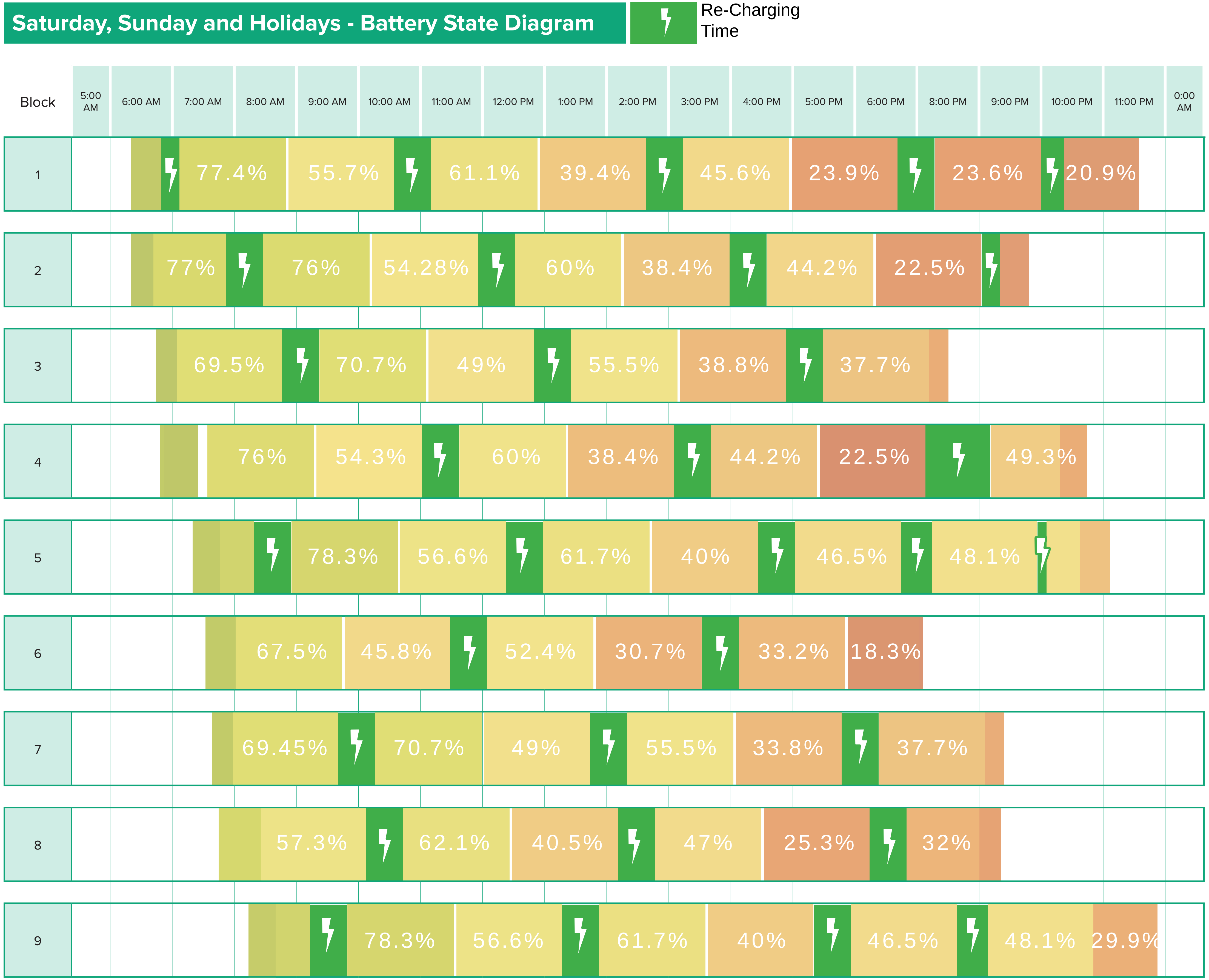
	59	8:16 PM	8:41 PM	8:53 PM	8:58 PM	9:00 PM	9:05 PM	9:11 PM	9:30 PM	9:34 PM			
9	39	10:16 AM	10:41 AM	10:53 AM	10:58 AM	11:00 AM	11:05 AM	11:11 AM	11:30 AM	11:34 AM	11:49 AM	12:01 PM	12:10 PM
	48	2:46 PM	3:11 PM	3:23 PM	3:28 PM	3:30 PM	3:35 PM	3:41 PM	4:00 PM	4:04 PM	4:19 PM	4:31 PM	4:40 PM
	57	7:16 PM	7:41 PM	7:53 PM	7:58 PM	8:00 PM	8:05 PM	8:11 PM	8:30 PM	8:34 PM	8:49 PM	9:01 PM	9:10 PM
	63	11:36 PM	11:44 PM	11:56 PM	0:00 AM	0:03 AM	0:08 AM	0:13 AM	0:29 AM	0:33 AM	0:46 AM		

Saturday, Sunday and Holidays - Battery State Diagram



CVX/BRT Annual Operating Costs

CVX - Lindsay to NAS Lemoore			
Phase 1C/2			
	Daily Vehicle Hours	Annual Vehicle Hours	Annual Opportunitiy Cost
Weekday	154	38,500	$4,235,000
Weekends/ Holidays	139	15,985	$1,765,000
Total		54,485	$6,000,000

Cost Per Hour	$110

BRT - Tulare to Visalia			
Phase 1C/2			
	Daily Vehicle Hours	Annual Vehicle Hours	Annual Opportunitiy Cost
Weekday	79	19,750	$2,172,500
Weekends/ Holidays	77	8,855	$977,500
Total		28,605	$3,150,000

Cost Per Hour	$110

PHASE 2

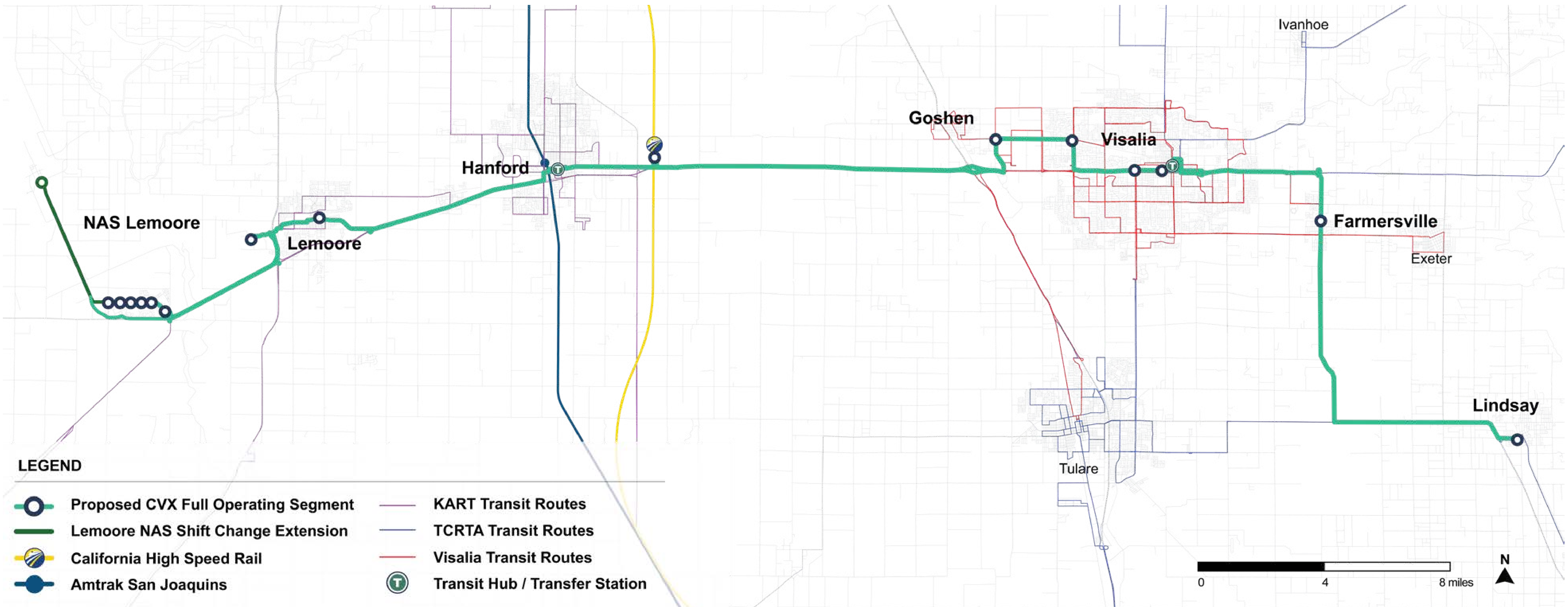
Phase 2 represents the service plan to be initiated with the opening of the High-Speed Rail station east of Hanford. The existing Hanford Amtrak station would no longer be served. There would be no changes in service span or frequency, as Phase 1C is high-speed rail ready.

Routing

Routing under Phase 2 is shown in Figure 5. The westbound route would be modified to turn north from SR 198 at 7th Avenue and use Lacey Boulevard to access the HSR station via a bus-only driveway. Leaving the station, the route would remain on Lacey Boulevard and 7th Street west to the Hanford Transit Center, before using Reddington Street to return to SR 198 westbound.

In the eastbound direction, the route heads north from SR 198 on Douty Street to 7th Street to the Hanford Transit Center, and then continues eastward on 7th/Lacey to the HSR station. Departing the station, the route returns west to SR 43 and south to regain SR 198 eastbound. The overall route is 1.3 miles longer than the Phase 1C length.

Figure 5 - CVX Phase 2 Route



Schedule

The schedules for Phase 2 are essentially the same as Phase 1C, with only a four minute increase in eastbound running time; as a result, there are no changes presented to the Phase 2 schedules for the purposes of this report.

Cost

Overall costs for Phase 2 are essentially the same as Phase 1C as the running time difference is not significant. Annual costs total about $6 million for CVX and $3.1 million for BRT.

OUTSTANDING ROUTING ISSUES AND REVISIONS

The City of Hanford awarded a Land Use and Transportation study in 2024 to integrate the HSR station into the downtown Hanford urban fabric. This work includes assessing a comprehensive transportation network and recommending a final alignment and identifying the Hanford stops for the CVX Phase 1 bus service   The study should consider two outstanding service items: 1) Westbound access into the HSR station via 7th Avenue, saving at least five minutes of running time, and 2) the length of the CVX bus route within downtown Hanford and assessing the number and location of any additional stops west of the new Hanford Transit Center and considering whether to access 198 on Douty/Reddington or use 11th Avenue.

In Lemoore, further consideration should be given (prior to implementation) of operation via 198 and 18th Avenue, or via D Street.

Both the Hanford and Lemoore routing discussion should be coordinated with further development of TSP measures.

03

CAPITAL PLAN

Traditionally, “over-the-road” 45-foot-long “motor coaches” – with raised passenger cabins and under-the-floor baggage compartments – are considered for longer distance services to provide better passenger comfort and storage capacity.

However, for a fixed-route regional service aimed at enhancing connectivity and providing a seamless experience for the users, a better bus option incorporates low floor boarding with multiple doors, accommodating fast passenger movements and easy access for people with disabilities.

Bus Typology

This study recommends a 45-foot low floor double deck bus, providing access to people with diasbilities, space for luggage, bikes, and strollers on the first level and comfortable seating on the upper level for longer trips.

The recommended bus meets both federal Buy America requirements and the California Air Resources Board's (CARB) Innovative Clean Transit (ICT) Regulation, adopted in December 2018, which mandates transit agencies transition their fleets to zero-emission technologies by 2040. In line with these regulations, this study recommends the implementation of Battery Electric Buses (BEB) to meet CARB's requirements.

Numerous transit agencies worldwide are rolling out Battery Electric Double Decker buses. Cities such as London, Hong Kong, Auckland, Singapore, and Santiago de Chile are leading the way. In North America, Toronto, Ottawa, Los Angeles, and more recently Seattle have also embraced Battery Electric Double Deckers, validating this technology and bus type. Battery capacity is rapidly improving, with many models now offering more than 650 kWh batteries and route ranges that exceed 200 miles, depending on conditions.

Fleet Size

The fleet size is calculated by dividing the total round-trip time by the headway. However, when dealing with electric buses, additional factors such as battery range, daily service hours, and charging times come into play. Based on these parameters, the recommended fleet size incorporates the base need to meet the schedule, along with an additional bus to provide adequate time for enroute charging, and a reasonable number of spare buses (typically about 15%). As a result, by Phase 1C the fleet needs will require 12 double deck electric buses.

In Phase 1A, service will be provided by existing KART and Visalia Transit buses. In Phase 1B, CVX service begins, and the fleet will be commissioned gradually as presented below:

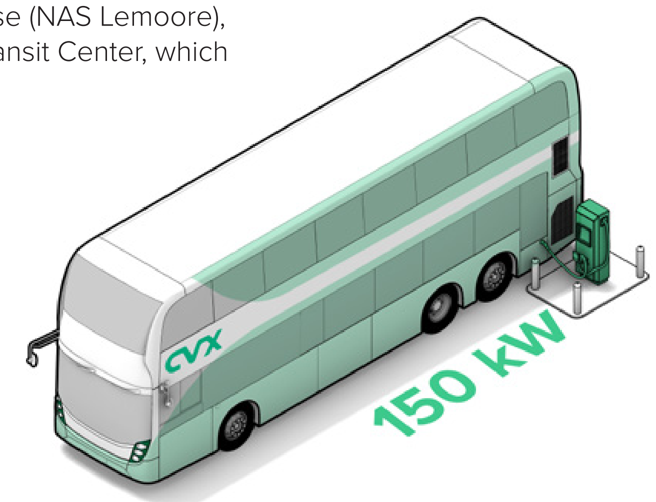
- Phase 1B: 3 buses plus 1 spare
- Phase 1C: 10 buses plus 2 spares

CHARGING INFRASTRUCTURE

Charging infrastructure requirements are driven by the operational profile of the bus fleet and evaluated based on schedule, route distance, concurrent charging, and technical parameters. Buses will charge at the Visalia Transit Operations and Maintenance Center and at the KART Operations and Maintenance Center in off-hours. Enroute/opportunity sites will be at Franklin & Enterprise (NAS Lemoore), which will have two chargers (plus one spare), and Lindsay Transit Center, which will have one charger and one spare.

Chargers

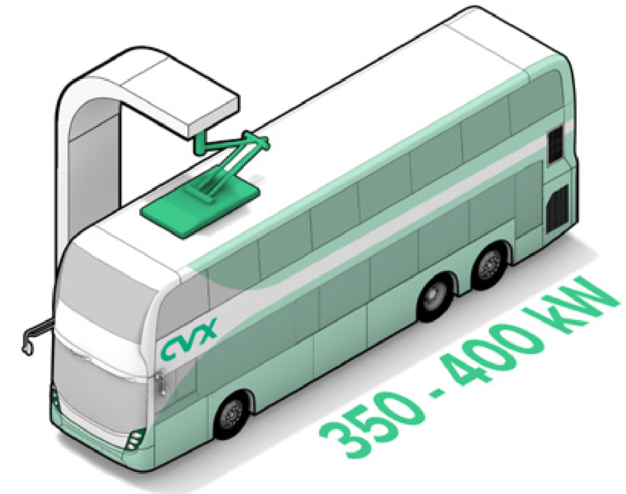
Chargers for battery electric buses come in a variety of designs to address the different needs of fleet operations. For this study, Arup considered plug-in chargers, reverse pantographs, and inductive charging, shown in Table 10 . Plug-in chargers are recommended for the bus maintenance yards, where vehicles will have long layovers to meet charging needs, whereas the reverse pantograph or induction charging is better suited for the opportunity charging sites at Frankling & Enterprise and Lindsay Transit Center.



Plug-In Chargers

Charge rate: 150 kW

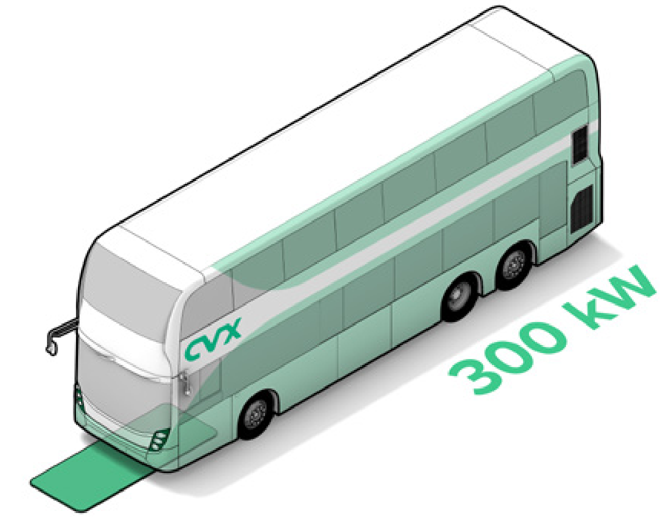
Plug-in chargers have a physical plug that connect form the charger to the bus. These chargers have a lower charge rate and can trickle charge the fleet overnight.



Reverse Pantograph

Charge rate: 350 - 400 kW

Reverse pantographs have the charging infrastructure mounted on the bus roof itself, such that when the bus parks under the charging station, the pantograph extends downward to connect with the bus and provide a charge.



Inductive Charging

Charge rate: 300 kW

Inductive charging does not use physical plugs and instead aligns wireless chargers in the bottom of the bus with a charging pad that is on the ground. Charging happens through electromagnetic fields, offering a convenient solution for on-the-go charging.

Given the charger options described above, Arup assumed the following technical parameters to evaluate the power requirements:

Table 10 - Parameters for Operational Profile Calculations

Parameter	Value	Unit
Energy Consumption	2.5	kWh/mile
Recharge rate	5	kWh/minute
Charging rating	300	kW
Maximum Usable Bus Battery	600	kWh

Capacity Needs

The operations of the bus fleet observe a 10-minute layover at the Lindsay Transit Center for charging. With only one charger on the site and brief windows of time to charge, the peak demands are very low and are not expected to exceed 350 kW.

The Franklin & Enterprise site will accommodate layovers that range from 21 minutes to 61 minutes and have up to two buses charging concurrently. During the worst-case scenario, Arup assumes two buses will charge concurrently for a total 31 minutes, resulting in a peak demand of 600 kW.

Lindsay Transit Center is located in Southern California Edison (SCE) territory. After reviewing SCE's publicly available distribution resource plan external portal, Arup confirmed that the local distribution feeder and substation have about 8MW and 33MW of reserve load capacity, respectively, indicating adequate capacity to serve the charging requirements through 2027.

Through conversations with personnel at the Naval Air Station, Arup determined that the existing infrastructure at the Franklin & Enterprise site also has sufficient capacity to support the peak demands of the charging buses. Personnel also indicated that the site had reliable power. Because of the available capacity and reliability at both the Lemoore and Linsday sites, Arup did not investigate interconnection of distributed energy resources for added resilience at this time.

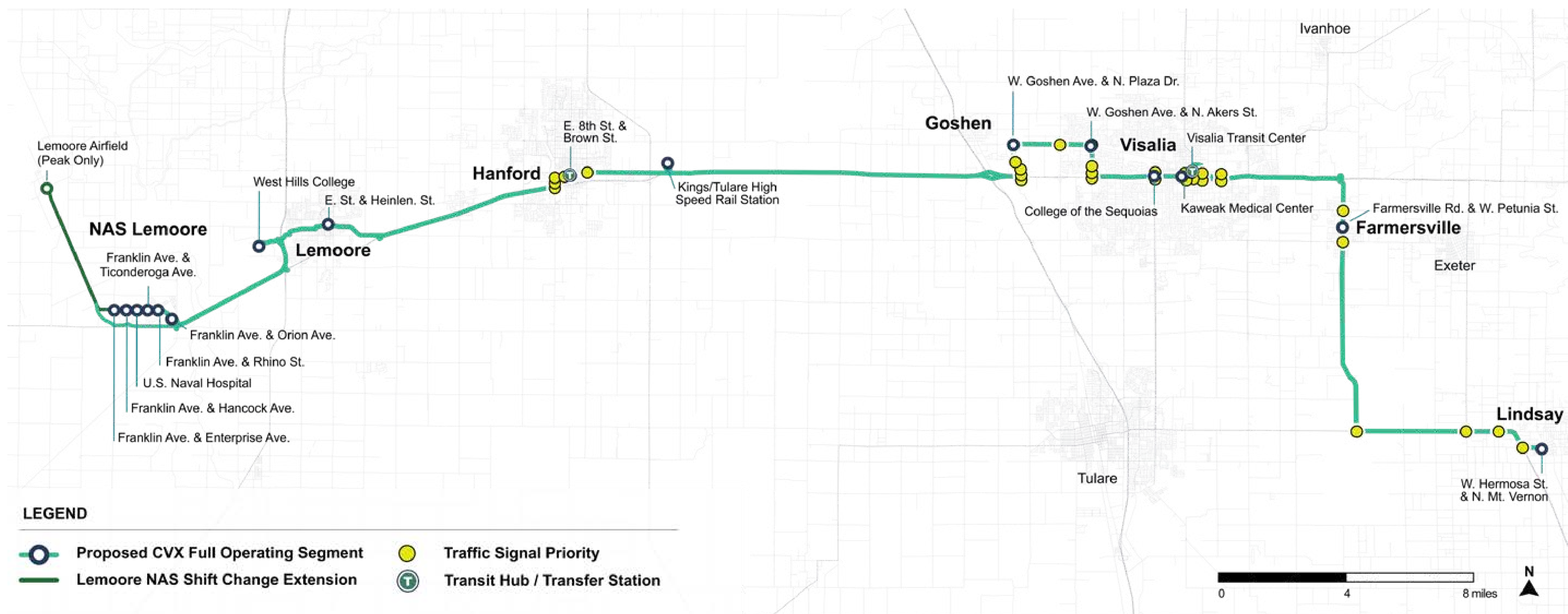
Power Infrastructure

Due to the availability of existing grid capacity at charging sites, additional power infrastructure requirements are relatively minimal. New conduit will need to be laid to interconnect the chargers with the grid system. This will further require new transformers and 1,000A service panels.

TRANSIT INFRASTRUCTURE

Transit infrastructure delivery will align with the service phasing, this section addresses the enhancements for the totality of the corridor. Transit infrastructure includes elements related to terminals, bus stops and transit signal priority. The figure below provides a visual representation of key infrastructure features along the corridor.

Figure 6 - Bus Stops and Terminals Along the CVX Corridor



Terminals

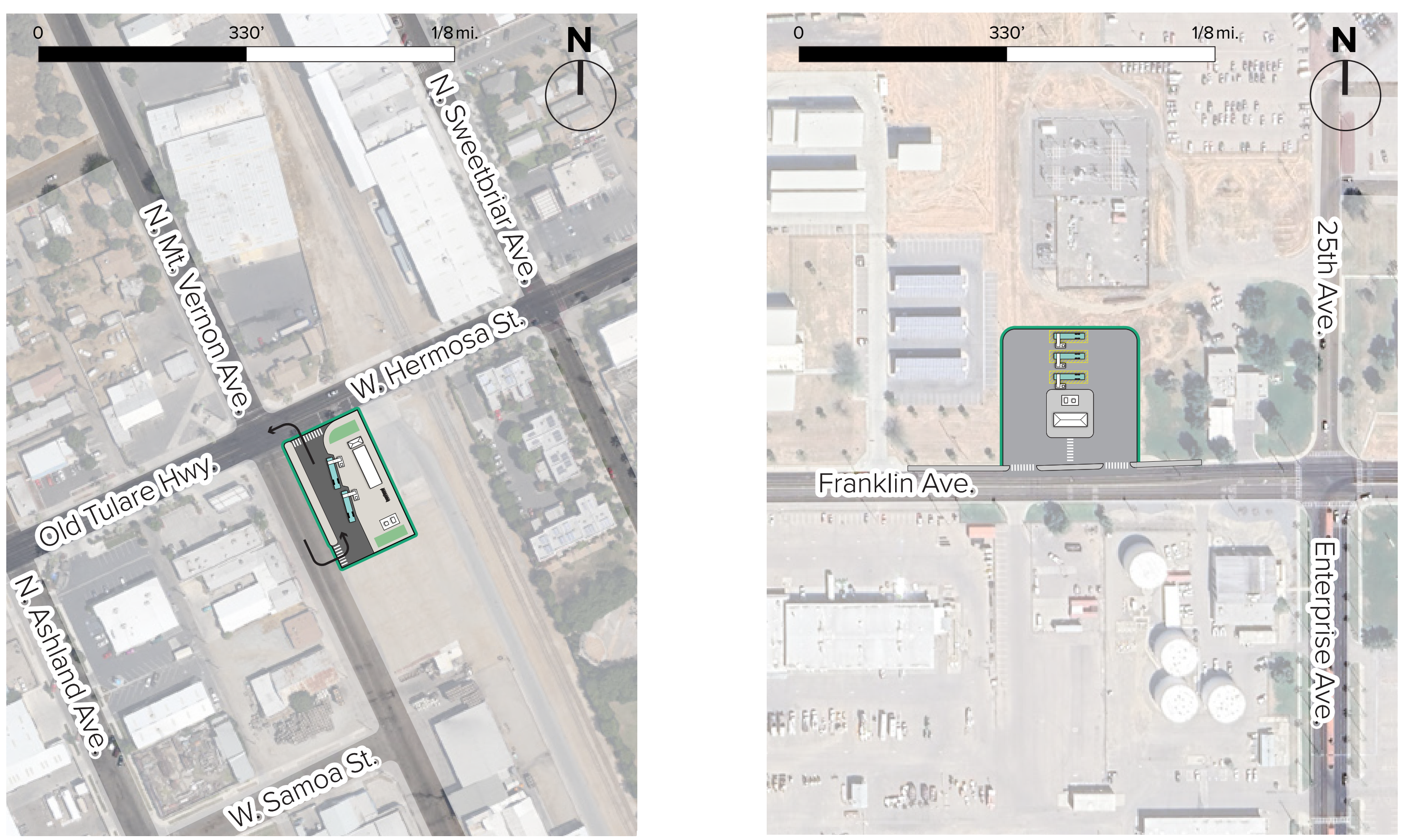
The terminals will be situated at both ends of the corridor, with one located in NAS Lemoore and the other in Lindsay.

The Lindsay terminal will be positioned on W. Hermosa Street, between N. Mt Vernon Avenue and the railroad tracks, while the NAS Lemoore terminal will be situated northwest of the intersection of Franklin Ave. and Enterprise Ave. The NAS Lemoore terminal will serve exclusively as a facility for charging the buses, as passengers will board and alight either at the Franklin and Enterprise stop or at the airfield gate stop.

The Lindsay terminal is located adjacent to the railroad right-of-way, establishing a connection between the initial bus service and the forthcoming rail service. This positioning also offers potential advantages for future implementation of the rail service, as certain infrastructure may be repurposed.

In terms of land acquisition, the terminals are situated on parcels owned by local authorities and the US Navy, both of which are key stakeholders in this project. This arrangement will streamline the development process, reducing the timeline for commissioning the transit infrastructure.

Figure 7 - Location of the Lindsay(left) and NAS Lemoore(right) Terminals



As the terminal in Lindsay will act as an initial/final stop, the facility will include:

Table 11 - Lindsay's Terminal Design Elements

Design Element	Description
Large transit shelter	15 feet high shelter that covers an area of 60 feet long and 18 feet wide. Aimed to cover users from the sun and rain.
Seating	Five modules of outdoor benches, each 24 inches wide and 18 inches above the ground.
Sidewalks	About 9,000 square feet of pedestrian walkways to connect stopping bays with the large shelter, resting area and exits of the terminal.
Passenger information and wayfinding	Information board to present the system map, schedules, and ridership procedures. It will also include expected travel times and real-time arrival times.
Micro-mobility parking	Micro-mobility racks (bicycles, scooters) aimed at enhancing intermodal connectivity.
Resting area for operators	150 square feet of resting space for bus operators between routes. This area will include a restroom.
Roadway surface for bus oprtations and bus lanes	12,000 square feet of heavy-duty concrete pavement.
Charging Infrastructure	Two bus chargers, one 1000 kVA transformer, and one 1000A service panel.

Conversely, the NAS Lemoore terminal will only act as charging and resting facility, which includes the following elements:

Table 12 - NAS Lemoore Terminal Design Elements

Design Element	Description
Resting area for operators	1,000 square feet of resting space for bus operators between routes. This area will also include a canteen and a restroom.
Roadway surface for bus operations and bus bays	About 34,000 square feet of heavy-duty concrete pavement.
Charging infrastructure	Three bus chargers, one 1000 kVA transformer, and one 1000A service panel.

Figure 8 and Figure 9 below present the concepts for the terminals.

Figure 8 - Lindsay Terminal

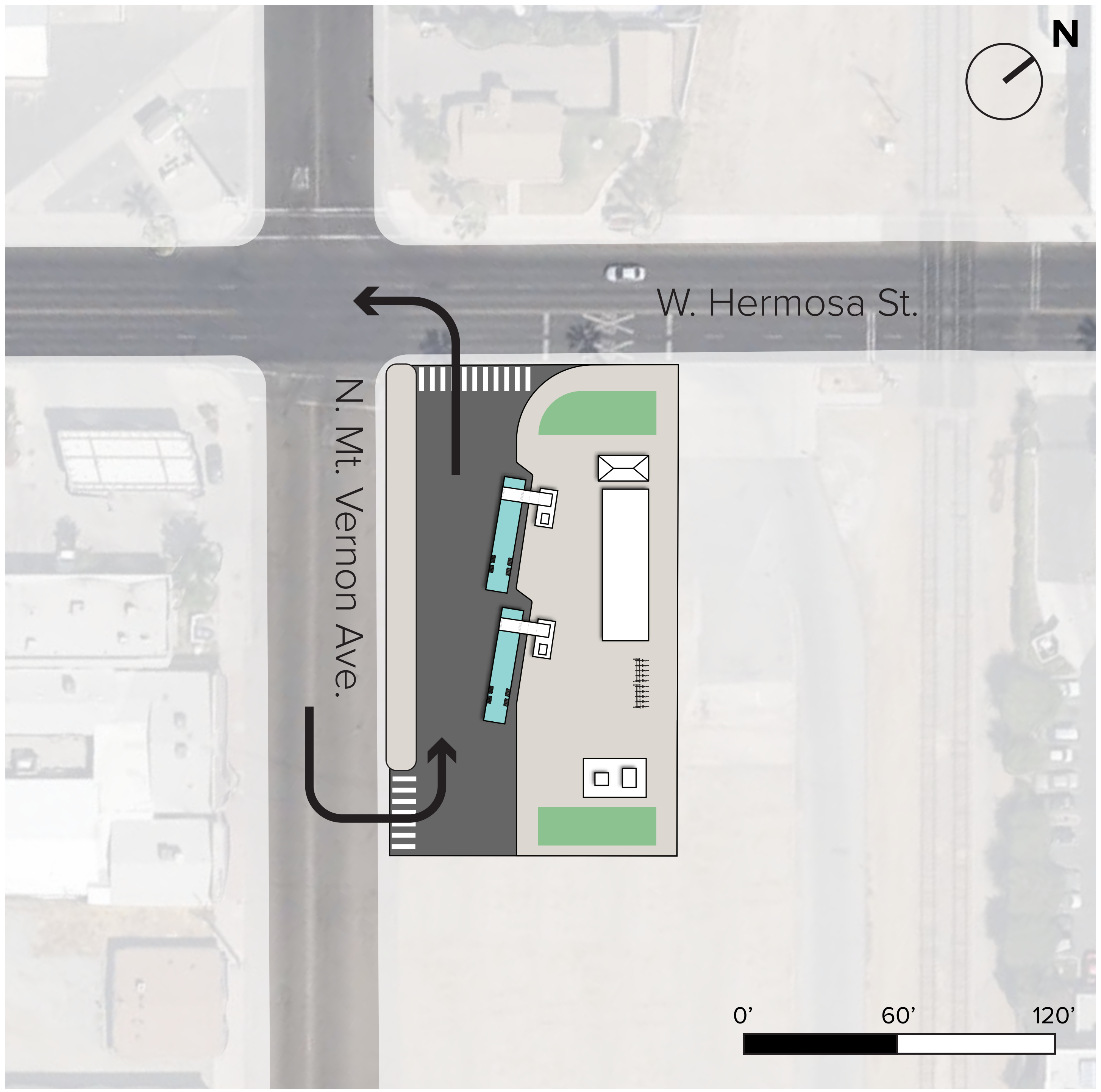
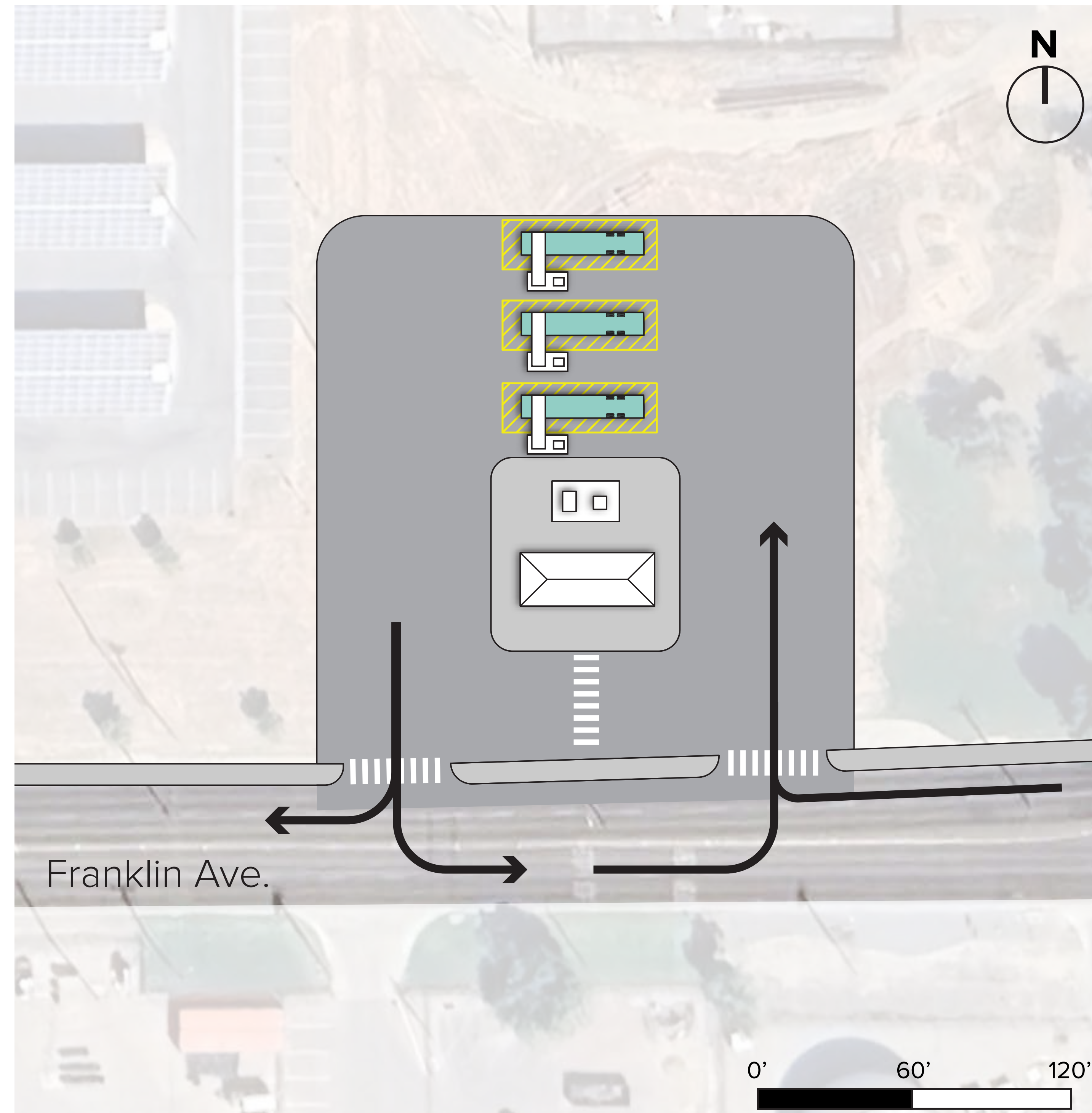


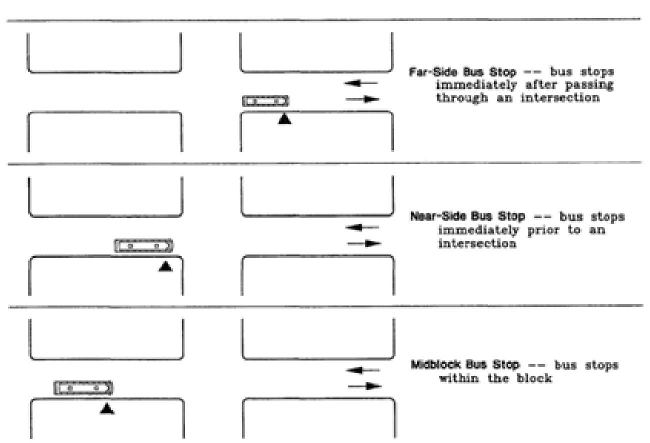
Figure 9 - NAS Lemoore Terminal



Bus Stops

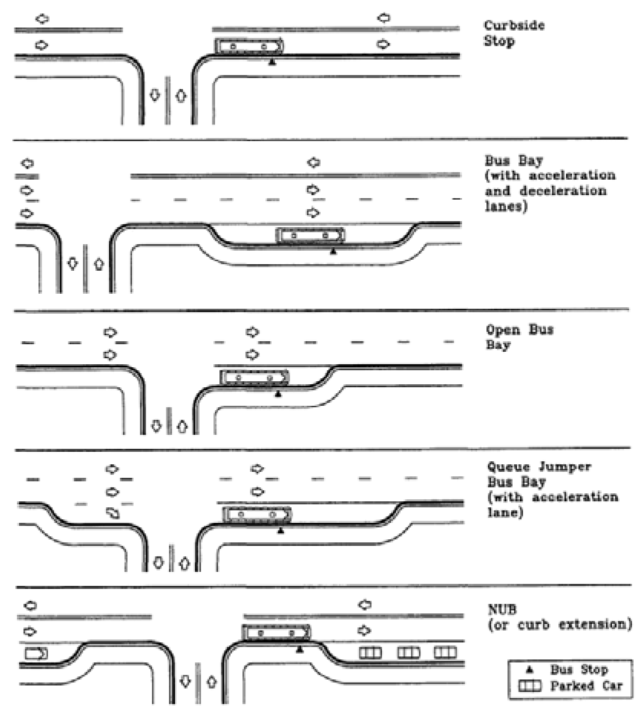
The positioning of the bus stops was determined through an analysis conducted as part of the service plan. This initial location serves as a crucial factor in progressing towards the final placement of the bus stops, determining their precise positioning relative to intersections or specific roads. Three alternatives have been considered, following the Guidelines for Location and Design of Bus Stops from the Transit Cooperative Research Program (TCRP Report 19): far-side, near-side, and midblock, each illustrated below.

Figure 10 - Bus Stop Placement



Once the placement of the bus stop is defined, the next step is to define the street-side design type of the bus stop, which includes curbside, bus bay, open bus bay, queue jumper bus bay and nub, as shown in Figure 11.

Figure 11 - Street-side design types for bus stops



Based on the TCRP guidelines on the placement of the bus stop and the street-site design type, Table 14 summarizes each stop classification. This summary does not include the High-Speed Rail connection as the development of the railroad infrastructure is still in its early stages.

Table 13 - Bus stop classification per placement and design type

Eastbound			
Town	**Bus stop name**	**Placement of bus stop**	**Street-side design types**
NAS Lemoore	Airfield Gate	Terminal/Transit Center	Curbside
	Franklin & Enterprise	Far side	Curbside
	Franklin & Hancock	Near side	Curbside
	Franklin Ave	Midblock	Curbside
	Franklin & Ticonderoga	Far side	Curbside
	Franklin & Rhino	Near side	Curbside
	Franklin & Orion	Near side	Curbside
Lemoore	West Hills	Midblock	Curbside
	Train Station	Far side	Curbside
Hanford	Amtrak	Near side	Curbside
	Transit Center	Terminal/Transit Center	Terminal/Transit Center
Visalia	Goshen & N. Plaza	Far side	Curbside
	N. Akers & Goshen	Far side	Curbside
	College of the Sequoias (W Noble Ave. & S. Mooney Blvd.)	Far side	Curbside
	Medical Center EB (S. Court St. & Willow Plaza)	Midblock	Curbside
	Transit Center	Terminal/Transit Center	Terminal/Transit Center
Farmersville	Transit Center	Near side	Curbside
Lindsay	Transit Center (Arr.)	Terminal/Transit Center	Terminal

Westbound			
Town	**Bus stop name**	**Placement of bus stop**	**Street-side design types**
Lindsay	Transit Center (Arr.)	Terminal/Transit Center	Terminal/Transit Center
Farmersville	Transit Center	Midblock	Curbside
	Transit Center	Terminal/Transit Center	Terminal/Transit Center
Visalia	Medical Center WB (W. Mineral King Ave. after S. Locust St.)	Midblock	Curbside
	College of the Sequoias (W. Mineral King Ave. & S. Mooney Blvd)	Near side	Curbside
	Goshen & N. Akers	Far side	Curbside
	Goshen & N. Plaza	Far side	Island
Hanford	Transit Center	Terminal/Transit Center	Terminal/Transit Center
	Amtrak	Far side	Curbside
Lemoore	Train Station	Midblock	Bus Bay
	West Hills	Midblock	Curbside
NAS Lemoore	Franklin & Orion	Far side	Curbside
	Franklin & Rhino	Far side	Curbside
	Franklin & Ticonderoga	Near side	Curbside
	Franklin Ave	Midblock	Curbside
	Franklin & Hancock	Near side	Curbside
	Franklin & Enterprise	Near side	Curbside
	Airfield Gate	Terminal/Transit Center	Curbside

Bus Stop Design and Amenities

Three main types of amenities were identified for all bus stops: a mobility hub, a standard shelter, and a pole flag. The selection depends on factors such as the location and anticipated number of users waiting at the bus stop.

For stops outside the NAS Lemoore base, mobility hubs are recommended. Eastbound stops within NAS Lemoore are suggested to have standard shelters, while westbound stops are recommended to have pole flags (it is anticipated there will be few boarding passengers on the base westbound). The NAS Lemoore Airfield stop is proposed as a mobility hub.

Figure 12 - Concept rendering of CVX transit infrastructure

Figure 13 - Pole flag for wayfinding

© Archiproducts

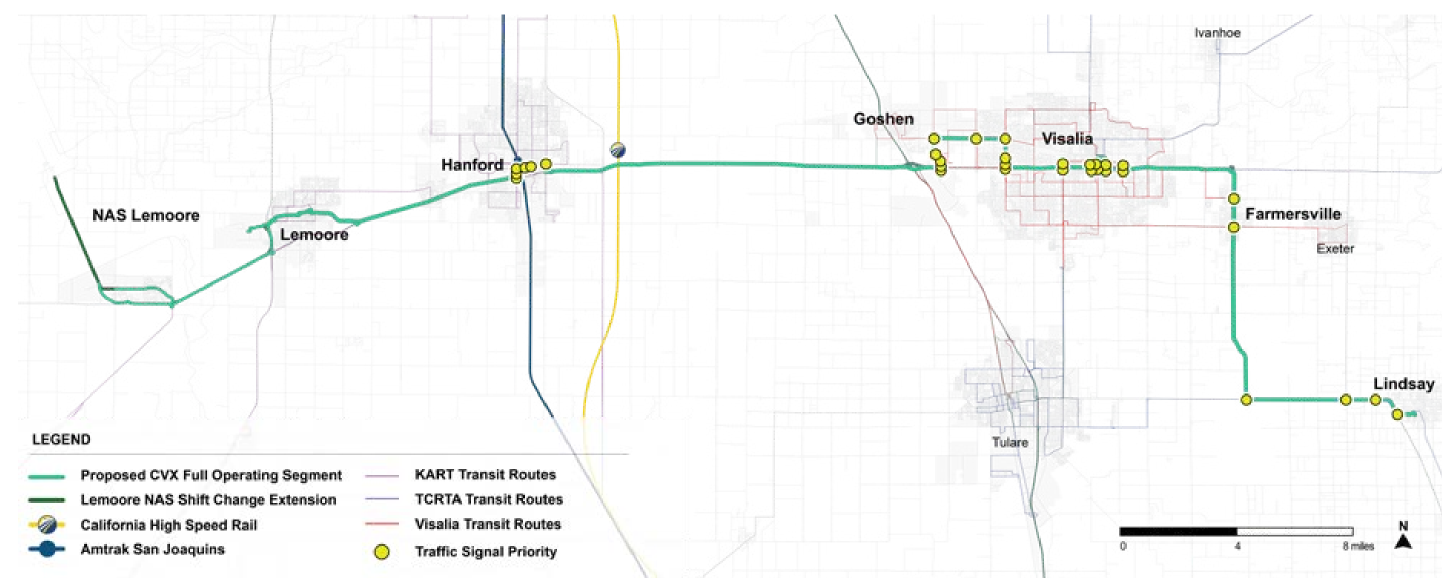
Figure 14 - Standard shelter

Figure 15 - Mobility hub conceptual rendering

Transit Signal Priority

The initially estimated bus travel times include approximately 10 minutes of signal delay in one direction. To improve bus travel times, Transit Signal Priority (TSP) and queue jumps are recommended at 30 intersections along the corridor. Queue jumps allow buses to traverse the intersection from the right lane without conflict on its own signal phase, bypassing other vehicles at its approach, by utilizing a unique signal head dedicated only to bus queue jump operations. Queue jumps require either a dedicated bus lane or a shared bus and right turn lane with adequate storage length. Queue jumps were assumed to be included at locations where the current lane configuration could easily support it; however, other locations could be further studied to determine if they can be modified to accommodate a queue jump.

Figure 16 - Proposed Transit Signal Priority Locations



This initial phase will include full signal upgrades, and new software to support TSP and queue jump technology. During the design process, consideration for active management at one or several of the traffic management centers will be considered. No right of way (ROW) expansion and no park and ride facilities are proposed for this initial phase. Further enhancements for additional intelligent transportation systems (ITS) devices throughout the corridor and fiber communications to "future proof" the corridor have not been included but can be further studied.

COST ESTIMATE OF CAPITAL IMPROVEMENTS

Basis of Pricing

The cost estimate is classified as a Level 5, Rough Order of Magnitude (ROM) estimate according to the Association for the Advancement of Cost Engineering International (AACEI) recommended practices. Table 15 below summarizes the classification.

The accuracy range of this estimate has been determined to be -50% and +100%. The accuracy range is a gauge of likely bid prices if the project was issued to tender, in 2024 dollars and at the scope described, at the time this report is submitted.

Pricing shown reflects probable construction costs on the date of this statement of cost estimate. This estimate is a determination of fair market value for the construction of this project. It is not a prediction of low bid. Pricing assumes competitive bidding for every portion of the construction work for all subcontractors, that is to mean four to five bids. If fewer bids are received, bid results can be expected to be higher.

Cost Algorithm

The total project price was calculated based on the cost algorithm shown in Appendix A.

Direct Cost

To quantify the scope of this project, the team detailed specific works required to complete the project and assigned quantities accordingly for each option. Direct cost unit rates have been developed for the project based on vendor quotes, comparable historical cost benchmarks, internal cost databases, past projects and RSMeans (a construction cost database for US and Canada). The unit rates include material, equipment, and labor costs in 2024 dollars.

Table 14 - AACE International Estimate Classification Matrix

Estimate Level	Estimate Description	Design Phase	Level of Completion	Methodology	Accuracy Range
5	**Rough order of Magnitude**	**Planning Schematic Design**	**0% - 5%**	**Models Capacity Factorred Historical costs**	**L: - 20% to -50% H:+30% to +100%**
4	Concept Feasibility	Planning Schemiatic Design	1% - 15%	Equipment Factored Parametric Models	L: - 15% to -30% H:+20% to +500%
3	Budget Authorization	Planning Schemiatic Design	10% - 40%	Unit Costs Assembles	L: - 10% to -20% H:+10% to +400%
2	Budget Control Estimate	Preliminary Design Engineering Design Documents Constructino Documents	30% - 70%	Detailed Unit Cost Detailed Take-Off	L: - 5% to -15% H:+5% to +30%
1	Bid	Detailed Design Engineering Construction Documents	50% - 100%	Detailed Unit Cost Detailed Take-Off Productivities Subcontractor Quotes	L: - 2% to -5% H:+3% to +15%

Cost Assumptions

This section outlines the assumptions for the scope of works required to execute this project.

Demolition

- Removal of pavement;
- Removal of existing streetlights;
- Removal of existing traffic signal poles.

Pavement

- New asphalt road with roadway striping.

EV infrastructure

- The following type of charging stations have been included in the estimate:
    1. 300kW Pantograph bus chargers – option 1 only
    2. 300kW Induction bus chargers - option 2 only
    3. 300kW Induction bus charger – vehicle equipment – option 2 only
- 150kW Standalone bus chargers included in both options.
- Bus charger costs includes material and installation costs.
- The material cost is based on a typical 350kW Pantograph and Induction bus charger cost.
- 15% of total EV infrastructure costs are added to account for testing and commissioning.

Electrical Equipment and Feeders

- The associated infrastructure for each charging solution is consistent between each solution. The infrastructure included is as follows:
    1. 1,000A service panel;
    2. 1,000KVA transformer;
    3. 50 LF of feeder per charger to connect chargers to electrical equipment;
    4. 200 LF of feeder per transformer to connect electrical equipment to the grid.

Facilities

- The facilities located along the planned bus route are consistent between both options and are assumed as follows:
    1. Mobility hubs including a sheltered waiting area, and sidewalk
    2. Small stops including a waiting area and sidewalk
    3. Flag poles including a flagpole waiting area
- Bus terminals with the following infrastructure:
    1. Operator restrooms, pavement, sidewalk, rest space, bike racks, and pavement paint
    2. Pavement, sidewalk, bike racks, and pavement paint
- Charging station including an operator restroom, rest space, and pavement
- Facilities were costed on a $/SF basis with areas provided by the design team.

Transit Elements

- Transit elements were costed on a per intersection basis with guidance from Arup's ITS experts.
- Transit elements included are as follows:
    1. Roadway striping;
    2. Transit signal priority;
    3. Roadway signs;
    4. Wayfinding.

Vehicles

- (12) 45' Battery Electric Double Decker Buses.
- The costs include an allowance per bus for necessary induction and pantograph charging infrastructure.
- The costs exclude markups and indirects.

Cost Estimate

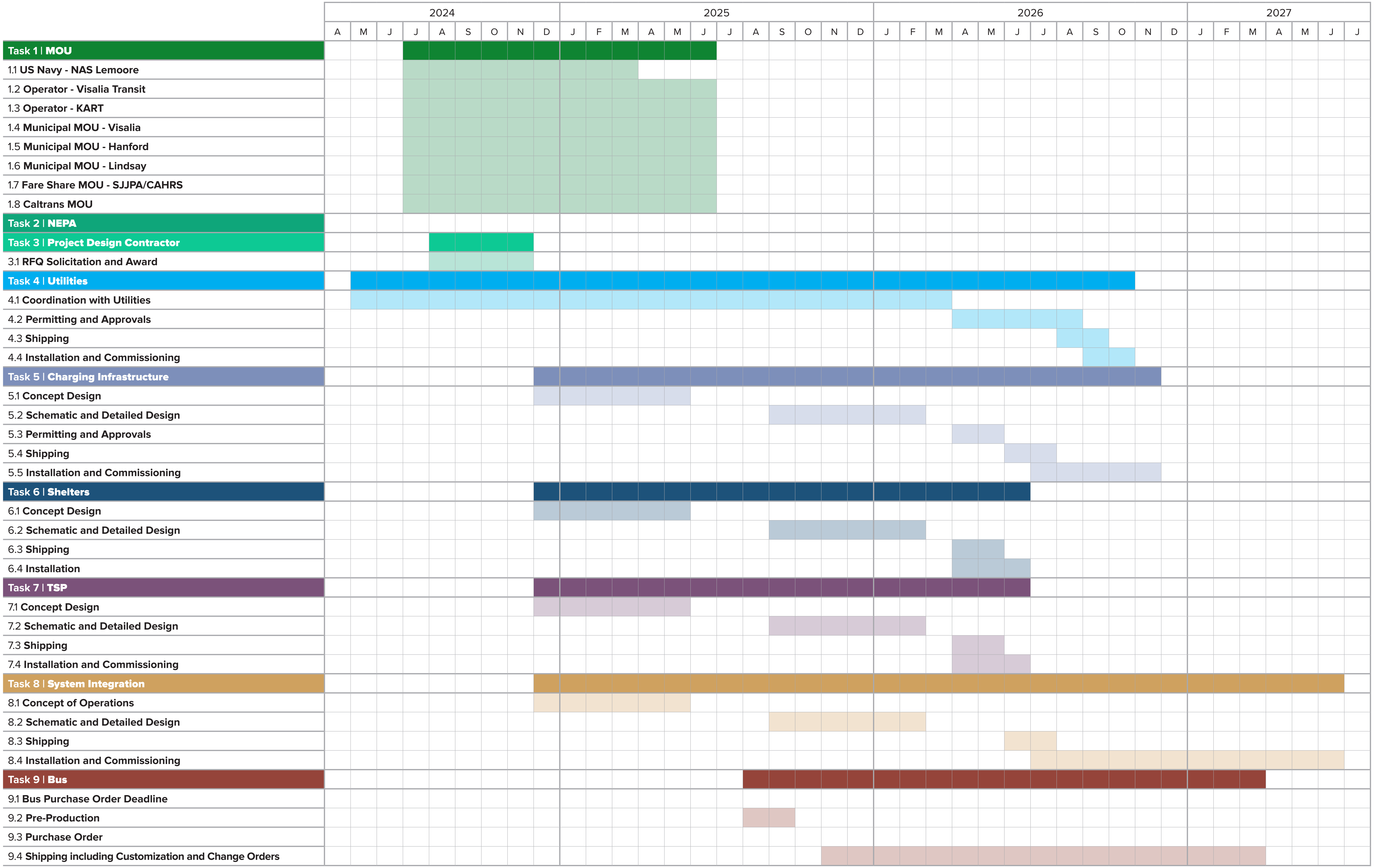
The cost estimate was presented to provide a Rough Order of Magnitude estimate for the implementation of the EV Bus infrastructure required for Central Valley Visalia. Two options were considered for the EV fleet, pantograph bus charging and induction bus charging. The fleet size was determined by the design team.

Table 15 shows the high-level capital cost summary with Arup's proposed number of chargers

Table 15 - Cost Estimate Summary

Number of Chargers	5
Number of Standalone Chargers	12
Demolition	$500,000
Pavement	$ 170,000
Chargers*	$1,950,000
EV Infrastructure	$3,350,000
Facilities	$5,130,000
Transit Elements	$9,710,000
Total Direct Costs	$20,810,000
Total Indirect Costs	$6,240,000
Total Contractor's Costs	$7,790,000
Total Construction Price	$34,840,000
Soft Costs	$3,480,000
Total Project Price w/o Electric Buses (Low:-50%)	$19,150,000
Total Project Price w/o Electric Buses	$38,300,000
Total Project Price w/Electric Buses (High: +100%)	$76,600,000
Electric Buses (12)	$21,600,000
Total Project Price w/Electric Buses (Low)	$40,750,000
Total Project Price w/ Electric Buses	$59,900,000
Total Project Price w/ Electric Buses (High)	$98,200,000

*The cost of chargers can vary by up to $70,000 depending on the selected technology, whether it's induction or reverse pantograph. Currently, we're taking a conservative approach by assuming the cost of the induction chargers, which is at the higher end of the spectrum.


2024
2025
2026
2027
A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J
Task 1 | MOU
1.1 US Navy - NAS Lemoore
1.2 Operator - Visalia Transit
1.3 Operator - KART
1.4 Municipal MOU - Visalia
1.5 Municipal MOU - Hanford
1.6 Municipal MOU - Lindsay
1.7 Fare Share MOU - SJJPA/CAHRS
1.8 Caltrans MOU
Task 2 | NEPA
Task 3 | Project Design Contractor
3.1 RFQ Solicitation and Award
Task 4 | Utilities
4.1 Coordination with Utilities
4.2 Permitting and Approvals
4.3 Shipping
4.4 Installation and Commissioning
Task 5 | Charging Infrastructure
5.1 Concept Design
5.2 Schematic and Detailed Design
5.3 Permitting and Approvals
5.4 Shipping
5.5 Installation and Commissioning
Task 6 | Shelters
6.1 Concept Design
6.2 Schematic and Detailed Design
6.3 Shipping
6.4 Installation
Task 7 | TSP
7.1 Concept Design
7.2 Schematic and Detailed Design
7.3 Shipping
7.4 Installation and Commissioning
Task 8 | System Integration
8.1 Concept of Operations
8.2 Schematic and Detailed Design
8.3 Shipping
8.4 Installation and Commissioning
Task 9 | Bus
9.1 Bus Purchase Order Deadline
9.2 Pre-Production
9.3 Purchase Order
9.4 Shipping including Customization and Change Orders

Appendix A

COSTING METHODOLOGY

COST ALGORITHM ASSUMPTIONS

Table 16 - Cost Algorithm Inputs

Description	Description	Formula	% of Total Direct Cost
Total Direct Cost (TDC)	Costs directly related to the installation of two types of EV bus chargers, associated infrastructure, new facilities, transit elements, and roadwork. Includes labor, equipment, and material costs.	TDC	100%
Indirect Costs (IC)	Includes general requirements (GR), such as: site preparation, mobilization/demobilization, temporary works, etc.	IC = Utility + GR	30%
Total Construction Cost (TCC)	Total construction costs, include direct and indirect costs.	TCC = TDC + IC	130%
Contractor's Cost (CC)	Contractor's administrative expenses, such us overhead and profit, as well as contractor contingency.	CC = OH&P + C	27%
Total Construction Price (TCP)	Total construction cost plus contractor administrative expenses. Includes overhead and profit.	TCP = TCC + CC	157%
Soft Costs (SC)	Preliminary engineering, final engineering, and PMCM.	SC	10%
Total Project Price (TPP)	Total construction price, plus soft costs.	TPP + TCP + SC	167%

Items excluded from Cost Estimate

- Utility application fee and work: including any additional civil works, equipment and distribution works required by the utility company to provide the required energy to the new EV charging infrastructure;
- Design and Geotechnical investigations;
- Other owner's costs, which include professional liability and other non-construction insurance;
- Risk-based contingency analysis;
- The costs or impacts of latent environmental issues that result in litigations or development delays;
- Local taxes and duties;
- Bonds and insurance;
- Right of way and or land acquisition costs;
- Removal and disposal of hazardous materials, unless stated in the estimate;
- Life Cycle Cost Analysis;
- Escalation beyond 2024.

Items that may affect Cost Estimates

The following items may affect cost estimates:

- Modifications to the scope of work included in the estimate;
- Special phasing requirements;
- Restrictive technical specifications or excessive contract conditions;
- Any other non-competitive projects schedule;
- Loss of productivity;
- Future market conditions, specially in the EV market;
- Availability of skilled labor;
- Restrictive work hours.

Appendix B

DETAILED COST ESTIMATE WORKBOOK

Name	Title
CVR	Cover
TOC	Table of Contents
MAT	Estimate Classification Matrix
BASIS OF ESTIMATE	Basis of Estimate
ESTIMATE	Cost Estimate
RATE	Unit Costs
QTY	Quantities
ESC	Escalation

Estimate Level	Estimate Description	Design Phase	Level of Completion	Methodology	Accuracy Range
5	**Rough order of Magnitude**	**Planning Schematic Design**	**0% - 5%**	**Models Capacity Factorred Historical costs**	**L: - 20% to -50% H:+30% to +100%**
4	Concept Feasibility	Planning Schematic Design	1% - 15%	Equipment Factored Parametric Models	L: - 15% to -30% H:+20% to +500%
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1	Bid	Detailed Design Engineering Construction Documents	50% - 100%	Detailed Unit Cost Detailed Take-Off Productivities Subcontractor Quotes	L: - 2% to -5% H:+3% to +15%

Assumptions

Demolition

- Quantities for pavement demolition were assumed to be 40% of the total development area.
- Quantities assumed to be under existing grass or planted area is estimated to be 60% of the total development area and would be cleared and grubbed.
- Existing street lights quantity is assumed to be only on paved surfaces and will be estimated per SF.
- Traffic signal pole is estimated from existing conditions and is provided as a lump sum

Earthworks

- Compaction and fine grading is assumed for total development area, including paved and landscaped areas.
- Total fill is assumed based on proposed design and requirement that areas under the building have to be at level +12ft. All fill would be imported, as excavation on site is minimal and will not have significant impact on cost saving. Existing surface is assumed to be at level +5.
- Retaining walls are estimated based on very high level understanding of the site development; quantities will be refined as design progresses. Height assumed as 8LF and Width assumed as 8in.
- Excavation is assumed at the areas which are required to be at level +2; it is assumed existing surface is at level +5

Pavement

- Vehicular pavement - is assumed to be asphalt per city standard - 4” concrete pavement with 3” aggregate base.
- Green loop - it is assumed to be colored asphalt. Quantities are based on CP_Design Guidelines Updates and CP_ Parameters for Cost Estimate given by West8.
- Pervious pavement - it is assumed to be multiple similar surface on the main and secondary pathways and other paved areas. Different areas will be separated for costing purpose as design is developed

Structures

- Pedestrian and bike linear bridge - this is assumed to bi simple span bridge either precast concrete or steel structure, with light weight concrete pavement; width assumed at 16 ft
- Pedestrian and bike circular bridge - elevated landmark bridge assumed round prefabricated metal shape assembled on site, based on concrete legs; width assumed at 16 ft.

District Utilities

- District utilities, assumed to be distributed under the green loop and connecting to the new buildings will not be shown in this estimate, as it is assumed to be part of separate project budget - including new utilities distribution, relocation and/or removal of existing utilities and trenching.

Utility work

- Irrigation - assumed as an allowance per SF of the all soft scape areas; it includes distribution, connection to the water supply, controllers, sprinkler heads, etc.
- Storm water drainage - assumed as an allowance per SF of the paved areas, including drains and connections to the existing or new main sewer.

Lighting

- Lighting Poles - Green loop - assumed light poles with lighting fixtures along path @30 FT on both sides. Each ficture is assumed 2 $6,000 plus installation cost.
- Electrical conduit and cable - assumed for the Green Loop lighting along the path, per LF. Include additional 10% for waste and additional length required for connections
- Lighting for other areas - each specific area is assumed to have additional lighting fixtures. Asumptions are given in the separate tab - Lighting

Roadway Striping and Signing

Roadway Striping - assumed per LF of the path/roadway/paved area

Roadway signels - assumed per each intersection within the development area

Roadway Signs - assumed as an allowance

Lanscaping

Lanscaping is devided in three main areas -grass, shrub and trees based on the propsed design and assuming % of each area

Grass and shrub is estimated per SF of the total area; trees are quantified per proposed design

Water amenities

Water amenities are divided into 3 separate groups - water features, detention ponds and creek;

Cost is estimated per SF for features and detention pond; creek is estimated per LF

Vertical Structures

Vertical structures cost assumptions are given in the separate tab - CP Budget Zones; including cost for each specific structure and cost per area.

Digital Overaly

A $10/sf allowance is included for Digital Overlay / Technology scope yet to be determined

Phasing

Additional cost allowance is given per SF for future phasing of the construction. It as assumed to be $120,000 per acre ($2.8/SF)

Exclusions

The following exclusions were made during preparation of this estimate:

Costs associated with rights of way easements.

Water distribution is excluded from the estimate

All General exclusions listed bellow.

Escalation beyond Q2 2019

Demolition of existing builings

Abatement of existing buildings

Disposal of Contaminated Spoils

Treatment of dewatering / contaminated plume

Microgrid - Private power distribution

Solar and PV panels

Levees/ flood break walls

Out of sequence and re-work due to phasing

Temporary Activation

Digital and Data measures

Pneumatic waste vacuum system

Battery enclosures

Vertical costs

Building façade architecture, canopies, green walls

New and relocation of existing utilities

Building and CUP utilities and distribution

Utildor or concrete culverts to contain future utilities

Contiguous levee works

See Level rise mitigation beyond raised elevations as shown to building entry zones (why is Caribbean 100 & 200 not shown with EL +12 an entries?)

Work within East and West Channel

Flood walls (EL +18) (assumed to part of west and east channel scope or vertical building scope)

Water parks

Food truck utility connections

Transportation Infrastructure Projects B, C, D, E, F, G

Light rail upgrades, station additions or line crossings

Buttress walls / flood mitigation

Soil ground Improvements

Groundwater plume impacts

Connection to PG&E 115kV Transmission Lines

Relcoation or removal of 115kV Transmission lines (along East Channel)

12vV Private Microgrid / Private Power distribution

Security Measures, apart from pop up bollards at the street entries only

Data & Digital Smart City Measures

Car, Bike and other equipment charging stations

Off Site Work and Utilities

Solar pavillions, energy producing bridge, wind forests

Gondola's

Bus Stops

ROW

Hazardous Material Management

West Channel Scope different of bridges

General Exclusions

Bonds

Insurance

Inflation Costs

Professional fees (Design and Project Management/Site Supervision)

Legal fees

Agent fees

Any other third party costs

Client internal costs

Contamination charges unless stated

Operational and maintenance costs

Escalation

Owner Contingency

Statement of Probable Cost

ARUP has no control over the cost of labor and materials, general contractor's or any subcontractor's method of determining prices, or competitive bidding and market conditions. This opinion of probable cost of construction is made on the basis of the experience, qualifications, and best judgment of the professional consultant familiar with the construction industry. ARUP cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from this or subsequent cost estimates.

Number of Chargers	5
Number of Standalone Chargers	12
Demolition	$500,000
Pavement	$ 170,000
Chargers*	$1,950,000
EV Infrastructure	$3,350,000
Facilities	$5,130,000
Transit Elements	$9,710,000
Total Direct Costs	$20,810,000
Total Indirect Costs	$6,240,000
Total Contractor's Costs	$7,790,000
Total Construction Price	$34,840,000
Soft Costs	$3,480,000
Total Project Price w/o Electric Buses (Low: -50%)	$19,150,000
Total Project Price w/o Electric Buses	$38,300,000
Total Project Price w/Electric Buses (High: +100%)	$76,600,000
Electric Buses (12)	$21,600,000
Total Project Price w/Electric Buses (Low)	$40,750,000
Total Project Price w/ Electric Buses	$59,900,000
Total Project Price w/ Electric Buses (High)	$98,200,000

*The cost of chargers can vary by up to $70,000 depending on the selected technology, whether it's induction or reverse pantograph. Currently, we're taking a conservative approach by assuming the cost of the induction chargers, which is at the higher end of the spectrum.

CAPITAL COST ESTIMATE	UNIT COST	UNIT	QTY	SUBTOTAL COST
Demolition				$500,000
Remove Pavement	$5	SF	33600	$168,000
Remove Existing Street Lights	$11,000	EA	30	$330,000
Pavement				$170,000
Asphalt Road	$20	SF	8640	$172,800
EV Infrastructure				$5,300,000
300kW Pantograph Bus Charger	$376,000	EA	0	$-
300kW Induction Bus Charger - Pad	$390,000	EA	5	$1,950,000
150kW Stand Alone Bus Charger	$180,000	EA	12	$2,160,000
1000A Service Panel	$77,000	EA	2	$154,000
1,000KVA Transformer	$81,700	EA	2	$163,400
Feeder to charger, includes cable,conduit and underground concrete ductbank	$160	LF	250	$40,000
Feeder connections between electrical equipment includes cable,conduit and underground concrete ductbank	$350	LF	400	$140,000
Testing and Commissioning for Equipment - Pantograph	$681,000	LS	0	$-
Testing and Commissioning for Equipment - Induction	$691,000	LS	1	$691,000
Facilities				$5,130,000
Mobility Hub (Waiting Area, Sidewalk)	$118,000	EA	15	$1,770,000
Small Stop (Waiting Area, Sidewalk)	$61,600	EA	6	$369,600
Flag Pole (Flag pole waiting area)	$2,470	EA	6	$14,820
Bus Terminal #1 (Bathroom, Pavement, Sidewalk, Mobility Hub, Rest Space, Bike Racks, Pavement Paint)	$636,360	EA	1	$636,360
Bus Terminal #2 (Pavement, Sidewalk, Mobility Hub, Bike Racks, Pavement Paint)	$247,940	EA	1	$247,940
Charging Station (Pavement, Rest Space, Bathroom)	$1,081,740	EA	1	$1,081,740
Concrete pad for buses	$30	SF	33600	$1,008,000
Transit elements				$9,710,000
Roadway Striping	$3	LF	720	$2,160
Transit Signal Priority	$321,800	EA	30	$9,654,000
Roadway Signs	$1,800	EA	28	$50,400
Wayfinding	$110	EA	31	$3,410
Total Direct Costs				$20,810,000
Total Indirect Costs				$6,243,000
General Requirements (Supervision, Project Office, Utilities, etc.)			30.0%	$6,243,000
Total Contractor's Costs				$7,791,000
Overhead and Profit			12.0%	$3,246,000
Contractor's Contingency			15.0%	$4,545,000
Total Construction Price				$34,844,000
Escalation			Exc	$-
Total Construction Prce w/ Escalation				$34,844,000
Soft Costs				$3,484,000
Preliminary Engineering			2%	$697,000
Final Engineering			3%	$1,045,000
PMCM			5%	$1,742,000
Total Project Price w/o vehicles (Low)			-50%	$19,150,000
Total Project Price w/o vehicles				$38,300,000
Total Project Price w/o vehicles (High)			100%	$76,600,000
Vehicles				$21,600,000
45' Battery Electric Double Decker Bus	$1,800,000	EA	12	$21,600,000
Total Project Price w/ vehicles (Low)				$40,750,000
Total Project Price w/ vehicles				$59,900,000
Total Project price w/ vehicles (High)				$98,200,000

Appendix C

HYDROGEN FUEL CELL BUS TECHNICAL MEMORANDUM

TECHICAL NOTE – HYDROGEN FUEL CELL BUSES CONSIDERATIONS

Summary

Two choices exist for decarbonization of the transport sector – battery electric (i.e., battery-electric buses – BEB) or hydrogen fuel cell (i.e., fuel cell electric bus – FCEB/FCEV) technology. Both store energy (in the form of chemical potential in a battery and as hydrogen in a fuel cell) that is eventually used to power electric traction motors, which move the vehicle.

Proponents of hydrogen fuel cell technology cite superior range and duty cycles in comparison to battery-electric technology. This is somewhat true, but a broader perspective suggests that hydrogen is best deployed as a niche player in the transport energy transition, due to high fuel cost, limited availability of zero-carbon fuel and increasing capacity of batteries.

This Note recommends the use of battery electric buses for the CVX bus service.

Background

The scope of work of the Cross Valley Corridor (CVC) Phase 1 Operations Plan includes the review of potential benefits and challenges of hydrogen fuel cell technology as part of Task 5: Phased Service and Operations Plan, Capital Plan, and Financial Plan. In the Kings-Tulare region, most transit agencies (Visalia Transit, Tulare County Regional Transit Authority – TCRTA; and Kings Area Rural Transit – KART), are adopting/considering battery electric technology (BEB) to attain their zero-emission transition. However, due to the nature of the CVC route, including its length and speed and overall duty cycle, considering hydrogen fuel cell technology as a propulsion option is warranted.

Fuel cells are a well-established technology, developed almost 185 years ago. Since that time, they have been used in niche energy applications, including providing electrical power for the Apollo Moon missions. Fuel cells generate electricity through a chemical reaction – in this case between oxygen (taken from the air) and hydrogen – that produces water and creates an electric charge during the reaction. Considering that a fuel cell mainly produces residual emissions of water and heat, it is considered as a zero-emission technology. In the strict sense of the expression, hydrogen fuel cell buses can be considered as electric buses. These vehicles have all the same electrical components as a battery-electric bus (batteries, electric traction motors, power control systems, etc.) but substitute a very large battery with a hydrogen storage tank and a fuel cell.

In terms of operations, FCEVs have a range between 250-300 miles and a re-fueling time of 10-15 minutes (most BEBs have a range of about 200 miles and take up to five hours to recharge). Agencies and operators may find this appealing since it resembles existing fossil-fuel-propulsion fueling practices.

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Hydrogen Production

Hydrogen is classified depending on the way that is produced. There are three main classifications:

- Grey: Produced from fossil fuel
- Blue: Produced from fossil fuel but emissions are captured and then stored underground
- Green: Produced from renewable sources

While FCEVs are currently considered zero-emission at the tailpipe, in “well-to-wheel” terms (encompassing the entire production cycle from the production of energy to its transportation to the vehicle and then its use in the vehicle) FCEVs have significant downsides.

Currently, most hydrogen production uses fossil fuels as its “feedstock.” In 2022, more than 90% of hydrogen production was based on fossil fuel sources , mainly natural gas (i.e., Grey Hydrogen”). This type of production releases carbon dioxide (CO_2), which is one of the major GHGs generated by internal combustion engines (ICEs). The production of grey hydrogen also emits unburnt methane, which creates a greater warming effect, but a shorter chemical duration, compared to CO_2. Although there are sustainable zero-carbon alternatives for the hydrogen production, these processes have productions costs that are considerably greater than fossil-fuel hydrogen feedstock.

Grey Hydrogen is typically produced in the “steam reformation” process where methane (CH_4) is combined with steam (H_2O) to produce H_2 and CO_2.

Blue Hydrogen is exactly the same as Grey Hydrogen except that the CO_2 produced is then sequestered. Blue Hydrogen is about twice as costly as Grey Hydrogen, while Green Hydrogen (zero-emission hydrogen using renewable electricity and water, where an electrical charge is used to break the H_2O chemical bond, resulting in H_2 and oxygen) is about 2.5 times as expensive as Grey Hydrogen. Using Blue Hydrogen as a benchmark, its cost is about 50% more expensive than an equivalent purchase of diesel. It should be noted that all fuel prices are volatile and dependent on international markets that frequently experience large swings in pricing.

Operating Considerations

The total cost of ownership (TCO) of hydrogen fuel cell buses is higher than battery electric buses, which means that in the long run operators would pay more for the transition to a zero-emission technology if they chose the hydrogen alternative. The factors related to these additional costs include:

Transportation and Storage – Hydrogen needs to be liquified to be transported and stored. This process requires hydrogen to be cooled below -423 F , which requires a considerable amount of energy. Furthermore, there are additional emissions associated with hydrogen transportation and re-valorization process.

Efficiency – Despite the operational convenience of FCEVs, this technology is less efficient than direct electric drives. Studies indicate that FCEVs are around 40% energy efficient because of the complex fuel cell energy generation process. This means that for every 100 watts of energy generated, approximately 40% watts go to the drivetrain . On the other hand, electric vehicles can achieve efficiencies of more than 80%. This has a major impact on the use of resources and the emissions associated with FCEVs. This infographic from Volkswagen illustrates the “well-to-wheel” costs comparison between hydrogen and direct electric vehicles:

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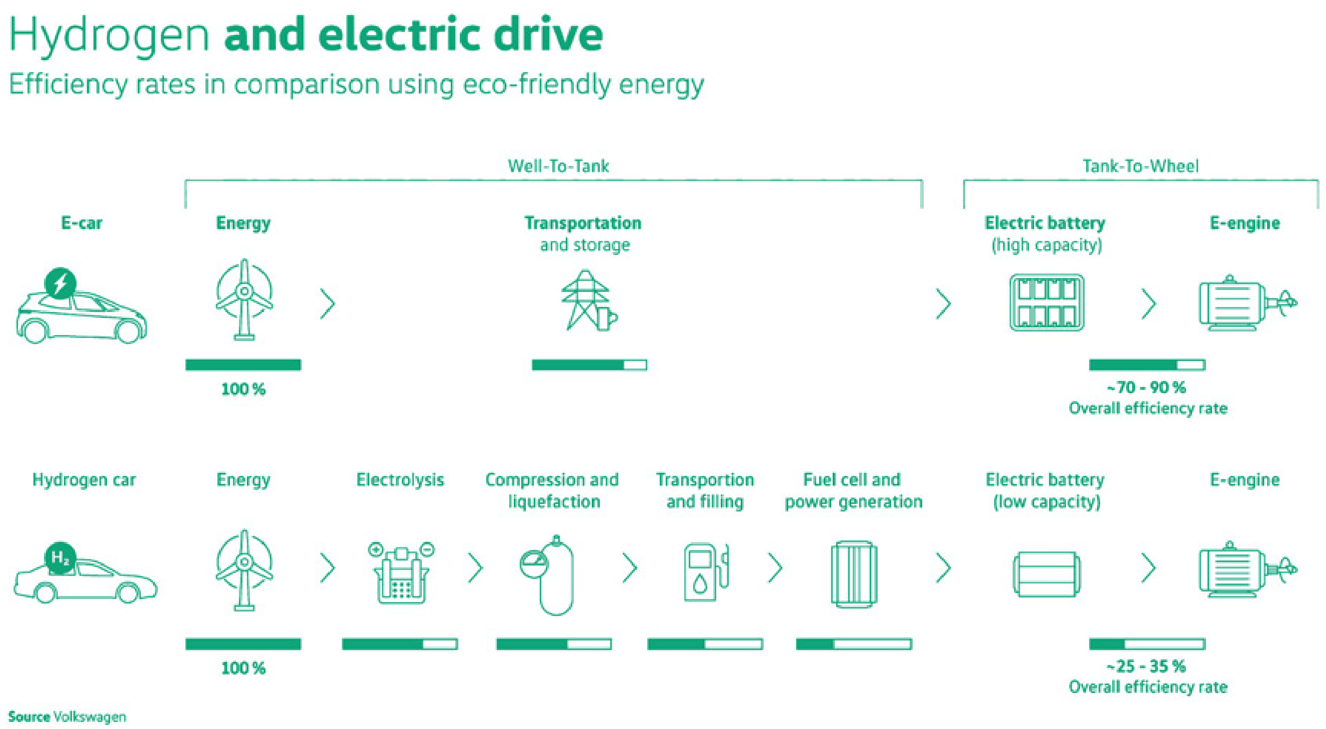
Figure 17 - Well to Wheel Efficiency Comparison



Total Cost of Ownership – Studies and case studies have shown that the TCO of FCEVs is higher than BEBs and this will be the case at least for the next decade. The TCO analysis considers all the costs of the assets throughout its lifespan. This includes purchasing, deployment, operations and maintenance and disposition, both for the buses and the charging/fueling infrastructure. The main drivers of the higher costs on the FCEVs side are related both with CAPEX and OPEX considerations.

In terms of CAPEX, the purchase costs of a BEBs range between $ 750,000 to $ 900,000 while an FCEV equivalent is around 20-25% greater. In terms of recharging/fueling infrastructure, is harder to establish similar comparison considering the costs for recharging infrastructure varieties depending on the location. Key elements such as required installed electrical power on site and the capacity of the distribution network in the surrounding area are specific for each development. Full battery-electric operation can create significant loads on the local utility – on the order of 20MW of power at some typical bus facilities of 250+ buses. The costs for this scale of can be significant, and often larger than the hydrogen fueling components.

Two main variable costs that have a major impact on the operating component of TCO: fuel/recharging and maintenance. Both technologies have similar maintenance costs, ranging from $0.4-0.6 per mile , however, BEBs maintenance costs tend to be on the higher end of this range. These maintenance costs are significantly lower compared to ICEs, resulting in considerable costs saving when transitioning to zero-emission technologies. Fuel/Energy costs are perhaps the major difference between the two technologies in terms of OPEX. On one side, hydrogen cost ranges from $0.9 to 1.1 per mile while BEB electricity costs tend to be less than $0.46 per mile . This means hydrogen fuel costs are more than double BEB power costs, and this assumes the lowest cost and highest environmental impact hydrogen. Hydrogen costs could be even greater using blue or green hydrogen.

Operating Considerations – Hydrogen bus operation is much more similar to diesel operation than battery-electric buses. The fueling process is very similar (almost the same as CNG buses) creating little difference in the "life-of-a-bus" both within the bus maintenance facility and on the road, where range and duty cycles are about the same.

Conversely, battery electric buses require at least four and likely five hours of charging within a bus facility, creating the need for more detailed and regimented cleaning and preventative maintenance schedules. In addition, BEB duty cycles tend to have lower ranges than FCEVs, although as battery technology improves, range is becoming less of an issue. Cold weather can also impact BEB services, as interior space heating can increase energy consumption by up to 40%.

SUMMARY & RECOMMENDATIONS

The main tradeoffs between BEB and FCEV can be summarized as follows:

Table 17 - Tradeoffs Comparison Between BEB and FCEV Technology

Tradeoff	Summary	Technology w/ Best-Fit
Equivalent Operations (Range, Duty Cycle, Operations)	FCEV distance ranges about 50% greater than BEB; FCEV most similar to ICE operations	FCEV
Cost	BEB low purchase cost than FCEV; fuel/energy at least 50% less than H2	BEB
Technical Efficiency	BEB have about 80% efficiency, twice that of FCEV	BEB
Environmental	California electricity is 60% carbon free and will be 100% carbon free by 2045 (by law); H2 is (currently) primarily dervied from fossil fuels	BEB

FCEVs have an advantage where limited range cannot be mitigated, or duty cycles are so extreme that a BEV could not achieve the same performance as a FCEV. While that may be true for very heavy equipment (dump trucks, cement trucks, construction equipment, etc.), it is not the case for the CVC.

Analysis indicates that it is possible to include opportunity chargers at the terminals for the CVC service, and these locations have adequate electrical capacity to service the energy needs of the CVC bus service. The current concept is to provide buses with 640kWh of battery capacity and then recharge after each 120-minute Lindsay to NAS Lemoore trip, allowing most vehicle assignments to return to their respective bus facility with one-third to one-half charge. While this protocol requires an additional vehicle assignment and longer driver dwells at terminals, the long duty cycles of the CVC service exceed even the parameters of FCEV, suggesting vehicle assignments will be similar for both propulsion options. BEBs will have longer driver layover times, but the cost of this is less than 2% of the total assumed operating costs and are very likely to be exceeded by the increased cost of hydrogen.

The documented increases in energy consumption related to cold weather do not apply to Kings and Tulare Counties, where winter temperatures rarely approach freezing.

The recommendation is to use battery-electric buses with enroute charging for the Cross Valley Corridor bus service.

Appendix D

TRANSIT SIGNAL PRIORITY RECOMMENDATIONS TECHNICAL MEMORANDUM

TECHNICAL NOTE – TRANSIT SIGNAL PRIORITY RECOMMENDATIONS

Central Valley Corridor - TSP Corridor Cost and Schedule Estimate

State Highway 198 in The Central Valley of California, from Exeter on the east to Hanford on the west, is undergoing a study for a new rail line. Hanford is home to naval operations and an existing Amtrak station which runs north/south between Bakersfield and the Bay Area. California High Speed Rail will construct a new station in 2030 east of this current Hartford Amtrak station. The existing bus service along this route operates with 3 stops a day in each direction.

An enhanced bus service is proposed as an initial phase to improve transit operations along the corridor. Current bus travel times include approximately 10 minutes of signal delay in one direction. To improve bus travel times, Transit Signal Priority (TSP) and queue jumps are recommended. Queue jumps allow buses to traverse the intersection from the right lane without conflict on its own signal phase, bypassing other vehicles at its approach, by utilizing a unique signal head dedicated only to bus queue jump operations. Queue jumps require either a dedicated bus lane or a shared bus and right turn lane with adequate storage length. Queue jumps were assumed to be included at locations where the current lane configuration could easily support it; however, other locations could be further studied to determine if they can be modified to accommodate a queue jump. This initial phase will include new bus stops, full signal upgrades, and new software to support TSP and queue jump technology. No ROW expansion and no park and ride facilities are proposed for this initial phase.

A high-level programmatic schedule and cost to deliver a TSP corridor has been developed. Schedule and cost for System Acceptance Testing, Training, and Operations and Maintenance are not included.

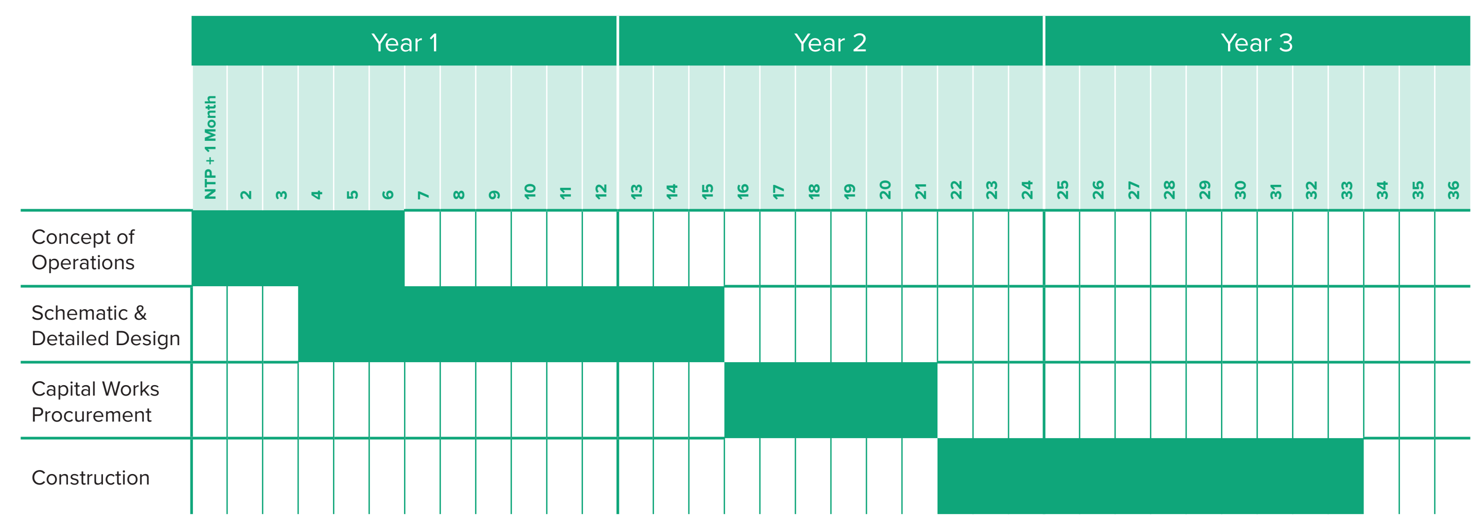
Schedule and Cost

Table 19 and Figure 18 and below summarize the schedule and cost for all elements of implementing TSP and queue jumps in the State Highway 198 corridor. Key assumptions for all elements are also provided. A 5% escalation rate was used to project costs into 2026.

Table 18 - Summary of TSP Costs and Schedule

Phase	Schedule	Cost
Concept of Operations (ConOps)	6 months (starts at NTP)	$ 480,000
Schematic & Detailed Design	12 months (start 3 months after start of ConOps)	$ 1,100,000
Capital Works Procurement	6 months (start at end of Detailed Design)	$ 80,000
Construction	12 months (start at end of Procurement)	$ 318,300 per jursidiction (without queue jump) $ 321,800 per jurisdiction (with queue jump) $176,050 per bus shelter

Figure 18 - Schedule for TSP improvements



Concept of Operations (ConOps)

Assumptions:

- No public outreach

Schematic & Detailed Design

Assumptions:

- Includes 60%, 90%, and 100% design development.
- Includes design of TSP and queue jumps.
- Shelter design is typical per location.
- Includes the design of 5G LTE communications

Capital Works Procurement

Assumptions:

- Assumes 4 months for procurement including 1 addendum and 1 round of Q&A

Construction

Assumptions:

- An example intersection was priced using a typical 4-way intersection with 2 travel lanes in each approach.
- All intersections require full signal upgrade.
- Using existing ROW.
- Communications is not required for TSP to operate, but the cost for 5G LTE was included to allow for advanced traffic operations capabilities (e.g., incident response).
- Bus shelters include a roof, bench, and associated civil costs. It does not include enhancements such as ticket vending machines etc.
- Estimate does not include the cost of work zone traffic control, surveying, field change payment, or mobilization.
- For communication, the 5G subscription is not part of the total wireless cost. It is subjected to change due to bandwidth demand changes.
- No static or dynamic signs are included.
- The estimates do not include any lump sum cost.
- No civil work is included in the estimates for the traffic signal upgrade.

Closing Remarks

This analysis responded to a TSP corridor with 5G LTE communications. Further enhancements for additional intelligent transportation systems (ITS) devices throughout the corridor and fiber communications to future proof the corridor have not been included but can be further studied. It is recommended that the corridor signals be optimized with the incorporation of TSP and queue jumps

Appendix E

TERMINAL DESIGN CONCEPTS

A B C D E F G H

KCAG
TCAG
ARUP

NO.	REVISIONS	DATE
1	Version 1	3/8/2024

Client
Tulare County Association of Governments (TCAG)

Job Title
Central Valley Corridor Phase 1 Capital Improvements

Key Plan

Drawing Title
Capital Improvements Airfield Gate

Scale	1:750 - 1:500
File Name	240306_Capital_improvements
Drawing Status	Capital improvements concept
Drawn By	JT
Checked By	TB
Job No	296118-00
Drawing No	1

KCAG
TCAG
ARUP

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NO.	REVISIONS	DATE
1	Version 1	3/8/2024

Client
Tulare County Association of Governments (TCAG)

Job Title
Central Valley Corridor Phase 1 Capital Improvements

Key Plan

Drawing Title
Capital Improvements Goshen and Plaza Stop

Scale	1:250
File Name	240306_Capital_improvements
Drawing Status	Capital improvements concept
Drawn By	JT
Checked By	TB
Job No	296118-00
Drawing No	5

KCAG
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NO.	REVISIONS	DATE
1	Version 1	3/8/2024

Client
Tulare County Association of Governments (TCAG)

Job Title
Central Valley Corridor Phase 1 Capital Improvements

Key Plan

Drawing Title
Capital Improvements Lemoore Train Station Stop

Scale	1:250
File Name	240306_Capital_improvements
Drawing Status	Capital improvements concept
Drawn By	JT
Checked By	TB
Job No	296118-00
Drawing No	4

NO.	REVISIONS	DATE
1	Version 2	3/8/2024

Client

Tulare County Association of Governments (TCAG)

Job Title

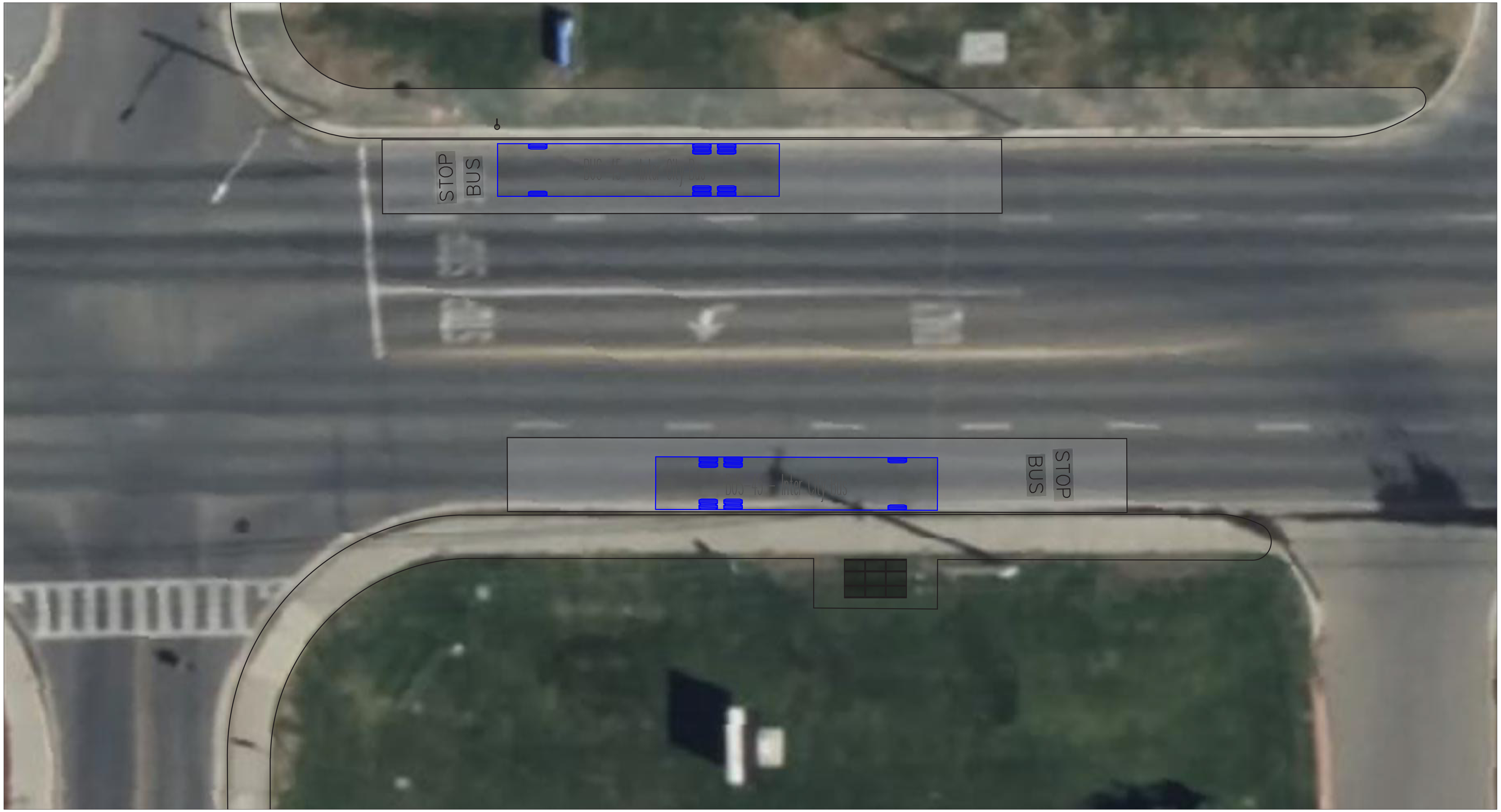
Central Valley Corridor
Phase 1
Capital Improvements

Key Plan

Drawing Title

Capital Improvements
Terminal - Lindsay

Scale	1:500
File Name	240306_Capital_improvements
Drawing Status	Capital improvements concept
Drawn By	JT
Checked By	TB
Job No	296118-00
Drawing No	6



NO.	REVISIONS	DATE
1	Version 1	3/8/2024

Client

Tulare County Association of Governments (TCAG)

Job Title

Central Valley Corridor Phase 1 Capital Improvements

Key Plan

Drawing Title

Capital Improvements Franklin and Enterprise Stop

Scale	1:200
File Name	240306_Capital_improvements
Drawing Status	Capital improvements concept
Drawn By	JT
Checked By	TB
Job No	296118-00
Drawing No	3

NO.	REVISIONS	DATE
1	Version 1	3/8/2024

Client
Tulare County Association of Governments (TCAG)

Job Title
Central Valley Corridor Phase 1 Capital Improvements

Key Plan

Drawing Title
Capital Improvements Terminal - NAS Lemoore

Scale	1:500
File Name	240306_Capital_improvements
Drawing Status	Capital improvements concept
Drawn By	JT
Checked By	TB
Job No	296118-00
Drawing No	2