Long Beach Transit
Zero-Emission Bus Rollout Plan

June 26, 2020

Developed with assistance from the Center for Transportation and the Environment

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Section A: Transit Agency Information

1. Transit agency's name	Long Beach Transit			
2. Mailing address	**Number, street:**	1963 E. Anaheim St.		
	City, County, Zip:	Long Beach, CA 90813		
3. Name of transit agency's air districts	South Coast Air Quality Management District		**4. Name of Transit agency's air basin(s)**	South Coast Air Basin
5. Total number of buses in Annual Maximum Service	186		**6. Population of the urbanized area transit agency is serving as last published by the Census Bureau before 12/31/17**	796,609
7. Contact information of the general manager, chief operating officer, or equivalent	**A: Contact name**	Debra Johnson		
	B: Title	Deputy Chief Executive Officer		
	C: Phone number	562.599.8501		
	D: Email	djohnson@lbtransit.com		
8. Is your transit agency part of a Joint Group (13 CCR § 2023.1(d)(3))?	**Yes** X **No** ☐			

Section B: Rollout Plan General Information

1. **Does your transit agency's Rollout Plan have a goal of full transition to zero-emission technologies by 2040 that avoids early retirement of conventional transit buses (13 CCR § 2023.1(d)(1)(A))?**

   Yes.

2. **The ICT regulation requires 100% ZEB purchase in 2029. Conventional transit buses that are purchased in 2028 could be delivered in or after 2029. Please explain how your transit agency plans to avoid potential early retirement of conventional buses in order to meet the 2040 goal.**

   Long Beach Transit (LBT) has committed to purchasing only Zero-Emission Buses (ZEB) from 2020 onward. All procurements are planned in corresponding end-of-life years for its historical fleets of diesel, gasoline hybrid and CNG buses. LBT will begin to purchase Fuel Cell Electric Buses (FCEB) in 2025 to achieve the duty cycles of longer routes and blocks with larger energy demands than the current Battery Electric Bus (BEB) achievable ranges on the market allow. Keeping the traditional, non-zero-emission vehicles in service until their natural 12-year end of life allows LBT the time to build infrastructure and acquire enough BEBs to support the more demanding routes.

3. **When did your transit agency's board or governing body approve the Rollout Plan?**
   a. **Rollout Plan's approval date** *(06/25/2020)*
   b. **Resolution number (optional)**
   c. **Is a copy of the board approved resolution attached to the Rollout Plan submitted to CARB (13 CCR § 2023.1(d)(2))?** *(**Yes**/No) (required)*

4. **Please provide contact information for CARB to follow up on details of the Rollout Plan, if needed.**
   a. **Contact name:** Tracy Beidleman
   b. **Title:** Manager, Government Relations Capital Planning and Grant Programs
   c. **Phone Number:** 562.599.8571
   d. **Email:** tbeidleman@lbtransit.com

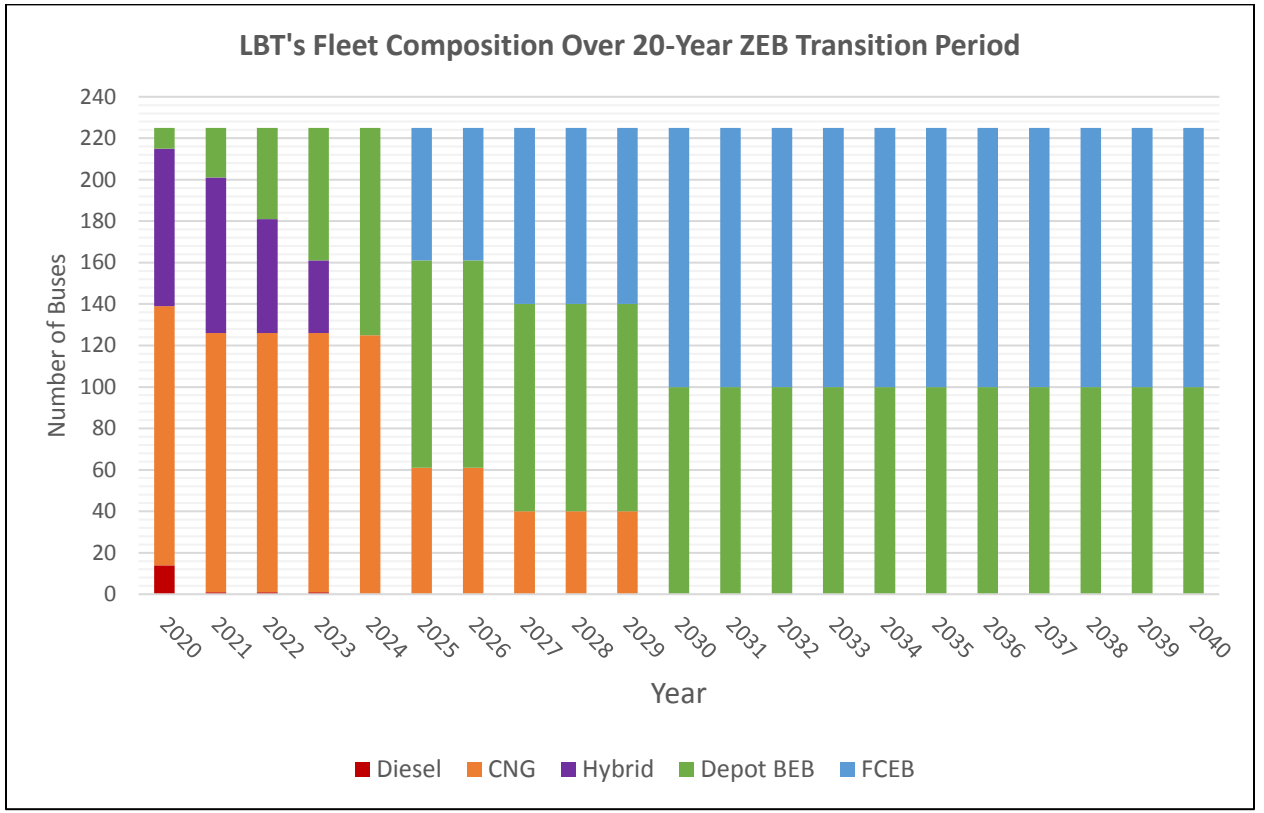
5. **Who has created the Rollout Plan?**
   This rollout plan was created by LBT with assistance from the Center for Transportation and the Environment.

Section C: Technology Portfolio

1. **What type(s) of zero-emission bus technologies does your transit agency plan to deploy through 2040? (13 CCR § 2023.1(d)(1)(B))**

   LBT will deploy both BEBs and FCEBs. Figure 1 displays the projected procurement schedule that supports a realistic timeline for infrastructure build, considers route achievability, and will not retire any vehicles before their useful life. LBT is committed to purchasing ZEBs from 2020 onward and retiring non-zero-emission buses at the end of their useful lives, eventually achieving a fully electric fleet by 2030 with a combination of BEBs and FCEBs. FCEB purchases are to begin in 2025 to give LBT time to prepare for receiving and supporting new technology for the agency's operations and maintenance teams. Some BEB procurements are already planned and in progress.

Figure 1: LBT's Fleet Composition Over 20-Year ZEB Transition Period



Section D: Current Bus Fleet Composition and Future Bus Purchases

1. **Please complete Table 1 with information on each individual bus in your current bus fleet.** *Please identify the fuel type of each individual conventional bus as diesel, compressed natural gas (CNG), liquefied natural gas (LNG), diesel hybrid (dHEB), gasoline hybrid (gHEB), propane, or gasoline. For zero-emission technologies, identify the fuel type as hydrogen or electricity and indicate which charging technology (depot, wireless, and/or on-route) will be used. Bus types include standard, articulated, over-the-road, double decker and cutaway buses.*

   Table 1 is representative of the LBT fleet as of the first quarter of 2020. It lists vehicles that are routinely operated in service, as well as a supporting contingency fleet.

Table 1: Individual Bus Information for Current Bus Fleet

Series	No. of Buses	Bus Type	Engine Model Year	Engine Serial Number	Engine Model	Engine Family	Bus Model Year	Fuel Type
1800	40	New Flyer Standard 40 Foot	2018	74224000	ISL9 G 280	HCEXH0540LBI	2018	CNG
1600	10	BYD Standard 40 Foot	N/A	Not Applicable			2016	Electricity, depot
1500	13	New Flyer Articulated	2015	73824854	ISL G320	FCEXH0540LBG	2015	CNG
1500	8	Gillig Standard 40 Foot	2015	73778955	ISL G280	ECEXH0540LBG	2015	CNG
1300	31	Gillig Standard 40 Foot	2013	Not Applicable	ISL G280	CCEXH0540LBG	2013	CNG
1200	33	Gillig Standard 40 Foot	2012	73368795	ISL G280	CCEXH0540LBG	2012	CNG
2900	25	New Flyer Standard 40 Foot	2009	RO7665029	Ford Triton V10	9ISEH06.8HB	2009	gHEB
2700	15	New Flyer Standard 40 Foot	2007	RO7681421	Ford Triton V10	9ISEH06.8HB	2007	gHEB
2500	22	New Flyer Standard 40 Foot	2005	RO7681653	Ford Triton V10	5ISEC06.8DHB	2005	gHEB
2400	14	New Flyer Standard 40 Foot	2004	RO7678286	Ford Triton V10	4ISEFM68GHEB	2004	gHEB
2200	13	New Flyer Standard 40 Foot	2002	No Known Agency Record			2002	Diesel

2. **Please complete Table 2 regarding expected future bus purchases, including the number of buses in total expected to be purchased or leased in the year of purchase.** *Identify the number and percentage of zero-emission buses of the total bus purchases each year, as well as bus types and fuel types. Identify the same type of information for purchases of conventional buses. Bus types include standard, articulated, over-the-road, double decker and cutaway buses. For zero-emission technologies, please identify the fuel type as hydrogen or electricity and the type of charging technology (depot, wireless, and/ or on-route). For conventional technologies, identify the fuel type as diesel, compressed natural gas (CNG), liquefied natural gas (LNG), diesel hybrid (dHEB), gasoline hybrid (gHEB), propane, or gasoline. (13 CCR § 2023.1(d)(1)(D))*

   Figure 2 demonstrates a projected schedule for LBT purchases that would be necessary to maintain the same level of service and achieve the energy demands of the current regular service. It also reflects the 12-year life span of the current fleet and the first ZEB replacement cycle, as well as other ZEB replacements in the future. Table 2 demonstrates LBT's commitment to 100% ZEB procurements beginning in 2020. Years in which buses are not purchased are omitted from the table.

Figure 2: LBT's Projected Annual Bus Procurements

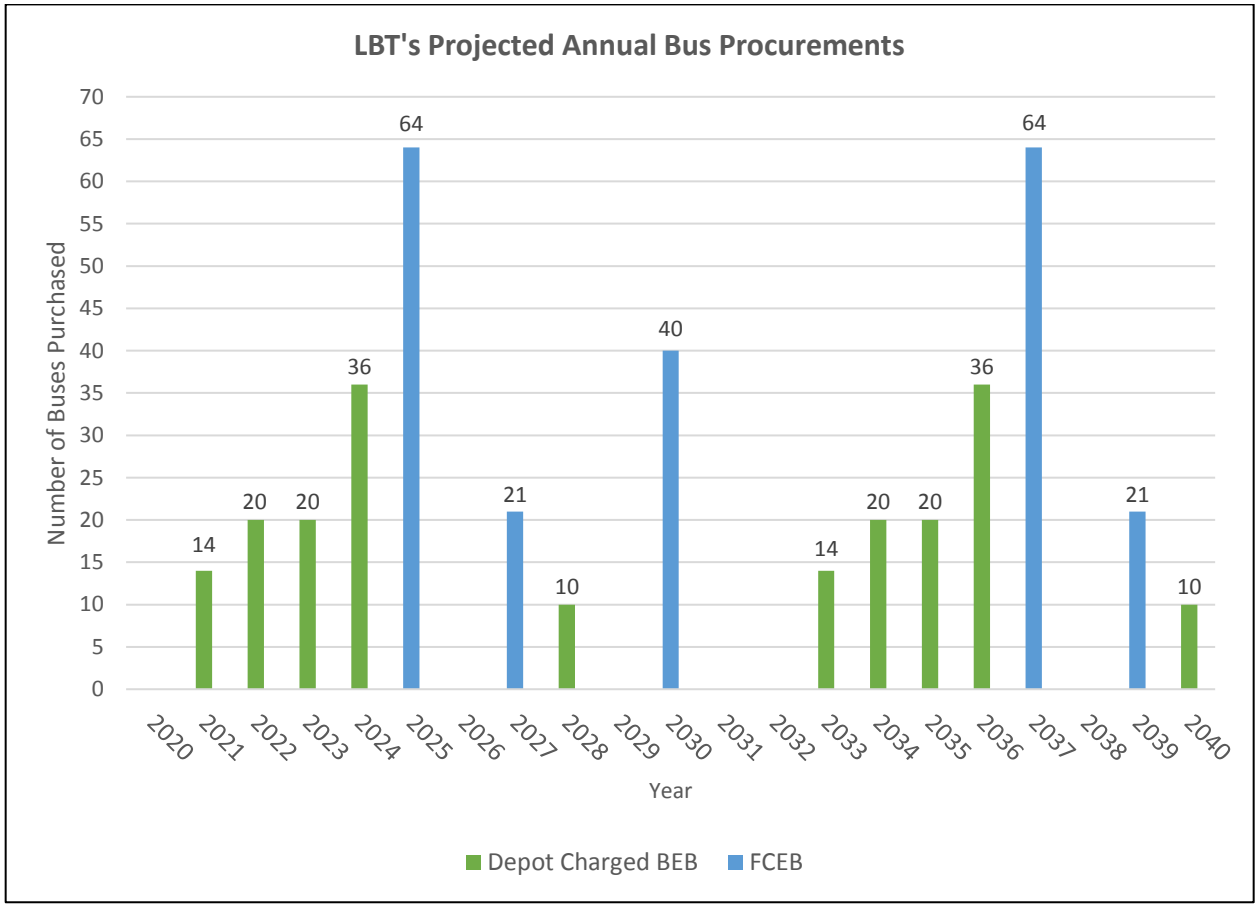


Table 2: LBT's Projected Annual Bus ZEB Procurement Details

Timeline (Year)	Total Number of Buses to Purchase	Number of ZEB Purchases	Percentage of Annual Bus Purchases	ZEB Bus Type(s) / ZEB Fuel Type(s)	Number of Conventional Vehicles
2021	14	14	100%	40' Standard BEB / Electric Depot	0
2022	20	20	100%	40' Standard BEB / Electric Depot	0
2023	20	20	100%	40' Standard BEB / Electric Depot	0
2024	36	36	100%	40' Standard BEB / Electric Depot	0
2025	64	64	100%	40' Standard FCEB / Hydrogen	0
2027	21	21	100%	13 60' Articulated & 8 40' Standard FCEB / Hydrogen	0
2028	10	10	100%	40' Standard BEB / Electric Depot	0
2030	40	40	100%	40' Standard FCEB / Hydrogen	0
2033	14	14	100%	40' Standard BEB / Electric Depot	0
2034	20	20	100%	40' Standard BEB / Electric Depot	0
2035	20	20	100%	40' Standard BEB / Electric Depot	0
2036	36	36	100%	40' Standard BEB / Electric Depot	0
2037	64	64	100%	40' Standard FCEB / Hydrogen	0
2039	21	21	100%	13 60' Articulated & 8 40' Standard FCEB / Hydrogen	0
2040	10	10	100%	40' Standard BEB / Electric Depot	0

3. **Following the same bus purchase timeline as identified in Table 2, please identify in Table 3 the required operational range your future zero-emission buses should have to be able to serve in your fleet. Please provide the estimated cost of each bus with that required operational range.**

   Table 3 demonstrates consideration of the limitations of current market BEBs' achievable duty cycle and range. To successfully transition the fleet's technology and ensure service remains stable, planning models confirm that there are always more blocks that BEBs can complete on a single charge than there are BEBs. Thus, LBT will never have to run a BEB on a block that is not achievable, although they also have the option of re-blocking to relieve a vehicle that requires a charge before providing additional service. More difficult routes with higher energy demands will be serviced by FCEBs, which have demonstrated longer ranges.

   Additionally, considerations regarding average degraded service capacity for the batteries are also accounted for in the achievability concept for route deployment and blocking. Degraded service capacity is determined to be 80% of name plate capacity and 90% degradation. The average degraded service capacity was calculated by multiplying the nameplate usable battery capacity (80%) by an additional degradation factor (90%) to get a degraded service capacity of 72%.

   Table 4 shows the averaged costs of ZEBs on the California state contract, noting that the price of FCEBs is the price of the New Flyer buses seeing as they are the only FCEB option on the contract currently. Table 3 is also demonstrative of LBT's historic configurable options costs and the state tax.

Table 3: Verifying Block Achievability Throughout Fleet Transition

Timeline (Year)	Number of FCEBs in Fleet	Number of BEBs in fleet	Total Number of Active Buses in Fleet	Proportion of BEBs in Fleet	Proportion of BEB Achievable Blocks*
2020	0	10	225	4%	45%
2021	0	24	225	11%	45%
2022	0	44	225	20%	50%
2023	0	64	225	28%	50%
2024	0	100	225	44%	57%
2025	64	100	225	44%	57%
2026	64	100	225	44%	64%
2027	85	100	225	44%	64%
2028	85	100	225	44%	71%
2029	85	100	225	44%	71%
2030	125	100	225	44%	79%
2031	125	100	225	44%	79%
2032	125	100	225	44%	83%
2033	125	100	225	44%	83%
2034	125	100	225	44%	89%
2035	125	100	225	44%	89%
2036	125	100	225	44%	93%
2037	125	100	225	44%	93%
2038	125	100	225	44%	96%
2039	125	100	225	44%	96%
2040	125	100	225	44%	98%

*A block is considered achievable if the strenuous energy requirements for the block are within the average degraded services capacity (72% of total capacity) of on-board battery storage. The estimated total battery capacity for 2020 is 450kWh and is expected to improve by 5% every two years. This chart does not include 24 contingency vehicles.

Table 4: Estimated Costs of Future ZEB Purchases

	40' BEB	60' BEB	40' FCEB	60' FCEB
Average Bus Base Price from CA State Contract	$720,000	$1,225,000	$1,015,000	$1,464,000
Estimated Cost of Configurable Options	$88,000	$88,000	$88,000	$88,000
Tax	10.25%	10.25%	10.25%	10.25%
Estimated Total Cost *	$891,000	$1,448,000	$1,216,000	$1,711,000

*Steady state pricing is assumed for modeling purposes. The general expectation is that BEB prices will remain steady, but FCEB prices will fall, although there is not enough information to make a confident projection in future pricing.

4. **Is your transit agency considering converting some of the conventional buses in service to zero-emission buses (13 CCR § 2023.1(d)(1)(E))?**

   No

Section E: Facilities and Infrastructure Modifications

1. **Please complete Table 5 with names, locations, and main functions of transit agency divisions or facilities that would be involved in deploying and maintaining zero-emission buses.** *Please limit the facilities to bus yards and facilities with maintenance, fueling, and charging functions, and exclude other operational functions like training centers, information and trip planning offices, and administrative buildings. Please identify which facility(ies) require construction, infrastructure modifications, or upgrades to support your transit agency's long-term transition to zero-emission technologies and the estimated timeline for such an upgrade. Please also specify the type(s) of infrastructure planned in each division or facility and provide their service capacities (e.g., en-route high-power charging system to deploy 20 BEB in 2025). (13 CCR § 2023.1(d)(1)(C)).*

   Figure 3 reflects the anticipated infrastructure builds required to accommodate LBT's fleet electrification. The initial infrastructure builds correspond to the Figure 2 procurement schedule: LBT1 will act as a BEB division with depot charging only to support the new BEBs in the fleet. Congruently, LBT2 will function as a hydrogen station and FCEB division.

   An assumption of $200,000 is expended for infrastructure master planning and design in the year prior to construction. Depot BEB infrastructure costs include: design, construction and equipment installation costs, transformers, switchgear, DC chargers, overhead gantries, and plug-in/pantograph dispensers for depot chargers. It also assumes replacement of AC chargers with DC chargers when current BYD buses retire, as LBT's current BEB fleet does not reflect the standard market charging scenario shift to DC charging that is taking shape with new deployments. Hydrogen infrastructure costs include maintenance bay upgrades for H_2 detection, ventilation systems, and the build-out of a hydrogen fueling station, including design, construction, and equipment installation costs. Each cost is associated with the project year in the Figure 3 timeline and the related procurement of the vehicles that require the build.

Figure 3: LBT's Estimated Annual Infrastructure Costs

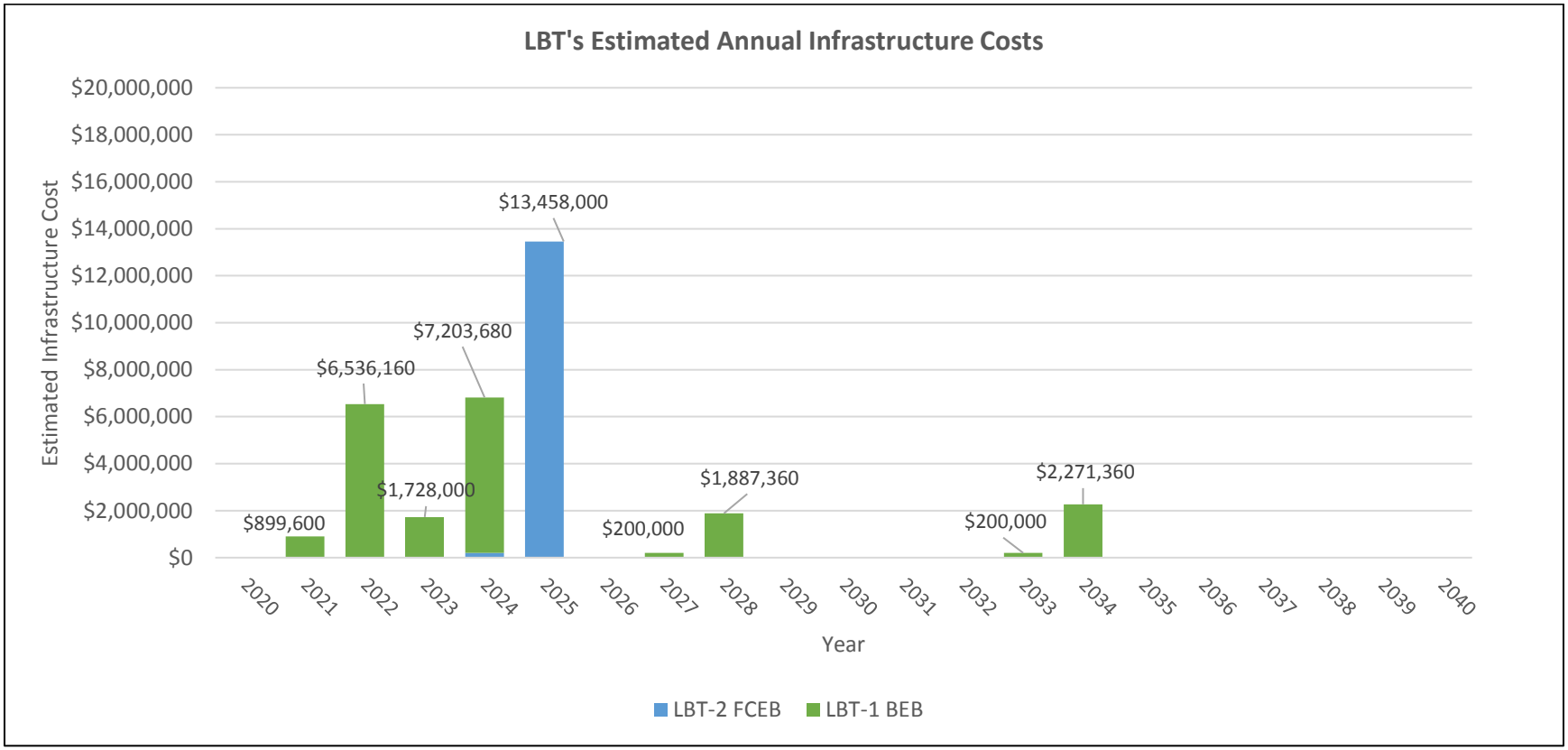


Table 5: Facilities Information and Construction Timeline

Division/Facility Name	Address	Main Function(s)	Type(s) of Infrastructure	Service Capacity*	Needs Upgrade?
LBT1	1963 E. Anaheim St. Long Beach, CA 90813	Diesel, gHEB and BEB division	Electric Charging Depot	141 buses	Yes
LBT2	6860 Cherry Ave. Long Beach, CA 90805	CNG and FCEB Division	Hydrogen Fueling Station	141 buses	Yes

*The service capacity is impacted by the installation of charging equipment and hydrogen fueling station. Service capacity may shrink with infrastructure installation. This is still under evaluation. Currently, LBT1 and LBT2 house only 125 buses each.

Regarding the information provided in Table 5, please explain the types of necessary upgrades or infrastructure modifications each facility or division needs to support your transit agency's long-term transition to ZEB. Please also provide the specification of each infrastructure in the related facility or division before and after the upgrades or modifications.

LBT1 has a present capacity of 141 buses and will require chargers, dispensers, and related grid and utility-owned infrastructure builds to support the energy demands of 100 active BEBs and 25 contingency fleet vehicles, which will also eventually be BEBs. LBT2 has a present capacity of 141 buses and will require a hydrogen station including storage, compression, maintenance facility upgrades and dispensers to support 125 FCEBs.

2. **Do you expect to make any modifications to your bus parking arrangements? Explain the modifications and why they are needed.**

   LBT does anticipate needing to make changes to the parking configuration to accommodate chargers and dispensers at LBT1 and a hydrogen fueling station at LBT2. This would be in addition to the existing BEB infrastructure at LBT1 and the CNG station at LBT2. While LBT is endeavoring to design and produce a new division configuration to accommodate ZEB infrastructure, Appendix A shows a map of LBT1 and LBT2 configured to maximize bus space to 141 at each site. Considering only 125 buses operate out of each facility, this plan allows for the necessary infrastructure upgrades.

3. **Do you expect to need additional parking spaces for completing the transition to zero-emission technologies? Explain why.**

   Yes, some footprint originally dedicated to bus parking will be utilized by charger dispensers and hydrogen station equipment.

4. **In Table 6, please identify the propulsion system of all buses that will be dispatched from the facilities identified in Table 5.**

Table 6: NOx-Exempt Area and Electric Utilities' Territories

Division/Facility Name	Type(s) of Bus Propulsion Systems	Located in NOx-Exempt Area?	Name(s) of Electric Utility in Service Area
LBT1	Diesel, Gas, Electric	No	Southern California Edison
LBT2	CNG, FCEB	No	Southern California Edison

5. **Please identify the electric utilities in your transit agency's service area.**

   Southern California Edison.

Note: The ICT regulation defines "NOx Exempt Areas" (13 CCR § 2023(b)(39)) as the following counties and air basins: Alpine, Amador, Butte, Calaveras, Colusa, Del Norte, Eastern Kern (the portion of Kern County within the Eastern Kern Air Pollution Control District), Glenn, Humboldt, Inyo, Lake, Lassen, Mariposa, Mendocino, Modoc, Mono, Monterey, Nevada, Northern Sonoma (as defined in title 17, California Code of Regulations, section 60100(e)), Plumas, San Benito, San Luis Obispo, Santa Barbara, Santa Cruz, Shasta, Sierra, Siskiyou, Northern Sutter (the portion of Sutter County that is north of the line that extends from the south east corner of Colusa County to the southwest corner of Yuba County), the portion of El Dorado County that is within the Lake Tahoe Air Basin (as defined in title 17, California Code of Regulations, section 60113), the portion of Placer County that is East of Highway 89 or within the Lake Tahoe Air Basin, Trinity, Tehama, Tuolumne, and Yub

Section F: Providing Service in Disadvantaged Communities

1. **Does your transit agency serve one or more disadvantaged communities, as listed in the latest version of CalEnviroScreen?**

   Yes.

   a. If yes, please describe how your transit agency is planning to deploy zero-emission buses in disadvantaged communities (13 CCR § 2023.1(d)(1)(F)).

   LBT provides service to 115 unique disadvantaged communities (DAC). Every one of LBT's routes serve a defined DAC. LBT's planned full-fleet electrification will occur in 2030, therefore operating ZEBs in 115 different DACs. The current LBT BEB fleet of 10 serves six DACs now, therefore increasing to 51 potentially served in 2021, and so forth until the entire fleet of 150 buses provides service to all 115 DACs.

   Due to the difficulty in assigning specific future bus procurements to routes, and with respect to LBT's needs to frequently arrange and adapt service, the Expected Year of First ZEB Deployment is indicative of when LBT expects to deploy and house ZEBs from and in each of their divisions. LBT1 currently houses BEBs and will continue to operate as a BEB division and to expand infrastructure with the fleet. Therefore, routes served by vehicles from LBT1 will see ZEB deployments in 2021 initially. LBT2 will depot and deploy FCEBs. The purchasing and build of this infrastructure will occur at a later time; thus, routes primarily operated out of LBT2 will begin to be served by FCEBs in 2025. LBT's entire fleet will be electric by 2030, which means all DACs will benefit from service of ZEBs no later than 2030 and likely sooner. A map of LBT routes, DACs and low-income census tract regions can be found in Appendix B.

   b. Please complete Table 7 with the estimated number of zero-emission buses your transit agency is planning to deploy in disadvantaged communities and the estimated timeline.

Table 7: Service in Disadvantaged Communities

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
1	2025	2030	6037543305 6037543306 6037543321 6037543322 6037543400 6037980025 6037544002 6037544001 6037575902 6037572302 6037576001 6037572600 6037572700 6037572900 6037573002 6037573003 6037573004 6037573202 6037576301 6037576200 6037575500 6037575300 6037575401 6037575402
21	2025	2030	6037553601 6037553801 6037553802 6037573402 6037570203 6037576001 6037570202 6037570502 6037570602 6037570603 6037573300 6037576901 6037576403 6037575101 6037575102 6037575202
22	2025	2030	6037551700 6037551800 6037553902 6037554301 6037554302 6037570204 6037573402

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
cont'd			6037553901 6037553502 6037553504 6037570203 6037576001 6037570100 6037573300 6037576901 6037576403 6037575101 6037575102 6037575202
23	2025	2030	6037553601 6037553801 6037553802 6037573402 6037553602 6037553901 6037553502 6037553504 6037570203 6037576001 6037570202 6037570502 6037570602 6037570603 6037573300 6037576901 6037576403 6037575101 6037575102 6037575202
37	2016	2016	6037575902 6037980033 6037576001 6037576301 6037576200 6037575803
45	2021	2024	6037980033 6037576903 6037576901 6037576403 6037576402 6037576401 6037576302 6037576301 6037575102 6037575103 6037575201

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
cont'd			6037575801 6037575802 6037575803 6037575202 6037575500 6037575300 6037575401 6037575402
46	2021	2024	6037575902 6037576001 6037576903 6037576901 6037576403 6037576402 6037576401 6037576302 6037576301 6037576200 6037575102 6037575103 6037575201 6037575202 6037575300 6037575402
51	2025	2030	6037542402 6037543202 6037543305 6037575902 6037572201 6037573100 6037573201 6037576001 6037570403 6037570404 6037570402 6037570303 6037570304 6037571701 6037571703 6037573002 6037573202 6037576301 6037576200 6037575300 6037575402
52	2025	2030	6037542402 6037543202 6037543305 6037575902

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
cont'd			6037572201 6037573100 6037573201 6037576001 6037570402 6037570303 6037570304 6037571701 6037571703 6037573002 6037573202 6037576301 6037576200 6037575300 6037575402
61	2025	2030	6037542402 6037543202 6037543305 6037570301 6037572201 6037573201 6037576001 6037570403 6037570404 6037570501 6037570402 6037570303 6037570304 6037570202 6037570601 6037573202 6037576302 6037576301 6037576200 6037575300
71	2025	2030	6037553601 6037553801 6037553802 6037553701 6037553702 6037573402 6037553602 6037553502 6037553504 6037576001 6037570501 6037570202 6037570601 6037570602

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
cont'd			6037573300 6037576401 6037576302 6037576301 6037576200 6037575201 6037575300
81	2021	2024	6037575902 6037576001 6037576903 6037576901 6037576403 6037576402 6037576401 6037576302 6037576301 6037576200 6037575803
91	2021	2024	6037554405 6037554404 6037575902 6037553100 6037554002 6037554101 6037554104 6037554105 6037554203 6037554204 6037576001 6037576901 6037576403 6037576402 6037576401 6037576302 6037576301 6037576200 6037575803
92	2021	2024	6037554405 6037575902 6037553100 6037554104 6037554105 6037554203 6037576001 6037576901 6037576403 6037576402 6037576401 6037576302

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
cont'd			6037576301 6037576200 6037575803
93	2021	2024	6037554403 6037554404 6037575902 6037553100 6037554002 6037554101 6037554104 6037554105 6037554203 6037554204 6037576001 6037576901 6037576403 6037576402 6037576401 6037576302 6037576301 6037576200 6037575803
94	2021	2024	6037575902 6037576001 6037576901 6037576403 6037576402 6037576401 6037576302 6037576301 6037576200 6037576200
96	2021	2024	6037576901 6037576403 6037576402 6037576401 6037576302 6037576301 6037576200
101	2025	2030	6037572201 6037573100 6037573201 6037555102 6037555211 6037572600 6037572700
102	2025	2030	6037573402 6037573100 6037573201

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
cont'd			6037555102 6037555211 6037572600 6037572700
103	2025	2030	6037572201 6037573100 6037573201 6037572600 6037572600
104	2025	2030	6037573402 6037573100 6037573201 6037555102 6037555211 6037572600 6037572700
111	2025	2030	6037575902 6037576001 6037570100 6037570502 6037570603 6037576200
112	2025	2030	6037575902 6037576001 6037570100 6037570502 6037570603 6037576200
121	2021	2024	6037576001
131	2025	2030	6037572100 6037572201 6037573402 6037576903 6037575103
151	2021	2024	6037575902 6037576001 6037576200 6037575901
171	2021	2024	6037573402 6037572800 6037572900 6037573002 6037573003 6037573004 6037573202 6037573300 6037575101 6037575103 6037575201

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
cont'd			6037575202 6037575500 6037575300 6037575401 6037575402
172	2021	2024	6037575902 6037573402 6037551900 6037552100 6037552900 6037553000 6037576001 6037573002 6037573004 6037573202 6037573300 6037576301 6037576200 6037575101 6037575103 6037575201 6037575803 6037575202 6037575300 6037575401 6037575402
173	2021	2024	6037575902 6037573402 6037551900 6037552100 6037552900 6037553000 6037576001 6037555102 6037555211 6037573002 6037573004 6037573202 6037573300 6037576301 6037576200 6037575101 6037575103 6037575201 6037575803 6037575202 6037575300 6037575401 6037575402

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
cont'd			6037555102 6037555211 6037573002 6037573004 6037573202 6037573300 6037576301 6037576200 6037575101 6037575103 6037575201 6037575803 6037575202 6037575300 6037575401 6037575402
174	2021	2024	6037575902 6037573402 6037576001 6037573002 6037573004 6037573202 6037573300 6037576301 6037576200 6037575101 6037575103 6037575201 6037575803 6037575202 6037575300 6037575401 6037575402
175	2021	2024	6037573402 6037572800 6037572900 6037573002 6037573003 6037573004 6037573202 6037573300 6037575101 6037575103 6037575201 6037575202 6037575500 6037575300 6037575401 6037575402

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
176	2021	2024	6037573402 6037572800 6037572900 6037573002 6037573003 6037573004 6037573202 6037573300 6037575101 6037575103 6037575201 6037575202 6037575500 6037575300 6037575401 6037575402
181	2021	2024	6037575902 6037572100 6037572201 6037573100 6037576001 6037573003 6037573004 6037576200 6037575901 6037575802 6037575401
182	2025	2030	6037575902 6037572100 6037572201 6037573100 6037576001 6037573002 6037573004 6037576200 6037575803 6037575402
191	2025	2030	6037543305 6037544002 6037544001 6037575902 6037572301 6037980033 6037572500 6037572302 6037576001 6037555102 6037571701 6037571703

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
cont'd			6037572600 6037572700 6037572800 6037572900 6037573003 6037576200 6037575901 6037575801 6037575802 6037575500 6037575401 6037555001
192	2025	2030	6037543305 6037544002 6037544001 6037575902 6037572301 6037980033 6037572500 6037572302 6037576001 6037570303 6037570304 6037570100 6037570502 6037570601 6037570602 6037570603 6037571701 6037571703 6037572600 6037572700 6037572800 6037572900 6037576200 6037575901 6037575801 6037575802 6037575500 6037575401
510	2025	2030	6037291300 6037292000 6037543306 6037543400 6037543501 6037543801 6037543903 6037601302 6037601401

LBT Route	Expected Year of First ZEB Deployment	Year of Complete Route Electrification	Location of Disadvantaged Community By Census Tract Number
cont'd			6037601402 6037601501 6037601502 6037601600 6037602200 6037603900 6037604100 6037980002 6037980014 6037544002 6037573402 6037573201 6037573100 6037572301 6037572201 6037572100

Note: The ICT regulation defines the "CalEnviroScreen" (13 CCR § 2023(b)(10)) as a mapping tool that is developed by the Office of Environmental Health Hazard Assessment (OEHHA) at the request of the California Environmental Protection Agency (CalEPA) to identify California's most pollution-burdened and vulnerable communities based on geographic, socioeconomic, public health, and environmental hazard criteria. The CalEnviroScreen is available for public use at https://oehha.ca.gov/calenviroscreen.

Section G: Workforce Training

1. **Please describe your transit agency's plan and schedule for the training of bus operators and maintenance and repair staff on zero-emission bus technologies (13 CCR § 2023.1(d)(1)(G)).**

   LBT has implemented and continues to implement a number of training programs attended by LBT bus operators, mechanics, utility maintenance workers, and supervisors on an annual basis, including new operator training and LBT's State Mandated Annual Refresher Training (SMART). These trainings are provided by experienced LBT staff. Additionally, manufacturers of the ZEB equipment such as the bus, charge management software, and charging equipment can provide training, including train-the-trainer courses, as it is often included in the procurement contract. The maintenance and operating staff have also participated in trainings from the Southern California Regional Transit Training Consortium (SCRTTC).

   LBT's training courses include Operator Refresher Training, New Operator Training, Bus Familiarization, and Bus Refresher Training. The annual training programs reach approximately 480 operators, 30 Transit Service Delivery (TSD) Supervisors, and two TSD Superintendents in the Transit Service Delivery department. In the Maintenance divisions, annual trainings prepare 60 mechanics, 32 utility personnel, 10 Maintenance Supervisors, two Utility Supervisors, three Quality Assurance Specialists, and the Fleet Maintenance Managers. These trainings encompass all propulsion technologies at LBT, namely CNG, Gas Hybrid, Diesel, and Battery Electric.

   The in-house curriculum includes New Bus Training, which incorporates pre-trip inspections, door operations, emergency equipment operations, steering, operational concerns, DMV pre-trip, bus components, and other portions of the bus functions and operations across bus technologies. Maintenance trainings are also an imperative element of the bumper to bumper technical training curriculum for mechanics, utility workers, and supervisors that focus on preventive maintenance requirements, hazards related to high voltage, personal protective equipment as required, component training and charging and fueling source training.

   These curricula take approximately three weeks to develop. Curricula generally includes a train-the-trainer mechanism of generational experiential learning within the organization and takes approximately two and one-half months to reach all necessary personnel at LBT. Each session is approximately four hours, with two sessions per day for roughly four to six employees per session. Operators train to drive the ZEB buses for at least one hour, in addition to completing the content training courses which cover standard operating procedures: braking, steering, turns, bus inspections, pre-trip inspections, farebox operations, fare structure, fare media, and aiding customers with disabilities and their mobility devices.

   For newly hired LBT employees, there are additional standard on-boarding trainings: Civil Rights programs, such as Limited English Proficiency (LEP), ensuring meaningful access to LBT programs and services by LEP persons for whom English is not the primary language and who may have limited ability to read, speak, right or understand English; Americans with

Disabilities Act (ADA) of 1990, ensuring access to LBT programs and services by persons with disabilities; Title VI, ensuring compliance with Title VI Act of the Civil Rights Act of 1964 which prohibits discrimination on the grounds of race, color, or national origin; also Title VII Equal Employment Opportunity (EEO), providing Equal Employment Opportunities (EEO) for all employees regardless of race, color, religion, sex, sexual orientation, age, national origin, ancestry, mental or physical disability, veteran status, marital status, pregnancy, genetic information, or any other protected category. The aforementioned training curricula will be implemented across the organizations and will reach all necessary LBT staff annually at minimum and likely more frequently

Section H: Potential Funding Sources

1. **Please identify all potential funding sources your transit agency expects to use to acquire zero-emission technologies (both vehicles and infrastructure) (13 CCR § 2023.1(d)(1)(H)).**

   LBT is prepared to pursue federal grants through the following funding programs: Federal Transit Administration's (FTA) Urbanized Area Formula program, as well as disrectionary grant programs such as the Bus and Bus Facilities (B&BF) program, Low or No Emission Vehicle Deployment Program (LoNo), and Better Utilizing Investments to Leverage Development (BUILD) grant, as well as other available federal discretionary grant programs.

   LBT will also seek funding from state resources through grant opportunites including, but not limited to, Senate Bill 1 State of Good Repair (SGR), Transit and Intercity Rail Capital Program (TIRCP), Low Carbon Transit Operations Program (LCTOP) funding, the California Energy Commission's Clean Transportation Program as well as Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) for bus purchases when available.

   Additionally, LBT will utilize various local subsidies to support zero-emission bus deployment such as Municipal Operators Service Improvement Program (MOSIP) funds and Measure R (a Los Angeles County half-cent sales tax allocated by Los Angeles County Metropolitan Transportation Authority (Metro)) funds. While the aforementioned funding opportunities are mentioned by name, LBT will not be limited to these sources only and will regularly assess opportunities for fiscal support for the ZEB program.

Section I: Start-up and Scale-up Challenges

a. Please describe any major challenges your transit agency is currently facing in small scale zero-emission bus deployment.

How might CARB assist you to overcome these challenges? Please share your recommendations.

Currently, LBT is not facing nor does it anticipate any major challenges to ZEB deployment. However, LBT has faced many challenges with new bus technology deployments in the past. LBT implemented a battery-electric bus (BEB) pilot program consisting of 10 BEBs in 2017.

Beginning in mid-2018, the BEBs developed battery balancing and degradation issues. Several factors contributed to the problem, including the buses being some of the first produced by the original equipment manufacturer (OEM) BYD at its new U.S. manufacturing plant, resulting in an inadequate initial commissioning. Also, LBT's planned use of the buses at 60–70 miles per day was too conservative, since the batteries were not allowed to discharge below a certain State of Charge (SOC). Subsequently, the battery capacity initially degraded quickly. There were initial challenges resulting in downtime and delays in putting the buses into service.

To monitor performance, BYD's Health Alert Monitoring System promised to be an ideal solution for real-time monitoring of the BEBs, scheduling and managing depot charging, and collecting detailed data for analysis. Initially, this system was not fully functioning at the beginning of the BEB deployment, which caused challenges for the evaluation. When data first became available, there were reliability issues that LBT traced down to interference in the wireless receivers collecting the data from the buses.

LBT and BYD have worked cooperatively to resolve these issues. LBT has now deployed the initial BEBs on other routes within the service area. An additional 14 BEBs are on order, and an RFP has been released for an additional 20 BEBs with an option for 20 additional more. LBT's experience with its first deployment has positioned the agency to manage continued successful ZEB deployments, and LBT does not anticipate any major challenges in upcoming deployments.

b. Please describe any challenges your transit agency may face in scaling up zero-emission bus deployment.

Generally, and as previously mentioned, LBT has experience with the purchase and deployment of ZEBs, specifically BEBs, and does not foresee major challenges in the procurement and deployment of these vehicles. Challenges can arise with any new propulsion technology, its corresponding infrastructure, or in training operators and maintenance staff. These challenges are overcome through a combination of OEM offered trainings, as well as other educational avenues such as conferences, technical school programs, and agency collaboration. Financial support for educating the workforce on the

deployment of these vehicles is under supported, however.

Additionally, the current market cost of ZEBs is between $750,000 and $1,200,000, which is about $250,000 to $700,000 more costly than traditional diesel buses. LBT will seek continued financial support to cover the incremental cost of ZEBs. The fueling infrastructure requirements for ZEB technology along with the construction required for installation also have an additional cost. Continued support for the capital cost of infrastructure required to deploy ZEB technology is imperative for the success of these technologies. Scaled economy of these alternative fuels, such as hydrogen, and subsidized or negotiated rates for electric vehicles by state utilities will also aid in the affordability of large-scale electrification. Notably, utility compliance and infrastructure to support newly heightened energy demands at agency's maintenance divisions for hydrogen stations and charging must be achieved. Often, the existing electrical infrastructure cannot support larger energy demands associated with powering an electric fleet or a hydrogen station, and projects must include the installation of new 12kV switchgears and/or new transformers.

Another limitation of the ZEB fleet transition is the state of industry technology available to accomplish service requirements for a transit agency's entire route duty cycles. This is mitigated through the utilizations of technical consultants and smart deployments.

a. How might CARB assist you to overcome these challenges? Please share your recommendations.

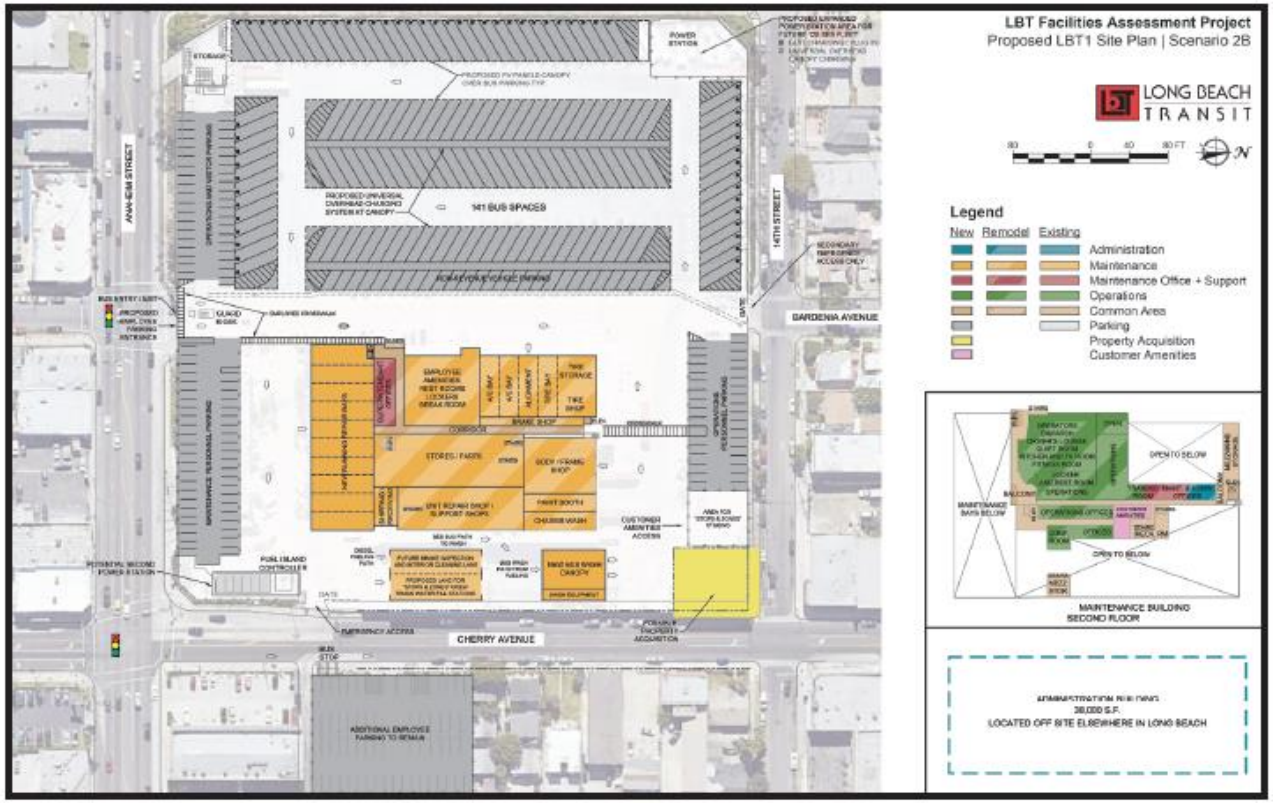
Regarding the aforementioned hurdles, CARB can support LBT by ensuring continued funding for, at minimum, the incremental cost of a bus, as well as infrastructure funding and legislative support in addition to existing delineated bus purchase money. Moreover, emphasis should be placed on proper transition and deployment planning. Legislative and financial support for agencies to contract consultants to ensure best practices and successful deployments will support the long-term objectives of continued deployments and ZEBs in service. Availability and pricing of hydrogen, both renewable and not, continue to be an affordability challenge that can be allayed by greater market diversity and legislative support that subsidizes renewable fuels and their production.

Appendix A: LBT1 and LBT2 Division Site Renderings

LBT-1

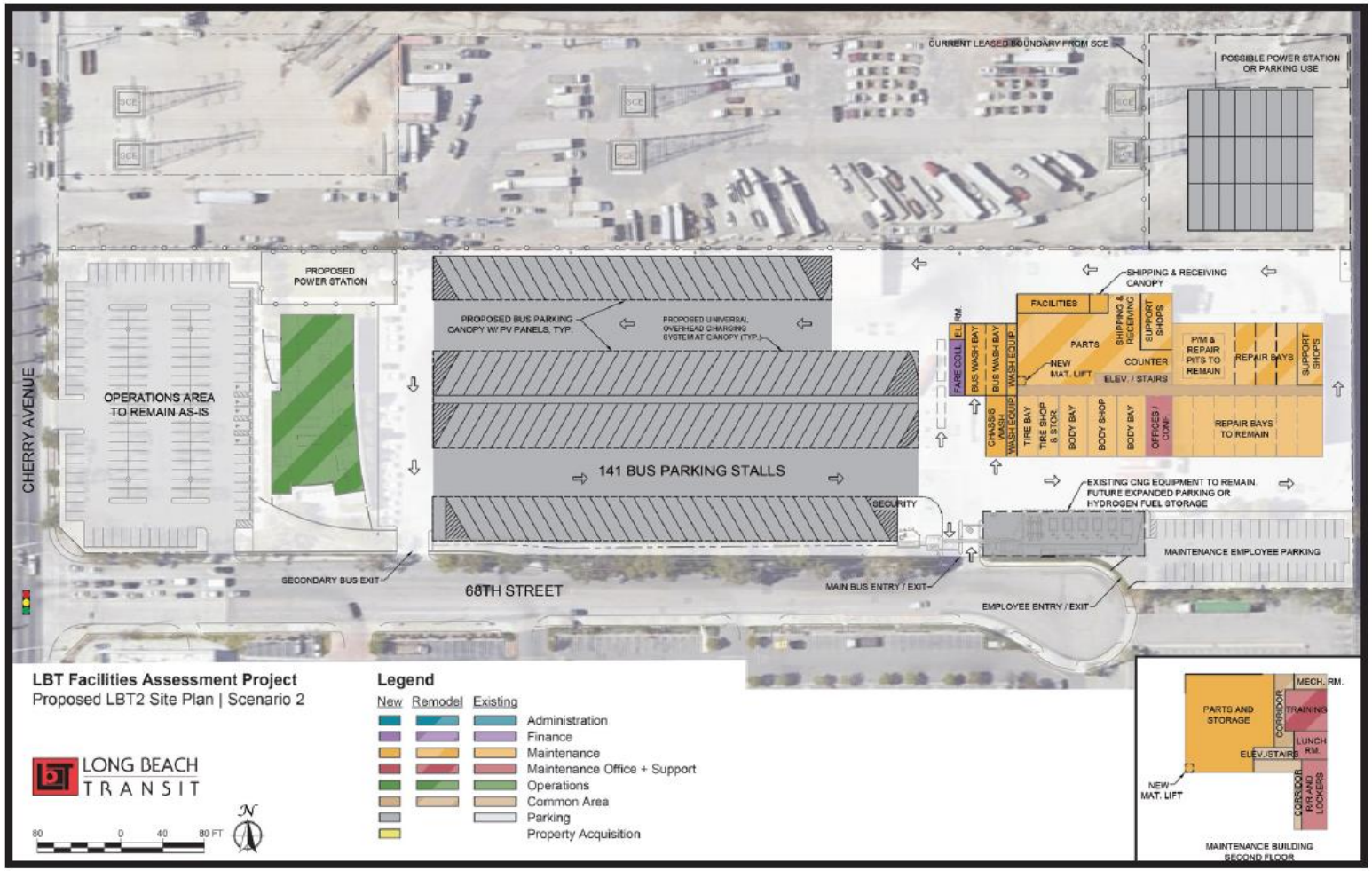
LBT Facilities Master Plan

Exhibit 2.1: Scenario 2B Layout



LBT2

Exhibit 3.4: Site Plan for LBT2-Scenario 2



Appendix B: LBT Disadvantaged Community and Low-Income Service Map