OMNITRANS

ZERO-EMISSION BUS ROLLOUT PLAN

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1 ROLLOUT PLAN SUMMARY

AGENCY BACKGROUND

Transit Agency's Name	Omnitrans
Mailing Address	1700 W. Fifth Street San Bernardino, CA 92411
Transit Agency's Air District	South Coast Air Quality Management District
Transit Agency's Air Basin	South Coast Air Basin
Total number of buses in Annual Maximum Service[1]	135
Urbanized Area	Riverside – San Bernardino
Population of Urbanized Area[2]	1,932,666
Contact information of general manager, chief operating officer, or equivalent	Erin Rogers General Manager 909.379.7100 Erin.rogers@omnitrans.org
Rollout Plan Content	
Is your transit agency part of a Joint Group[3]	No
Is your transit agency submitting a separate Rollout Plan specific to your agency, or will one Rollout Plan be submitted for all participating members of the Joint Group?	N/A
Please provide a complete list of the transit agencies that are members of the Joint Group (optional)	N/A
Contact information of general manager, chief operating officer, or equivalent staff member for each participating transit agency member	N/A
Does Rollout Plan have a goal of full transition to ZE technology by 2040 that avoids early retirement of conventional transit buses?	Yes
Rollout Plan Development and Approval	
Rollout Plan's approval date	05/06/20
Resolution No.	321-2020
Is copy of Board-approved resolution attached to the Rollout Plan?	Yes (Appendix A)
Contact for Rollout Plan follow-up questions	Connie Raya Director of Maintenance 909.379.7183 Connie.raya@omnitrans.org
Who created the Rollout Plan?	Consultant
Consultant	WSP

[1] The ICT regulation defines "Annual Maximum Service" (13 CCR § 2023(b)(3)) as the number of buses in revenue service that are operated during the peak season of the year, on the week and day that maximum service is provided but excludes demand response buses.
[2] As last published by the Census Bureau before December 31, 2017
[3] The ICT regulation defines a Joint ZEB Group or Joint Group (13 CCR § 2023.2) as two or more transit agencies that choose to form a group to comply collectively with the ZEB requirements of section 2023.1 of the ICT regulation.

2 EXECUTIVE SUMMARY

2.1 INTRODUCTION

In accordance with the California Air Resource Board's Innovative Clean Transportation regulation, the following report serves as Omnitrans' Rollout Plan to transition its bus fleet to 100 percent zero-emission (ZE) by 2040.

2.2 BACKGROUND

2.2.1 CALIFORNIA AIR RESOURCE BOARD'S INNOVATIVE CLEAN TRANSPORTATION REGULATION

The California Air Resource Board's (CARB) Innovative Clean Transportation (ICT) regulation requires all public transit agencies in the State of California to transition from conventional buses (compressed natural gas, diesel, etc.) to zero-emission buses (battery-electric or fuel cell electric) by 2040. The regulation requires a progressive increase of an agency's new bus purchases to be zero-emission buses (ZEBs) based on their fleet size. By 2040, CARB expects all transit agencies in the state to be operating only ZEBs.

To ensure that each agency has a strategy to comply with the 2040 requirement, the ICT regulation requires each agency, or a coalition of agencies ("Joint Group"), to submit a ZEB Rollout Plan ("Rollout Plan") before purchase requirements take effect. The Rollout Plan is considered a living document and is meant to guide the implementation of ZEB fleets and help transit agencies work through many of the potential challenges and explore solutions. Each Rollout Plan must include a number of required components (as outlined in the Rollout Plan Guidelines) and must be approved by the transit agency's governing body through the adoption of a resolution, prior to submission to CARB.

Omnitrans must comply with the following requirements under the ICT regulation [4]:

- **July 1, 2020 –** Board-approved Rollout Plan must be submitted to CARB
- **January 1, 2023 –** 25 percent of all new bus purchases must be ZE
- **January 1, 2026 –** 50 percent of all new bus purchases must be ZE
- **January 1, 2029 –** 100 percent of all new bus purchases must be ZE
- **January 1, 2040 –** 100 percent of fleet must be ZE
- **March 2021 – March 2050 –** Annual compliance report due to CARB

2.2.2 ZERO-EMISSION BUS TECHNOLOGIES

According to the ICT regulation, a ZEB is a bus with zero tailpipe emissions and is either a battery-electric bus (BEB) or a fuel cell electric bus (FCEB).

BEBs depend on a system to store and retrieve energy much as cars and trucks need fuel. BEBs have multiple battery packs that power an electric motor, resulting in ZE. BEBs, similar to many other battery-powered products,

4 The ICT defines a "Large Transit Agency" as an agency that operates in the South Coast or the San Joaquin Valley Air Basin and operates more than 65 buses in annual maximum service or it operates outside of these areas, but in an urbanized areas with a population of at least 200,000 and has at least 100 buses in annual maximum service. A "Small Transit Agency" is an agency that doesn't meet the above criteria. Each class of transit agency has its own purchase requirements.

must be charged for a period of time to be operational. Currently, BEBs can be charged at the facility, on the route (opportunity charging) and via a number of connectors and dispensers.

A FCEB uses hydrogen and oxygen to produce electricity through an electrochemical reaction to power the propulsion system and auxiliary equipment. This ZE process has only water vapor as a byproduct. FCEB can replace diesel or compressed natural gas (CNG) fuel buses without significant changes to operations and service and functions as a resilient backup alternative in case of natural disaster. The fuel cell is generally used in conjunction with a battery, which supplements the fuel cell's power during peak loads and stores electricity that is recaptured through regenerative braking, allowing for better fuel economy.

While both of these technologies provide ZE benefits, the feasibility and viability of their application is largely based on an agency's service and operational parameters.

2.2.3 OMNITRANS' EXISTING ZERO-EMISSION BUS EFFORTS

Omnitrans is already embracing the prospects of a ZE future and is taking multiple steps to not only meet the requirements of CARB's ICT regulation, but to also provide a cleaner and more sustainable future for the communities that it serves. These efforts include:

- The technical feasibility and viability of Omnitrans adopting and operating an all-ZEB fleet was analyzed in the San Bernardino County Transportation Authority's (SBCTA) *San Bernardino Countywide Zero Emission Bus Study* (herein after referred to as "Master Plan"). The Master Plan serves as a guiding document for the five transit agencies within San Bernardino County (Mountain Area Regional Transit, Morongo Basin Transit Authority, Omnitrans, City of Needles, and Victor Valley Transit Authority) to transition to all-ZEB fleets by 2040. Omnitrans (and other agencies) were instrumental in the Master Plan's development and success. Agencies supported the development of the plan by knowledge sharing, facilitating site visits, and reviewing and providing feedback on the plan and technical documentation.
- In February 2020, Omnitrans purchased four BEBs that are expected to be delivered and operational in 2021.
- Omnitrans is actively engaged with Southern California Edison (SCE) to take advantage of their Charge Ready Program which will provide support on the planning, design, installation, and funding of BEB-supporting infrastructure.
- Omnitrans' future West Valley Connector, a planned bus rapid transit (BRT) project, is currently being developed and Omnitrans, in partnership with SBCTA and WSP, is analyzing the technical feasibility of utilizing ZEBs to serve the line.

2.3 OMNITRANS' PATH TO ZERO-EMISSION BUS ADOPTION

The decision on whether to adopt BEBs and/or FCEBs is largely based on availability, applicability, and costs. Due to rapidly changing technologies, it's highly likely that strategies to adopt ZEBs today may need to be adapted and revised to account for advancements and changes in ZEB technology in the future. The plans presented in the Rollout Plan are subject to alterations and may not necessarily reflect the ultimate implementation strategy of Omnitrans. This Rollout Plan will serve as a guiding document for ZEB implementation, or as a baseline for subsequent studies and implementation towards ZEB adoption pursuant to the ICT regulation.

2.3.1 EXISTING CONDITIONS

Omnitrans is the largest and highest-ridership transit operator in San Bernardino County. Omnitrans served over 11.1 million riders in Fiscal Year 2018-2019, a substantially-higher total than any of the other San Bernardino County transit operators. Omnitrans was established in 1976 through a joint powers agreement, which now includes 15 cities and unincorporated parts of the county.

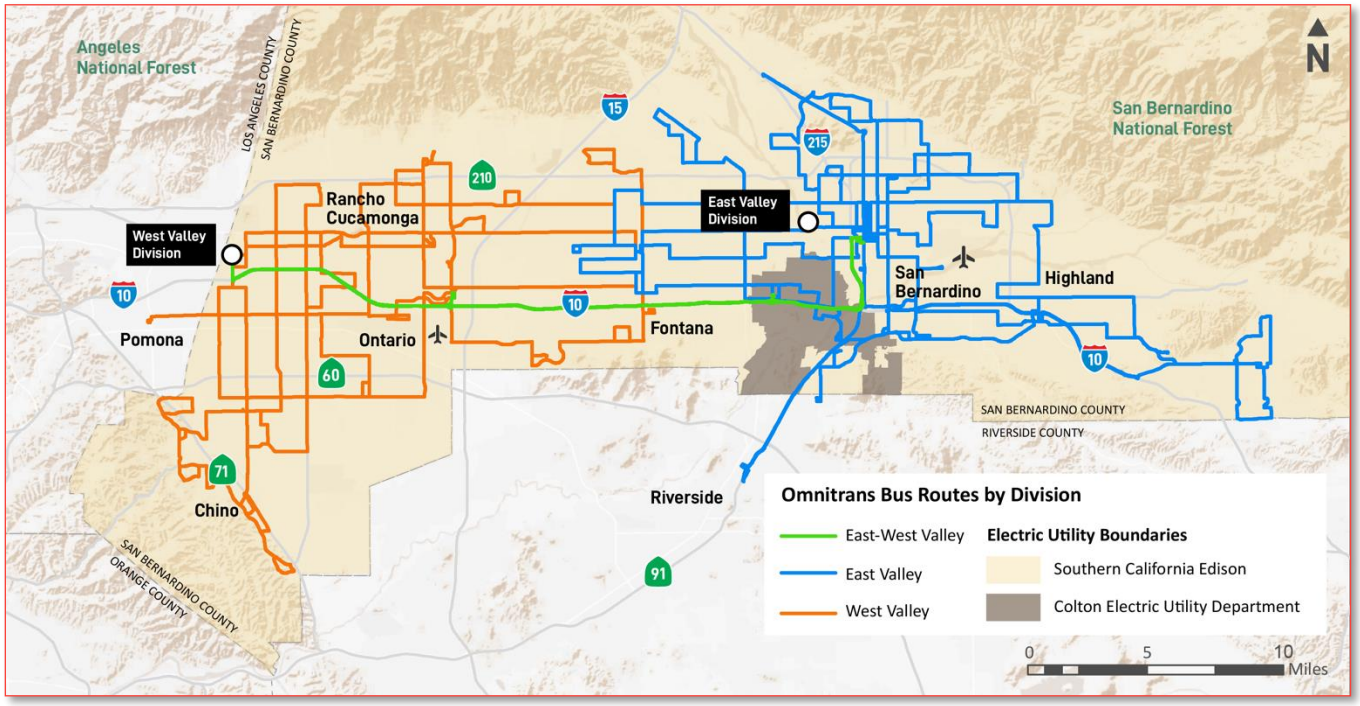
As of April 2020, Omnitrans directly operates 186 CNG-powered buses for fixed-route service. These buses are served by two divisions, the West Valley Division in Montclair, and the East Valley Division in San Bernardino. Table 2-1 summarizes the existing conditions of each division and Figure 2-1 presents the locations and associated routes of each division.

Table 2-1. Existing Conditions Summary

AGENCY	FACILITY	# BUSES	TYPES OF BUSES	FUEL TYPE
Omnitrans	West Valley	71	Standard	CNG
	East Valley	115	Standard; Articulated	CNG

Source: WSP, February 2020

Figure 2-1. Omnitrans Divisions and Routes



Source: WSP, February 2020

2.3.2 PROPOSED ZERO-EMISSION BUS STRATEGIES

Previous and current ZEB analyses have determined that at present, BEBs and supporting infrastructure is the ZEB technology that best meets the needs of Omnitrans for its purchasing and transition requirements pursuant to the ICT regulation.

Based on existing service needs and site configurations, overhead (plug-in and/or pantograph) chargers are proposed at both the West Valley and East Valley divisions. The proposed layout are based on utilizing a 150-kW DC charging cabinet in a 1:2 charging orientation (one DC charging cabinet energizes two separate dispensers/buses). This charger-to-dispenser ratio would meet the requirements to charge Omnitrans' fleet overnight and minimize peak electrical demand.

At this time, the space constraints of the division coupled with the full BEB buildout precludes the feasibility of onsite storage or generation of hydrogen. However, there is a possibility for offsite fueling with the proposed plan. There is also an opportunity to convert to primarily FCEBs, however, Omnitrans recent procurements of BEBs is being used as a baseline for a larger adoption of the technology. That said, Omnitrans remains open to FCEB integration as the technology and market continues to advance. Table 2-2 summarizes the agency's ZEB facility improvements.

Table 2-2. ZEB Strategies Summary

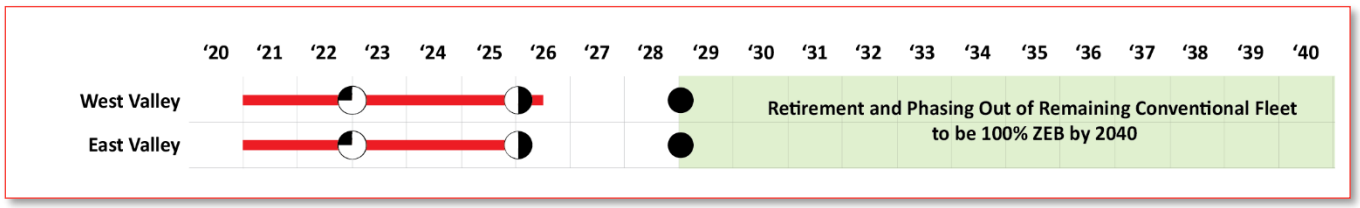
DIVISION	PROPOSED ZEB STRATEGY	BEB	# OF EXISTING BUSES	# OF BUSES SUPPORTED	# OF CHARGERS	# OF DISPENSERS	CHARGER RATING
West Valley	BEB	Overhead-Mounted; Plug-In/Pantograph	71	74	37	74	150 kW
East Valley	BEB	Overhead-Mounted; Plug-In/Pantograph	115	120	60	120	

Source: WSP, February 2020
Note: Chargers are based on a 1:2 ratio (i.e., one charger for two buses).

2.3.3 PHASING AND CONSTRUCTION

The process of integrating ZEBs into Omnitrans' fleet is broken down into a number of important tasks and phases related to construction of supporting facilities. The assumed approach is a design-bid-build strategy. Multiple requests for proposals need to be developed and put out for bid, with accompanying design and construction activities taking place. Utility upgrades, onsite (phased) construction, and other activities are expected to last approximately five years, for each division. Since ZEBs are not operational unless the facilities are in place, it is pertinent to meet construction deadlines because it has the ability to impact both service and ICT regulation compliance. It is assumed that buses can be procured 18 months before the conclusion of the facilities' construction. ICT regulation bus procurement requirements (percentage of new bus acquisitions) are indicated via Harvey Balls in 2023, 2026, and 2029. Figure 2-2 presents the construction schedule for each division and the various milestone purchase requirements pursuant the ICT regulation.

Figure 2-2. Summary of Omnitrans' Construction and Purchase Schedule



Source: WSP, February 2020

2.3.4 START-UP AND SCALE-UP ISSUES

Based on the Rollout Plan, Omnitrans will meet the purchase and reporting requirements pursuant to the ICT regulation. However, it should be noted that the plan assumes a number of factors for this to happen. For instance, it is assumed that existing range issues will be resolved by the time Omnitrans procures buses (i.e., each existing bus will be replaced at a 1:1 ratio). It is also assumed that funding is in place to construct and implement infrastructure in the allotted time.

The following briefly describes some of the challenges that Omnitrans must address or overcome in its adoption of an all ZEB fleet:

- **Operating conditions.** Omnitrans operates in extreme temperatures. Hot summer conditions, in particular, require air conditioning that can rapidly deplete batteries, and thus, range.
- **Range issues.** Omnitrans has many blocks that exceed current BEB *and* FCEB ranges. This means that Omnitrans will have to consider the following strategies to reduce or avoid service disruptions:
  - **Buy more buses.** This can assist with service requirements; however, more buses will require more chargers, more space at the division, and potentially higher utility costs.
  - **Opportunity charging.** This strategy could potentially reduce the costs (per bus) due to a smaller battery requirement, however, it would result in more capital infrastructure and utility costs.
  - **Service changes.** This would require the manipulation of block structure. While the riders may not notice the change, the agency will have to consider the potential impacts to operator and maintenance costs.
- **Technological adaptation.** With the 2040 deadline looming, it is difficult to anticipate future technological enhancements and changes, such as improved batteries and chargers. Slight changes in these technologies could improve bus ranges, in turn, reducing costs. Omnitrans has to be aware of these changes as it would be counterproductive to invest in technologies that will soon be outdated.
- **Costs.** Adoption of ZEBs has many benefits, including potential lifecycle cost savings. However, the investment required for capital and change management will be very expensive. Omnitrans will have to be creative with funding mechanisms and sources to ensure that the transition to ZEB will not be detrimental to its operations and service.
- **Market Production Factors.** The ICT regulation will put a lot of pressure on original equipment manufacturers (OEMs) to produce ZEBs at unprecedented rates. However, it is not only California that is interested in converting to ZEBs. These monumental policy changes will have a great impact on these transitions, however, it will also make it challenging to meet ZEB goals for Omnitrans if the supply of buses cannot meet demand.

2.3.5 NEXT STEPS

The process to transition to ZEBs should and will be iterative to minimize risk, but also to accommodate new developments in a rapidly evolving market. Omnitrans will use the information outlined in both the Rollout Plan and Master Plan to identify and further refine the following:

- **Determination of the proper mix of BEBs and FCEBs.** Both the Rollout Plan and the Master Plan address and analyze Omnitrans' unique operational conditions to determine paths forward toward 100 percent ZEB adoption. The recommendations contained herein address what the WSP team believes is the most feasible and cost-effective means of implementation. However, Omnitrans will have to re-address these issues and determine whether these recommendations regarding feasibility based on costs, service requirements, and availability have changed as Omnitrans transitions to ZEBs.
- **Address incomplete service blocks.** The WSP team's analysis has revealed that many blocks cannot be completed when considering BEBs and FCEBs, meaning, Omnitrans will have to determine if they're going to file exemptions (under ICT regulation), purchase additional buses, restructure service to suit technological limitations, or invest in opportunity charging. These choices are rooted in Omnitrans' policies and plans outside of ZEB considerations.
- **Costs refinement.** Construction, capital, operating, and maintenance costs vary based on a number of factors. It will be important to get an understanding of the up-front costs and lifecycle costs and savings of investing in ZEBs. The WSP team developed cost estimates (presented in the Master Plan) and Omnitrans will need to revisit these estimates to determine if pricing has changed and make implementation changes, such as changes in their purchasing schedules, accordingly.
- **Explore collaboration opportunities.** Whether purchasing vehicles via CalACT or strategizing on a joint agreement for opportunity charging, Omnitrans can continue to maximize their outcomes by engaging with other regional and local agencies. It is important for Omnitrans to continue to participate in groups such as the Zero-Emission Bus Resource Alliance (ZEBRA) working group, California Transit Association (CTA) and the state's chapter of the Association for Commuter Transportation (ACT), the American Public Transportation Association's (APTA) Bus Technology Committee, and other industry working groups.
- **Engage utilities.** Whether adopting BEBs or FCEBs, there is a good chance that the amount of power at the yard is either insufficient or needs to be adapted to these new technologies. While procuring buses and installing chargers may be relatively straightforward, the process and protocols associated with electrical enhancements on the utility side can be complex. Therefore, it is recommended that Omnitrans continues to engage with SCE to ensure that they can meet critical deadlines.
- **Consider pilot opportunities.** At this time, Omnitrans is able to commit to BEB and/or FCEBs. Since four BEBs are currently on order, it will be easy for Omnitrans to pilot and gauge the performance of a BEB on its routes. However, it may be of interest to engage FCEB OEMs and/or peer agencies that operate FCEBs to collaborate on a pilot project.

3 INTRODUCTION

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3.1 BACKGROUND

3.1.1 CALIFORNIA AIR RESOURCE BOARD'S INNOVATIVE CLEAN TRANSPORTATION REGULATION

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To ensure that each agency has a strategy to comply with the 2040 requirement, the ICT regulation requires each agency, or a coalition of agencies ("Joint Group"), to submit a ZEB Rollout Plan ("Rollout Plan") before purchase requirements take effect. The Rollout Plan is considered a living document and is meant to guide the implementation of ZEB fleets and help transit agencies work through many of the potential challenges and explore solutions. Each Rollout Plan must include a number of required components (as outlined in the Rollout Plan Guidelines) and must be approved by the transit agency's governing body through the adoption of a resolution, prior to submission to CARB.

According to the ICT regulation, each agency or Joint Group's requirements are based on its classification as either a "Large Transit Agency" or a "Small Transit Agency". The ICT defines a Large Transit Agency as an agency that operates in the South Coast or the San Joaquin Valley Air Basin and operates more than 65 buses in annual maximum service or it operates outside of these areas, but in an urbanized area with a population of at least 200,000 and has at least 100 buses in annual maximum service. A Small Transit Agency is an agency that doesn't meet the above criteria.

Omnitrans is categorized as a "Large Transit Agency" under the ICT regulation and must comply with the following requirements [5]:

- **July 1, 2020 –** Board-approved Rollout Plan must be submitted to CARB
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5 The ICT defines a "Large Transit Agency" as an agency that operates in the South Coast or the San Joaquin Valley Air Basin and operates more than 65 buses in annual maximum service or it operates outside of these areas, but in an urbanized areas with a population of at least 200,000 and has at least 100 buses in annual maximum service. A "Small Transit Agency" is an agency that doesn't meet the above criteria. Each class of transit agency has its own purchase requirements.

3.1.2 OMNITRANS

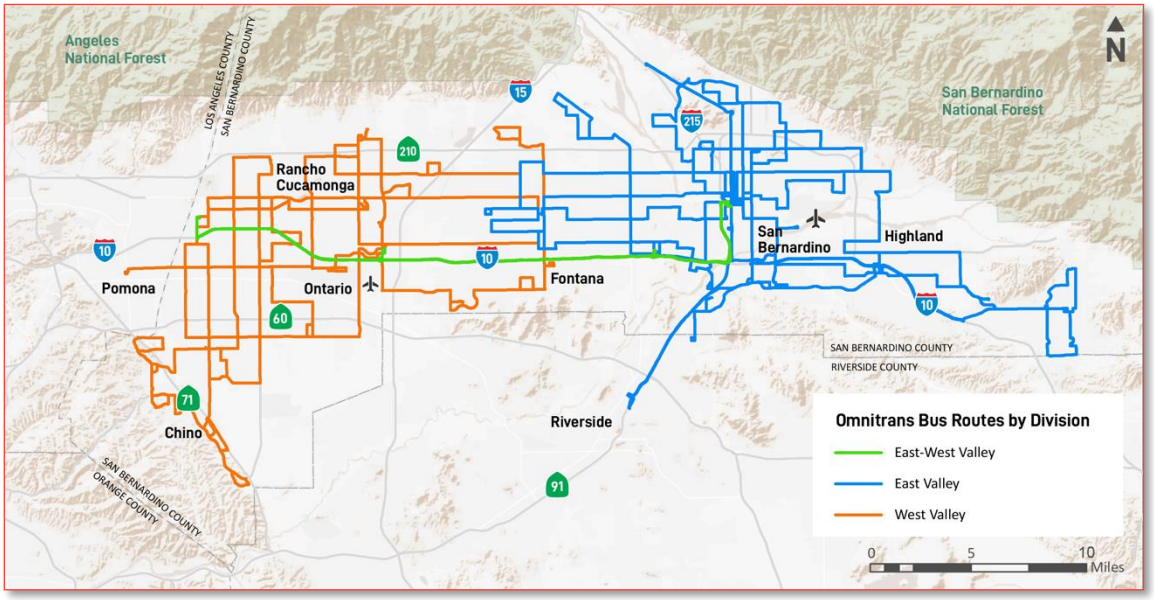
Omnitrans is the largest and highest-ridership transit operator in San Bernardino County. Omnitrans served over 11.1 million riders in Fiscal Year 2018-2019, a substantially-higher total than any of the other San Bernardino County transit operators. Omnitrans was established in 1976 through a joint powers agreement, which now includes 15 cities and unincorporated parts of the county.

SERVICE AREA

Omnitrans serves the urbanized area referred to as the San Bernardino Valley, south of the San Bernardino Mountains, which has a population of approximately 1.7 million and includes the cities of Chino, Chino Hills, Colton, Fontana, Grand Terrace, Highland, Loma Linda, Montclair, Ontario, Redlands, Rialto, San Bernardino, Upland, Rancho Cucamonga, Yucaipa, and portions of unincorporated areas of the County of San Bernardino. The service area includes Ontario and San Bernardino airports, several Metrolink and Amtrak stations, as well as connections to several other regional bus transit authorities: Foothill Transit, Riverside Transit Authority, Mountain Transit (MT), Victor Valley Transit Authority (VVTA), and Pass Transit (Beaumont and Banning); and a connection with Sunline (Palm Springs area) will begin in May 2020.

Omnitrans' service is organized into two divisions: East Valley Division, which serves the cities of Colton, Fontana, Grand Terrace, Highland, Loma Linda, Redlands, Rialto, San Bernardino, Yucaipa and unincorporated areas of the County; and West Valley Division, which serves the cities of Chino, Chino Hills, Fontana, Montclair, Ontario, Rancho Cucamonga, Upland, and unincorporated areas of the County. There are also two smaller division locations that Omnitrans currently uses primarily for paratransit vehicles.

Figure 3-1. Omnitrans Service Area



Source: WSP, February 2020

ENVIRONMENTAL FACTORS

The San Bernardino Valley area is typical of Southern California in terms of environmental conditions. With a hot-summer Mediterranean climate, average high temperatures that peak in August at 96 degrees; December is the

coldest average month with a 41-degree average low. During the fall, the region is particularly affected by the Santa Ana winds, bringing higher temperatures and increased risk of wildfires.

SCHEDULE AND OPERATIONS

Omnitrans operates 34 bus routes across four types of service: standard intercity routes, BRT, freeway express, and local shuttles (Table 3-1). Routes in Omnitrans' system connect at several transit centers, which are off-street facilities, and transfer centers, which are on-street stops with multiple routes. The transit centers Omnitrans uses include: Chaffey College Transit Center, Chino Transit Center, Fontana Transit Center (Metrolink), Montclair Transit Center (Metrolink), Pomona Transit Center (South Pomona Metrolink), Riverside Metrolink, San Bernardino Transit Center (Metrolink), and Yucaipa Transit Center. Omnitrans does not own or operate any transit center or transfer center with the exception of the San Bernardino Transit Center.

Table 3-1. Omnitrans Summary of Routes

COMMUNITY	ROUTES
Bloomington	19, 29
Chino	81, 83, 84, 85, 88, OmniGo 365
Chino Hills	88, OmniGo 365
Colton	1, 15, 19, 22, 215, 290
Fontana	10, 14, 15, 19, 20, 29, 61, 66, 67, 82
Grand Terrace	OmniGo 325
Highland	3, 4, 15
Loma Linda	sbX Green Line, 2, 8, 19, OmniGo 325
Mentone	8
Montclair	66, 85, 88, 290
Ontario	61, 80, 81, 82, 83, 86, 290
Pomona	61
Rancho Cucamonga	61, 66, 67, 80, 81, 82, 85
Redlands	8, 15, 19, 208
Rialto	10, 14, 15, 19, 22
San Bernardino	sbX Green Line, 1, 2, 3 & 4, 5, 7, 8, 10, 11, 14, 15, 208, 215, 290
Upland	66, 83, 84, 85
Yucaipa	8, 19, 208, OmniGo 308/309/310

Source: WSP, February 2020

The vast majority of Omnitrans' routes operate daily. Most routes operate with limited service on Saturday, and service is further limited on Sundays. All but two standard routes operate on Saturday; a select few do not operate on Sunday.

All single- and double-digit routes are standard intercity routes. These routes range from seven to 30 thirty miles in route length. The 200-level routes are freeway express routes, serving Interstate 10 and Interstate 215 corridors with limited stops; these routes are also generally longer than the intercity routes. Lastly, the 300-level routes are OmniGo shuttles, which use smaller vehicles to travel short, circular routes in the communities of Yucaipa, Grand Terrace, and Chino Hills.

Omnitrans' only current BRT service is the sbX Green Line, which travels along the E Street Corridor between Cal State University San Bernardino and Loma Linda University and Medical Center. Five of the sbX Green Line's 16

miles are in dedicated bus lanes. Omnitrans has a planned future system of 10 BRT routes; SBCTA is currently leading the final design of the West Valley Connector bus rapid transit line, expected to start operation in 2024, and will provide service in the cities of Montclair, Ontario, Pomona, and Rancho Cucamonga. See Section 3.2.3 for additional details.

3.2 EXISTING ZEB PLANS, PROCUREMENTS, AND PROJECTS

3.2.1 SAN BERNARDINO COUNTY TRANSPORTATION AUTHORITY'S COUNTYWIDE ZERO-EMISSION BUS STUDY

In April 2019, SBCTA issued a contract task order to WSP USA, Inc. to conduct an analysis to determine the best path forward for the City of Needles, MT, Morongo Basin Transit Authority (MBTA), Omnitrans, and VVTA, respective of the ZEB transition pursuant to the ICT regulation.

The goals of the analysis are three-fold for each agency:

1. Determine the most cost-effective approach to a 100 percent ZEB fleet
2. Determine the capital improvements required to support ZEB fleets
3. Provide a financing and purchasing strategy to acquire ZEBs in accordance with the ICT regulation

The overall results of WSP's analysis will be presented in two documents, a Countywide Rollout Plan and the *San Bernardino Countywide Zero Emission Bus Study* (herein after referred to as "Master Plan"), The Rollout Plan serves as each agency in San Bernardino's compliance document per CARB's ICT regulation[6]. The Master Plan is a preliminary planning document that supports each agency in its implementation goals.

The Master Plan is considered a living document and is iterative in nature due to rapid technological development and changes within the ZEB market.

3.2.2 EXISTING ZERO-EMISSION BUS PROCUREMENTS

In February 2020, Omnitrans awarded a purchase order to New Flyer of America, Inc. for the provision of four 40-foot BEBs (expected delivery in 2021). To support these vehicles, Omnitrans is actively engaged with the utility, Southern California Edison (SCE). SCE's Charge Ready Program will provide the agency with support on the planning, design, installation, and funding of BEB-supporting infrastructure at Omnitrans' East Valley and West Valley divisions.

3.2.3 WEST VALLEY CONNECTOR

The West Valley Connector is a BRT project that proposes limited stops, providing speed and quality improvements to the public transit system within the corridor. Among the numerous benefits, BRT provides premium transit with 10-15-minute headways, Transit Signal Priority, dedicated lanes, enhanced stations and integration with other bus routes.

The project seeks to improve mobility in the San Bernardino Valley with an enhanced, state-of-the-art BRT system to address the growing traffic congestion and the projected one million increase in population by 2030. Omnitrans,

6 Omnitrans was analyzed separately since as a "Large Transit Agency" they are required to submit in 2020. The four other agencies included in the Countywide Rollout Plan are not required to submit a Rollout Plan until 2023, therefore, they may opt to file individually (using their respective section in the Countywide Rollout Plan), or receiving individual Board approvals to submit as a "Joint Group".

in partnership with SBCTA and WSP, is currently analyzing the feasibility of utilizing BEBs or FCEBs to serve the West Valley Connector.

3.3 ROLLOUT PLAN APPROACH

Pursuant to the ICT regulation, the Rollout Plan identifies a strategy for Omnitrans to procure and operate all ZEBs by 2040. Due to the rapidly-evolving nature of ZEB technologies, it is possible that the findings and recommended approaches in this report will be outdated when it is time for implementation. For that reason, several generous assumptions were included to account for technological advancements. For example, current BEB technology is not sufficient to meet the range requirements of all of Omnitrans' service blocks. To account for potential future improvements, the Rollout Plan assumes that battery technology will eventually meet the requirements of Omnitrans, therefore, a 1:1 (conventional bus to ZEB) replacement ratio was used to account for future ZEB bus procurements and facility enhancements. This approach ensures that Omnitrans is planning for the future and not conforming to or purchasing infrastructure that will only be compatible with existing technologies. To account for potential fleet increases, facilities are planned and designed for maximum build-out to ensure that enough ZEB infrastructure is in place for fleet expansion.

The *Start-Up and Scale-Up Challenges* section identify the barriers that may prohibit or make these full-buildout scenarios difficult to achieve. These challenges will serve as the springboard for refinements and strategies in the next stages of implementation.

3.4 ROLLOUT PLAN PURPOSE AND STRUCTURE

In accordance with CARB's Rollout Plan Guidance, the Rollout Plan provides an overview of several key components to Omnitrans' ZEB transition, including, but not limited to, fleet acquisitions, facilities and infrastructure enhancements, implementation schedule, personnel training, and funding considerations.

The Rollout Plan is structured as follows:

1. **Introduction** *Details the ICT regulation and provides background on Omnitrans.*
2. **Fleet and Acquisitions** *Presents the existing fleet and procurement plan for buses through 2040.*
3. **Facilities and Infrastructure Modifications** *An overview of each division and the proposed ZEB modifications.*
4. **Disadvantaged Communities** *Discusses the disadvantaged communities (DACs) that will be impacted by the ZEB transition.*
5. **Workforce Training** *Provides background on personnel training requirements for ZEB implementation.*
6. **Costs and Funding Opportunities** *Discusses rough order of magnitude costs and potential funding sources.*
7. **Start-Up and Scale-Up Challenges** *Provides an understanding of challenges and issues that will need to be mitigated or addressed towards ZEB adoption.*

4 FLEET ACQUISITIONS

The following section provides an overview of Omnitrans' existing bus fleet, justification for ZEB technology, and a ZEB procurement schedule through 2040.

4.1 EXISTING BUS FLEET

As of April 2020, Omnitrans directly operates 186 compressed natural gas (CNG)-powered buses for fixed-route service. Table 4-1 presents a summary of Omnitrans' existing bus fleet.

Table 4-1. Summary of Omnitrans' Existing Bus Fleet

MANUFACTURER	SERIES	FUEL TYPE	LENGTH	IN SERVICE YEAR	BUS TYPE	NUMBER OF BUSES
New Flyer	C40LF*	CNG	40'	2003	Standard	4
	XN40	CNG	40'	2009	Standard	27
		CNG	40'	2011	Standard	17
		CNG	40'	2012	Standard	20
		CNG	40'	2014	Standard	16
		CNG	40'	2015	Standard	15
		CNG	40'	2016	Standard	13
		CNG	40'	2018	Standard	24
		CNG	40'	2019	Standard	23
	XN60	CNG	60'	2012	Standard	14
		CNG	60'	2018	Standard	1
					Total Buses	**186**

Note: *There are an additional 12 C40LF's that serve as Omnitrans' contingency fleet.
Source: Omnitrans, April 2020

4.2 ZEB TECHNOLOGY APPLICATION

Past and ongoing ZEB analysis for Omnitrans' operations has determined that BEB adoption is the ZEB technology that best meets the needs of Omnitrans for their purchasing and transition requirements pursuant to the ICT regulation. However, Omnitrans remains open to FCEB integration as the technology and market continues to advance. The following provides an overview of overarching specifications for each ZEB type that Omnitrans is considering in their transition.

4.2.1 BATTERY-ELECTRIC BUS

Omnitrans' future BEBs are expected to have specifications that are compatible with the Society of Automotive Engineers' (SAE) J1772 (plug-in) and SAE J3105 (pantograph) charging standards. By supporting both standards, Omnitrans' buses will have flexibility in charging in multiple layouts. The plug-in standard will allow buses to charge at the base (overnight) and while being serviced, and the pantograph standard will allow buses to charge at the base and at potential on-route charging stations. The roof-mounted charging rails that are associated with the pantograph standard will allow a BEB to access high-power charging (200-600 kW) (Figure 4-2).

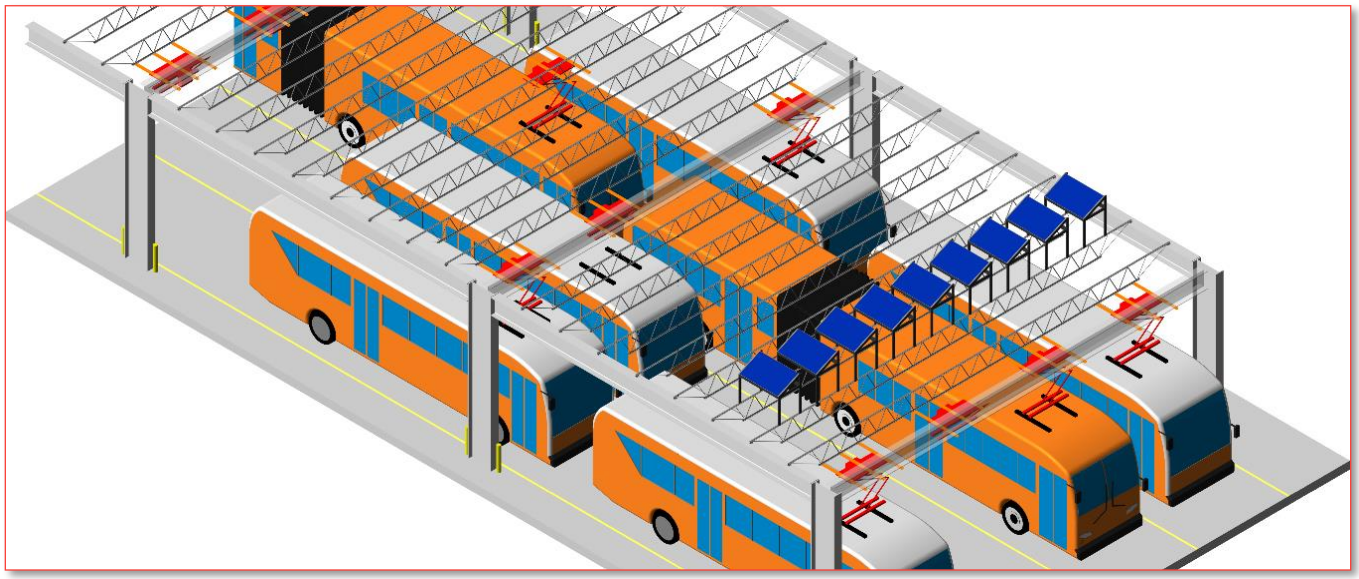
Based on Omnitrans' existing service needs and site configurations, it is recommended that an overhead-mounted (pantograph and/or plug-in) charging strategy be implemented to support BEBs at both West Valley and East Valley divisions. The dispensers will be supported by an overhead frame that will cover the surface of the bus parking tracks. This overhead strategy is due to space constraints at both divisions. The overhead frame can also support photovoltaic panels and electrical equipment and components (conduit, etc.).

The proposed facility layouts for each division are based on utilizing a 150-kW DC charging cabinet in a 1:2 charging orientation (one DC charging cabinet energizes two separate dispensers/buses). This charger to dispenser ratio maximizes space utility, reduces costs, and meets the requirements to charge the fleet during servicing and dwell time on the site while minimizing the peak electrical demand. However, Omnitrans is currently exploring other strategies that may require less power and space, such as a 1:3 charging orientation.

Inductive (wireless) charging for BEBs is also a future consideration, however, this technology is still very expensive, and has yet to be deployed on a large scale to prove its viability for fleet operations.

Based on current site circulation and configurations, all plug-in ports shall be at the rear of the bus. The following figures illustrated the various BEB connection types that Omnitrans is considering. Figure 4-1 presents a conceptual pantograph charger with supporting frame.

Figure 4-1. Overhead-Mounted Pantograph Charger



Note: The frame can also support plug-in dispensers, however, they will have to be situated above the rear of the bus to be compatible with some OEMs.
Source: WSP, March 2020

Figure 4-2. Inverted Pantograph and Charge Rails

Source: WSP, March 2020

4.2.2 FUEL CELL ELECTRIC BUS

For the specific routes which route-modeling has identified as not capable of being served by existing BEB technology, it is recommended that FCEBs be considered. If FCEBs are integrated into the fleet, they should be fueled at a future commercial or public hydrogen fueling station located in either Ontario or Chino. Based on the recommended BEB strategy, onsite storage or generation is infeasible due to space constraints, however, if plans are revised, onsite solutions may be deemed feasible.

On-site liquid storage (delivered by truck) is a consideration dependent upon space constraints. Alternatively, an on-site electrolyzer that generates hydrogen from water, could be used to eliminate the need to deliver hydrogen to the site. Note that while possible to self- generate, the available space at both Omnitrans' sites do not allow for a large enough electrolyzer to generate more hydrogen than could be used to fill four to six FCEBs, daily (assumption of 37 kilograms per bus at 350 bar).

Even with technical feasibility, there are a number of risks and potential community concerns that would need to be addressed and mitigated with both on-site hydrogen production and/or storage before integration.

4.3 PROCUREMENT SCHEDULE

In accordance with the ICT regulation, Omnitrans will prioritize ZEB purchases and progressively increase the percentage of ZEB purchases over time. Based on initial analysis, the last CNG bus is expected to be purchased in 2028. All new buses purchases are anticipated to be ZEB starting in 2029, in accordance with the ICT regulation.

Early retirement should not be an issue pursuant to the ICT regulation based on Omnitrans' assumed procurement schedule. However, if it becomes an issue, Omnitrans will deploy a number of strategies to ensure that buses fulfill their "useful life". One potential strategy is to place newly acquired buses on Omnitrans' longest (distance) blocks of service. This will ensure that these buses meet their distance-based useful life requirement more rapidly.

Omnitrans' existing fleet consists of 186 buses. Assuming a 1:1 replacement ratio, each existing bus will eventually be replaced with an equivalent BEB or FCEB. However, the number of ZEBs required may increase with time based on service requirements.

Table 4-2 presents a summary of Omnitrans' anticipated bus procurements through 2040. Years 2023, 2026 and 2029 are highlighted because these indicate when Omnitrans' new purchases should be 25 percent, 50 percent, and 100 percent ZEB, respectively.

Table 4-2. Summary of Omnitrans' Future Bus Purchases (through 2040)

		ZERO-EMISSION BUSES				CONVENTIONAL (CNG) BUSES			
YEAR	TOTAL BUSES	NUMBER	PCT.	BUS TYPE	FUEL TYPE	NUMBER	PCT.	BUS TYPE	FUEL TYPE
2020*	**4**	4	100%	40'	BEB	0	0%	-	-
2021	**0**	0	0%	-	-	0	0%	-	-
2022	**0**	0	0%	-	-	0	0%	-	-
2023	**0**	0	0%	-	-	0	0%	-	-
2024	**0**	0	0%	-	-	0	0%	-	-
2025	**31**	8	26%	40'	BEB	23	74%	40'	CNG
2026	**34**	17	50%	40'/60'	BEB	17	50%	40'/60'	CNG
2027	**0**	0	0%	-	-	0	0%	-	-
2028	**16**	8	50%	40'	BEBs/FCEBs	8	50%	40'	CNG
2029	**15**	15	100%	40'	BEBs/FCEBs	0	0%	-	-
2030	**13**	13	100%	40'	BEBs/FCEBs	0	0%	-	-
2031	**0**	0	0%	-	BEBs/FCEBs	0	0%	-	-
2032	**29**	29	100%	40'/60'	BEBs/FCEBs	0	0%	-	-
2033	**23**	23	100%	40'	BEBs/FCEBs	0	0%	-	-
2034	**0**	0	0%	-	BEBs/FCEBs	0	0%	-	-
2035	**0**	0	0%	-	BEBs/FCEBs	0	0%	-	-
2036	**0**	0	0%	-	BEBs/FCEBs	0	0%	-	-
2037	**8**	8	100%	40'	BEBs/FCEBs	0	0%	-	-
2038	**17**	17	100%	40'/60'	BEBs/FCEBs	0	0%	-	-
2039	**23**	23	100%	40'	BEBs/FCEBs	0	0%	-	-
2040	**33**	33	100%	40'/60'	BEBs/FCEBs	0	0%	-	-

Note: CNG buses assumed to be replaced after 14 years in service and BEBs assumed to be replaced after 12 years in service.
In February 2020, Omnitrans procured their first four BEBs
Source: WSP, February 2020

4.3.1 ZEB RANGE REQUIREMENTS AND COSTS

Omnitrans operates 334 blocks during weekdays, 296 of which are longer than 100 miles. Omnitrans' longest block is approximately 410 miles. Depending on operational parameters, including operator behavior, ambient temperature, traffic, and ridership, these ranges may be unattainable or difficult to achieve on certain days. Based

on existing routes, Omnitrans will only be able to support BEB on a 1:1 ration until 2028 (pending advancements in the technology). If vehicle manufacturers cannot meet these range requirements after 2028, Omnitrans will consider a number of strategies to supplement onboard battery storage, including additional buses, midday charging, battery/charging management systems, and solar and battery storage. As mentioned, in future ZEB applications, Omnitrans will also consider FCEBs, especially if battery technology doesn't advance as forecasted.

4.3.2 ZEB CONVERSIONS

Conventional bus conversions to ZEB technologies are not currently being considered at this time. However, Omnitrans will remain open to conversions if they are deemed financially feasible and align with ZEB adoption goals.

5 FACILITIES AND INFRASTRUCTURE MODIFICATIONS

The following section details the planned charging strategies, infrastructure, detailed division improvements, and construction and phasing schedule.

5.1 METHODOLOGY

Since ZEB technology continues to evolve, it is difficult to commit to a costly strategy that may become outdated or obsolete in the future. However, it is also pertinent to ensure that strategies are future-ready. For this reason, the recommended facility and infrastructure modifications are based on what can physically be accommodated at each division. This provides Omnitrans with a ceiling for what can physically be constructed and worst-case scenario for electric utility planning. Since service changes and bus movements may occur multiple times a year, by establishing a full-build scenario, Omnitrans can optimize, and tailor strategies based on existing (or anticipated) service.

As previously mentioned, the current path forward for Omnitrans is all BEB, however, the analysis of FCEB feasibility is ongoing. In anticipation of future FCEB integration, a hydrogen storage footprint was established at each division where vehicles and space can support it.

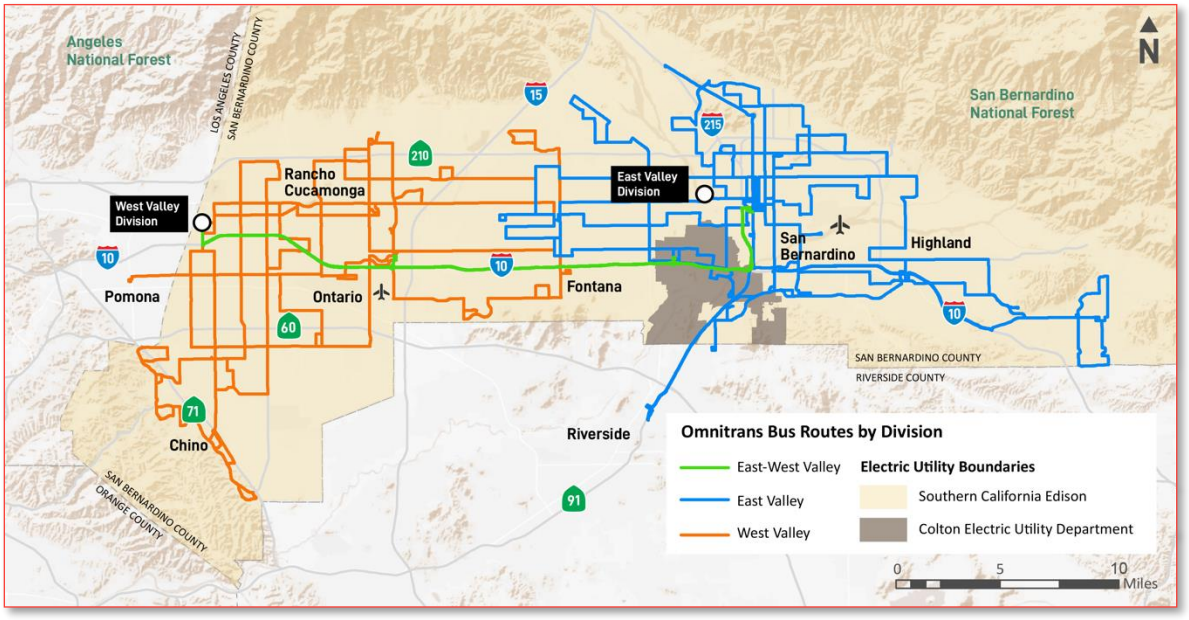
5.2 FACILITY MODIFICATIONS

Omnitrans' transition to ZE technologies will require a number of modifications and changes to existing infrastructure and operations. This will include the enhancements and expansions of electrical equipment, additional electrical capacity, and the installation of BEB chargers, dispensers, and other components. These modifications will occur at Omnitrans' two divisions, the West Valley Division in City of Montclair, and the East Valley Division in the City of San Bernardino. Opportunity for on-route charging is also being considered and being analyzed at potential transit centers and layover locations.

Based on existing service needs and site configurations, overhead (plug-in and/or pantograph) chargers are proposed at both the West Valley and East Valley divisions. The proposed layout are based on utilizing a 150-kW DC charging cabinet in a 1:2 charging orientation (one DC charging cabinet energizes two separate dispensers/buses). This charger to dispenser ratio would meet the requirements to charge Omnitrans' fleet overnight and minimize peak electrical demand.

Figure 5-1 illustrates the location of Omnitrans' divisions and Table 5-1 summarizes the modifications and schedule of each division.

Figure 5-1. Omnitrans' Base Locations



Source: WSP, February 2020

Table 5-1. Omnitrans' Division Summary

GARAGE	ADDRESS	MAIN FUNCTIONS	PLANNED INFRASTRUCTURE	SERVICE CAPACITY	UPGRADES REQ'D?	TIMELINE
West Valley	4748 E. Arrow Hwy. Montclair, CA	Fueling, Storage, and Maintenance	Overhead Pantograph or Plug-In Charging	74 buses	Yes	2021-2026
East Valley	1700 W. 5th St. San Bernardino, CA	Fueling, Storage, and Maintenance	Overhead Pantograph or Plug-In Charging	120 buses	Yes	2021-2026

Source: WSP, February 2020

The following sections detail the process of each division's transition from existing conditions to BEB-readiness.

5.2.1 WEST VALLEY DIVISION

EXISTING CONDITIONS

West Valley Division is located at 4748 E. Arrow Highway in the City of Montclair. The division has an assumed maximum bus capacity of 74 buses with electrical service provided by SCE.[7]

Currently, 71 CNG-powered buses are stored, maintained, fueled, and serviced at the division. The division includes the following separate structures and major site areas: A one-story maintenance building, one-story transportation building, stand-alone wash building, stand-alone fuel building, an employee parking lot on Arrow Highway, and a CNG compressor yard with support equipment.

Buses enter from Arrow Highway and park in the yard before undergoing service. Individual buses are then taken by nightly service staff to the fuel lanes for fare retrieval and fueling before pulling forward to the bus wash lanes.

7 It is assumed that the West Valley Division is supported by a 12 KV line, which can support approximately 8.3 MW of peak power. It is likely that this circuit supports more than West Valley, though. In order to determine the specific amount of power available and the means to get it to the division, a method of service study needs to be conducted by SCE.

After fuel and wash, buses are circulated back into the bus parking tracks, parking in either herringbone or angled configurations. The interiors of the buses are cleaned during the fueling process. Once re-parked after nightly service, buses remain parked in-place until morning pull out unless a maintenance issue has been identified.

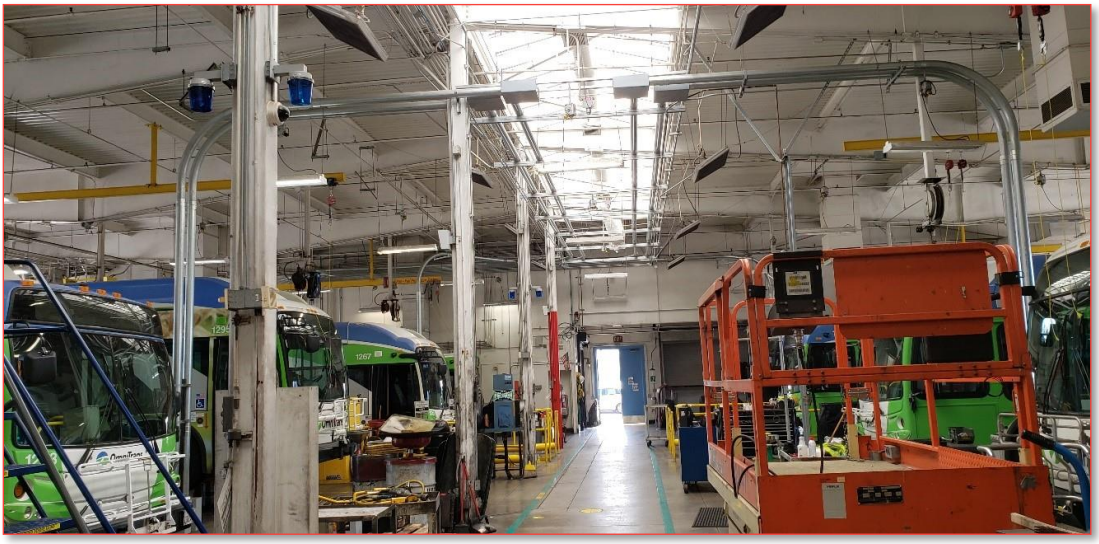
All bus parking tracks are approximately 13-feet wide and buses are assigned to specific spaces. Non-revenue vehicles (NRVs) are parked in a row of spaces along the western edge of the bus parking spaces. Additionally, battery electric NRV's are parked and charge along the eastern wall of the maintenance facility.

According to Omnitrans, a new overhead transformer and a 600-amp service meter along with two power cabinets and four depot charge boxes will be installed in the north west corner of the yard for the first four BEBs (expected delivery in 2021). This is part of the SCE Charge-Ready Transport program.

Figure 5-2. West Valley Division - Existing Conditions

Source: Google Earth, February 2020

Figure 5-3. West Valley Division's Maintenance Bays



Source: WSP, February 2020

PLANNED ZEB MODIFICATIONS

It is recommended that the West Valley division adopt an overhead platform-mounted retractor cord DC plug-in or overhead pantograph charging solution. With this approach, the West Valley division is capable of parking 74 buses (max capacity of the division) with 74 charging positions in a 1:2 charger to bus dispenser ratio. Ground-mounted charging cabinets and dispensers are not recommended for West Valley as they would create a significant reduction in bus parking capacity due to parking losses to accommodate ground-mounted charging equipment.

Table 5-2 summarizes the ZEB infrastructure planned at the West Valley division.

Table 5-2. West Valley Division Supporting Infrastructure Summary

DIVISION	CHARGING STRATEGY	# OF EXISTING BUSES	# OF BUSES SUPPORTED	# OF CHARGERS	# OF DISPENSERS	CHARGER RATING
West Valley	Overhead Plug-in or Pantograph	71	74	37	74	150 kW

Source : WSP, February 2020

The following BEB equipment and locations are proposed:

— 37 ground-mounted DC charging cabinets located at both ends of the proposed overhead support structures. Distribution to 74 retractor cord plug-in dispenser (or pantograph) charging positions mounted from overhead support structures in a new 45-degree track parking layout.

— Dispensers are located for connecting to the rear of the bus to reduce the length of support structure at the rear of the parking tracks in order to maintain bus turning clearances.

— The overhead support structure columns are to be placed every three to four tracks. These columns will also provide the mounting space for retractor cord controls to be installed to control each overhead dispenser's charging cable position for a plug-in option, or to support overhead mounted pantographs.

The plug-in charging dispensers (or pantographs) and charging cabinets will be served by the following electrical infrastructure:

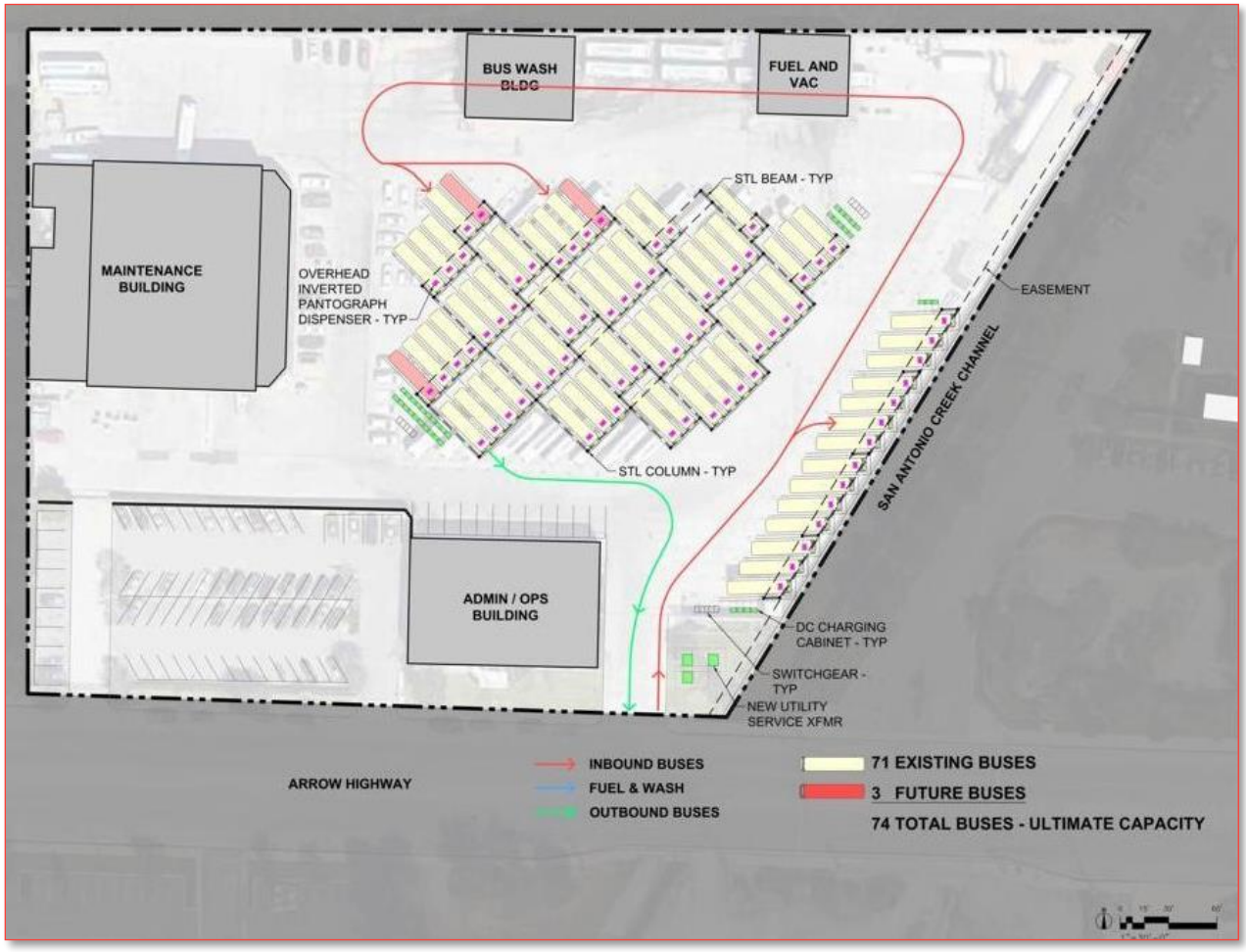
— Three medium voltage utility service transformers in a new utility yard in the open space south of the existing parking yard and east of the site entrance.

— Three sets of switchgear will be located near the proposed overhead support structures to reduce long-distance medium voltage conduit runs.

If FCEBs are to be integrated in the future (using the proposed configuration), it is recommended that offsite commercially available hydrogen fueling stations be utilized. Required clearances around liquid hydrogen storage exceed what the current site configuration is able to accommodate, making onsite hydrogen fueling infeasible at this time.

Figure 5-4 illustrates the West Valley Division at full build-out.

Figure 5-4. West Valley Division – Full ZEB Build-Out



Source: WSP, March 2020

PHASING AND CONSTRUCTION STRATEGY

The process of integrating ZEBs into Omnitrans' fleet is broken down into a number of important tasks and phases related to construction of supporting facilities. The assumed approach is a design-bid-build strategy. Multiple

requests for proposals (RFPs) need to be developed and put out for bid, with accompanying design and construction activities taking place. Utility upgrades, onsite (phased) construction, and other activities are expected to last approximately five years, for each division. This five years is a conservative estimate based on the amount of time it will take the utility to provide upgraded electrical equipment *outside* of the division. The onsite upgrades and construction of BEB supporting infrastructure can be done concurrently.

To minimize or avoid operational or service impacts, it is recommended that onsite construction be implemented in phases. This method essentially segments the yard and ensures that construction continues without completely shutting down the division.

Since ZEBs are not operational unless the facilities are in place, it is pertinent to meet construction deadlines because it has the ability to impact both service and ICT regulation compliance. It is assumed that buses can be procured 18 months before the conclusion of the facilities construction.

The following provides details on recommended phasing for the West Valley division.

PHASE 1

The recommended first phase of charger installation the for the West Valley Division is to install all of the in-ground conduit to route electrical service from the new electrical yard to seven charging cabinets with 14 overhead plug-in (or pantograph) dispensers mounted to the new overhead support structure on the eastern boundary of the yard.

PHASE 2

Phase 2 at West Valley will consist of yard trenching to distribute electrical service to the northern yard parking area and construct the overhead support structure over 30 bus positions and dispensers for an additional 20 charging positions.

PHASE 3

Phase 3 at West Valley will complete yard trenching to distribute to electrical service to the southern yard parking grouping and the remainder of the overhead support structure and remaining dispensers.

5.2.2 EAST VALLEY DIVISION

EXISTING CONDITIONS

East Valley Division is located at 1700 West 5th Street in the City of San Bernardino. The division has an assumed maximum bus capacity of 120 buses with electrical service provided by SCE.[8]

Currently, 115 CNG-powered buses are stored, fueled, and serviced at the division. The East Valley facility includes the following separate structures and major site areas: A two-story maintenance building, two-story transportation building, stand-alone wash building, stand-alone fuel building, an employee parking lot, and a CNG compressor yard with support equipment. Employee parking is on site in the employee parking lot along 5th Street or the satellite employee parking, which is off Medical Center Drive.

Buses enter from Medical Center Drive and park facing west in the yard before undergoing service. Individual buses are then taken by Omnitrans nightly service staff to the fuel lanes for fare retrieval and fueling before pulling forward to the bus wash lanes. After fuel and wash, buses are circulated back into the bus parking tracks and re-parked facing

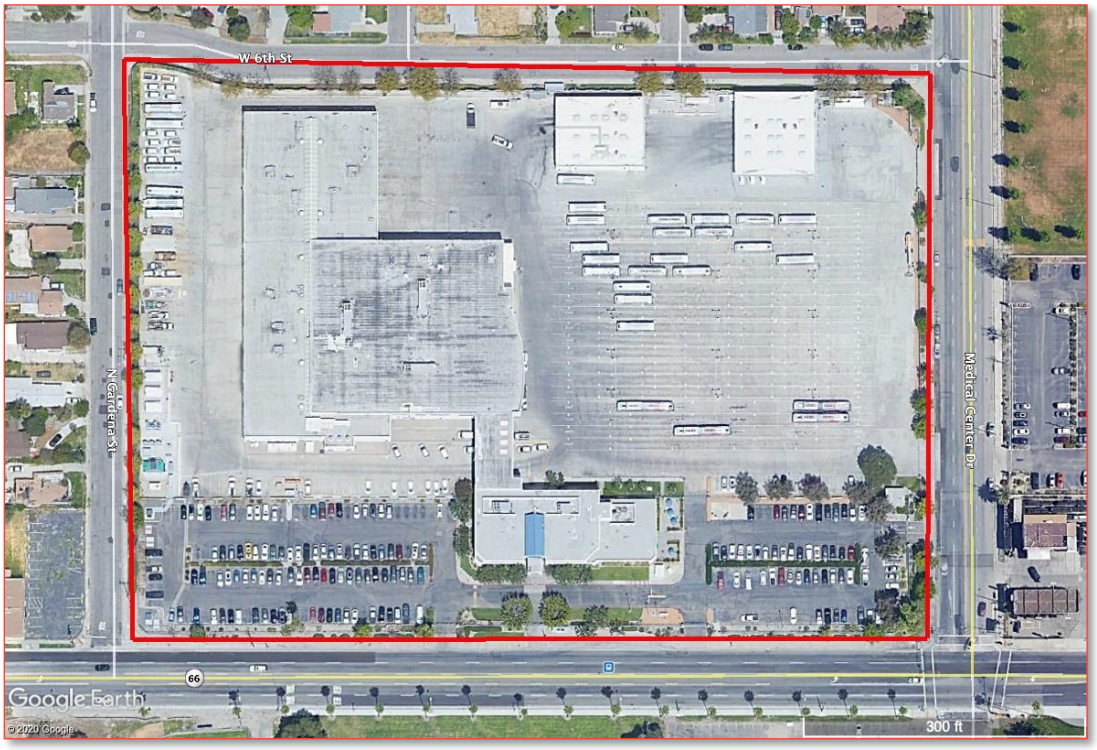
8 It is assumed that the West Valley Division is supported by a 12 KV line, which can support approximately 8.3 MW of peak power. It is likely that this circuit supports more than West Valley, though. In order to determine the specific amount of power available and the means to get it to the division, a method of service study needs to be conducted by SCE.

east in nose-to-tail tracks. The interiors of the buses are cleaned during the fueling process. Once re-parked after nightly service, buses remain parked in-place until morning pull out unless a maintenance issue has been identified.

All bus parking tracks are approximately 13-foot wide and buses are not assigned to specific spaces. NRV vehicles are parked in a row of spaces along the southern edge of the maintenance building and the southern fence in the bus circulation area south from the maintenance building. Additionally, battery electric NRV's are parked and charge along the southern fence in this area.

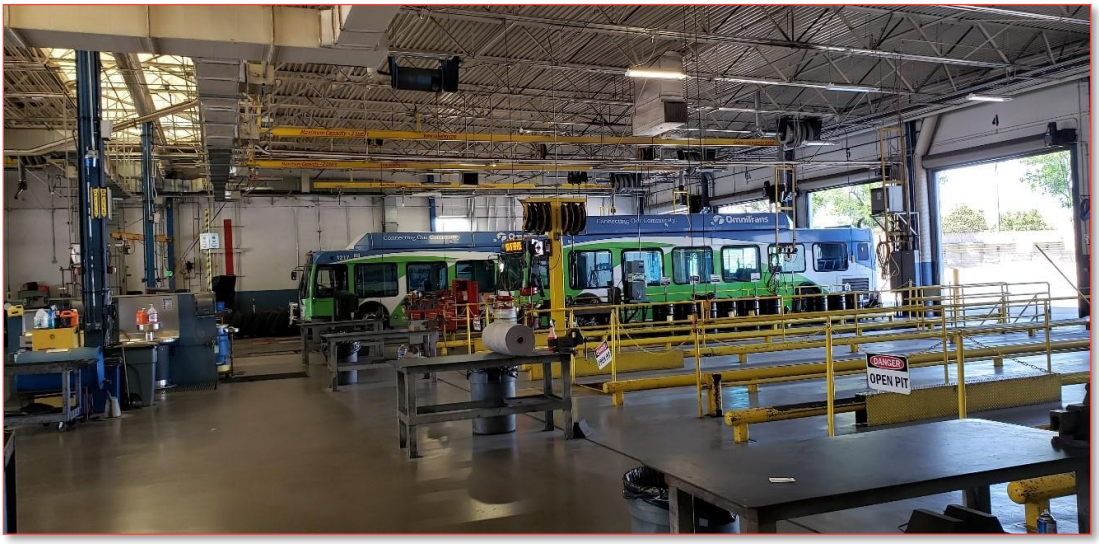
A new transformer and a 600-amp service meter along with two power cabinets and five depot charge boxes will be installed along the east side of the property along Medical Center Drive for the first four BEBs. This is part of the SCE Charge-Ready Transport Program.

Figure 5-5. East Valley Division - Existing Conditions



Source: Google Earth, February 2020

Figure 5-6. East Valley Division's Maintenance Bays



Source: WSP, February 2020

PLANNED ZEB MODIFICATIONS

It is recommended that the East Valley division adopt an overhead platform-mounted retractor cord DC plug-in or overhead pantograph charging solution. With this approach, the West Valley division is capable of parking 120 buses (max capacity of the division) with 120 charging positions in a 1:2 charger to bus dispenser ratio. Ground-mounted charging cabinets and dispensers are not recommended for East Valley as they would create a significant reduction in bus parking capacity due to parking losses to accommodate ground-mounted charging equipment.

Table 5-3 summarizes the ZEB infrastructure planned at the East Valley division.

Table 5-3. East Valley Division Supporting Infrastructure Summary

DIVISION	CHARGING STRATEGY	# OF EXISTING BUSES	# OF BUSES SUPPORTED	# OF CHARGERS	# OF DISPENSERS	CHARGER RATING
East Valley	Overhead Plug-in or Pantograph	115	120	60	120	150 kW

Source : WSP, February 2020

The following BEB equipment and locations are proposed:

— 60 ground-mounted charging cabinets located in a centralized island in the middle of the parking racks. Distribution to 120 retractor cord plug-in dispenser or overhead pantograph charging positions mounted from an overhead support structure in the existing track parking.

— Dispensers are located for connecting to the rear of the bus to reduce the length of support structure at the rear of the parking tracks in order to maintain bus turning clearances. Additionally, the eastern-most front row of tracks will have the dispensers staggered back slightly to allow for less support structure and easier maneuvers out of the track parking area.

— Overhead support structure columns will be placed every four tracks. These columns will also provide the mounting space for retractor cord controls to be installed to control each overhead dispenser's charging cable position.

The plug-in (or pantograph) charging dispensers and charging cabinets will be served by the following electrical infrastructure:

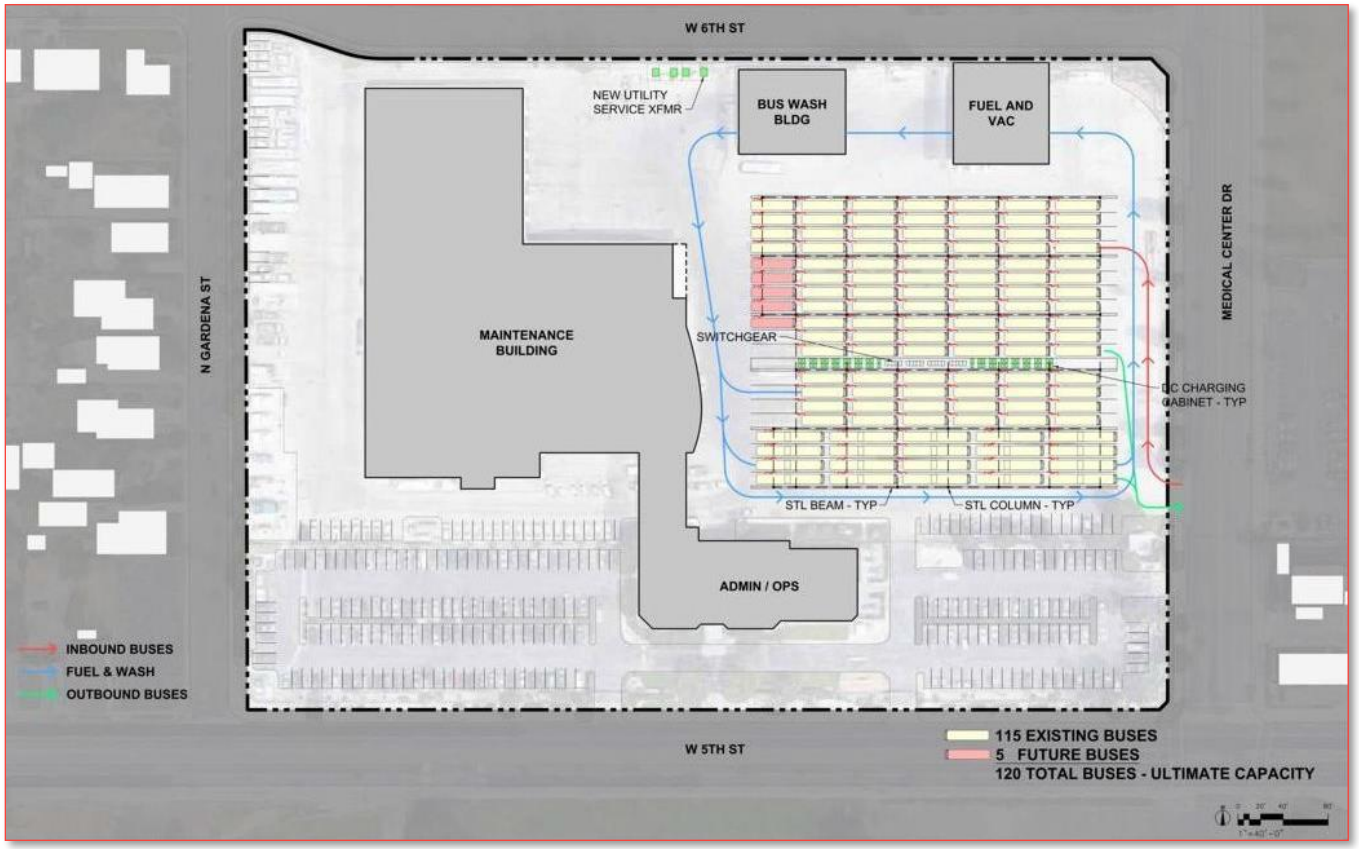
— Four medium voltage utility service transformers in a new utility yard in the open space along the northern site wall and west of the existing bus wash.

— Four sets of switchgear in a central utility yard in the open space at a central island in the parking tracks.

If FCEBs are to be integrated in the future (using the proposed configuration), it is recommended that offsite commercially available hydrogen fueling stations be utilized. Required clearances around liquid hydrogen storage exceed what the current site configuration is able to accommodate, making onsite hydrogen fueling infeasible at this time.

Figure 5-7 illustrates the East Valley Division at full build-out.

Figure 5-7. East Valley Division – Full ZEB Build-Out



Source: WSP, February 2020

PHASING AND CONSTRUCTION STRATEGY

The process of integrating ZEBs into Omnitrans' fleet is broken down into a number of important tasks and phases related to construction of supporting facilities. The assumed approach is a design-bid-build strategy. Multiple RFPs need to be developed and put out for bid, with accompanying design and construction activities taking place. Utility upgrades, onsite (phased) construction, and other activities are expected to last approximately five years, for each division. This five years is a conservative estimate based on the amount of time it will take the utility to

provide upgraded electrical equipment *outside* of the division. The onsite upgrades and construction of BEB supporting infrastructure can be done concurrently.

To minimize or avoid operational or service impacts, it is recommended that onsite construction be implemented in phases. This method essentially segments the yard and ensures that construction continues without completely shutting down the division.

Since ZEBs are not operational unless the facilities are in place, it is pertinent to meet construction deadlines because it has the ability to impact both service and ICT regulation compliance. It is assumed that buses can be procured 18 months before the conclusion of the facilities construction.

The following provides details on recommended phasing for the East Valley division.

PHASE 1

The first phase of construction will include the installation of all in-ground conduit to route electrical service from the new electrical service yard to the proposed overhead structure and charging cabinet island. A portion of the support structure should be installed over the northern half of the exiting parking tracks and the charging cabinet platform should be installed on the southern central edge of the new support structure to support the initial 30 charging cabinets. The conduit routing power from the electrical yard to the support structure should be sized for the ultimate distribution demand to meet the needs of the subsequent phase without further trenching. 60 overhead retractor cable plug-in (or pantograph) charging dispensers will be hung from the new support structure to serve each of the covered parking spaces and controls for the retractor cable (plug-in charging) in each spot will be located on the nearest support structure column.

PHASE 2

Phase 2 at East Valley will consist of construction of the southern half of the support structure and charging cabinet in a mirrored design of the northern portion completed in Phase 1. The additional transformer and switchgear will be installed on the pads and conduit constructed in the electrical yard during Phase 1 and routed via the overhead support structure, so that no new trenching will be required. The new support structure housing an additional 60 retractor cable plug-in (or pantograph) charging dispensers and overhead platform with 30 additional charging cabinets will be installed to provide the entire yard with charging capabilities.

6 DISADVANTAGED COMMUNITIES

DACs refer to the areas that suffer the most from a combination of economic, health, and environmental burdens. The CalEPA and California's Senate Bill 535, define a "disadvantaged" community as a community that is located in the top 25th percentile of census tracts identified by the results of the California Communities Environmental Health Screening Tool (CalEnviroScreen).

CalEnviroScreen uses environmental, health, and socioeconomic data to measure each census tract (community) in California. Each tract is assigned a score to gauge a community's pollution burden and socioeconomic vulnerability. A higher score indicates a more disadvantaged community, whereas a lower score indicates fewer disadvantages.

The replacement of conventional buses with ZEBs can yield many benefits in the communities they serve, including a reduction of noise and harmful pollutants. DACs are disproportionately exposed to these externalities, thus, should be prioritized and considered during initial deployments of ZEBs.

6.1 OMNITRANS' DISADVANTAGED COMMUNITY ANALYSIS

To understand ZEBs impacts on Omnitrans' service area, it was pertinent to establish if (1) its garage is in a DAC; and (2) if its routes traverse DACs.

At this time, both the West Valley and the East Valley divisions are located in DACs. Both yards also serve routes that traverse DACs. The West Valley division serves 129 Census tracts, 78 of which (60 percent), are considered disadvantaged. Whereas, the East Valley division serves 163 Census tracts, 103 of which (63 percent), are considered disadvantaged.

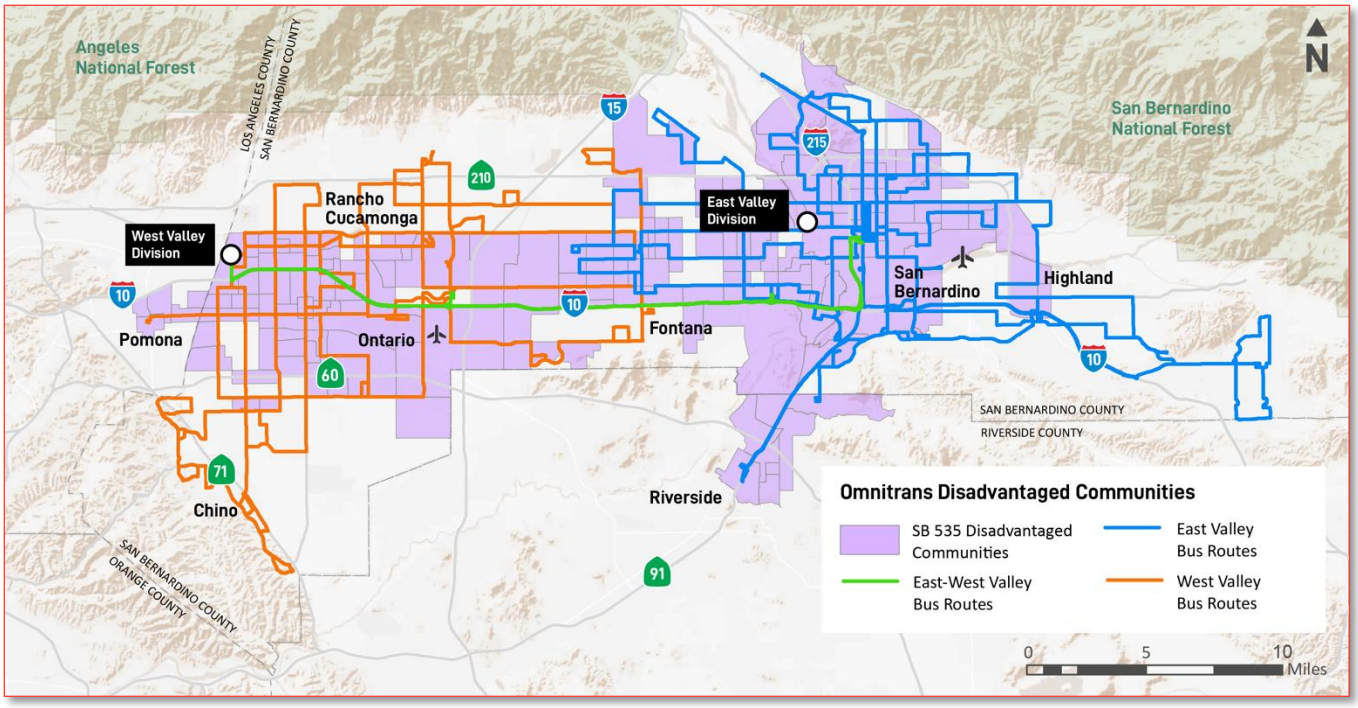
Table 6-1 summarizes Omnitrans' divisions and census tracts served in terms of DACs. Figure 6-1 illustrates Omnitrans' divisions and the Census tracts that they serve.

Table 6-1. Omnitrans' Disadvantaged Communities

DIVISION	IN DAC?	NOx EXEMPT AREA?	COMMUNITIES SERVED	DACs SERVED	PCT. OF DACs SERVED
West Valley	Yes	No	129	78	60%
East Valley	Yes	No	163	103	63%

Source : CalEnviroScreen 3.0, February 2020

Figure 6-1. Omnitrans' Disadvantaged Communities



Source : CalEnviroScreen 3.0, February 2020

7 WORKFORCE TRAINING

The following section provides an overview of Omnitrans' plan and schedule to train personnel on the impending transition.

7.1 TRAINING REQUIREMENTS

The transition to ZEBs will significantly alter Omnitrans' service and operations. Converting to ZEBs from CNG is an arduous endeavor and will impact all ranks of the organization. This will require extensive change management and training which will be provided by the OEMs and Omnitrans. Training will need to be conducted after buses are procured and in advance of the delivery of the first buses. Omnitrans procured its first BEBs in 2020 with an expected 2021 delivery. Therefore, it is expected that all personnel will be sufficiently trained before the buses arrive. Training conditions and schedules will be included in procurement documents, as they are with all existing procurements. If other OEM-provided buses are procured in the future and/or if new components, software, or protocols are implemented, it is expected that Omnitrans' staff will be trained well in advance of the commissioning of these additions. Since battery technology is rapidly evolving, it is likely that buses and their supporting battery chemistries and software will change between 2020 and 2040, therefore, Omnitrans' future procurements/deliveries will require refresher or updated trainings for relevant staff.

Safety training, however, will be provided on an annual or other recurring basis to ensure that staff is knowledgeable and maintains best and safe practices when operating, handling, or servicing BEB-supporting components or infrastructure.

The following provides a list of personnel and positions that will need to be retrained upon adoption of ZEBs (this list is not exhaustive):

- **Bus Operators**
  Bus operators will need to be familiarized with the buses, safety, bus operations, and pantograph operations.
- **Facilities Maintenance Staff and Maintenance**
  Maintenance staff will need to be familiarized with scheduled and unscheduled repairs, high-voltage systems, and the specific maintenance and repair of equipment.
- **First Responders**
  Local fire station staff will need to be familiarized with the new buses and supporting facilities.
- **Tow Truck Service Providers**
  Tow truck providers will need to be familiarized with the new buses and proper procedures for towing ZEBs.
- **Body Repairers**
  Body repairers at the contracted operator will need to be familiarized with the safety-related features and other components of ZEBs.
- **Instructors**
  Maintenance instructors will need to understand all aspects of the transition of ZEBs to train others.
- **Utility Service Workers**
  Staff will become familiarized with proper charging protocol and procedures that are ZEB-specific.
- **Management Staff**
  All Management will be familiarized with ZEB operations and safety procedures.

8 COSTS AND FUNDING OPPORTUNITIES

The following section identifies preliminary capital costs and potential funding sources that Omnitrans may pursue in its adoption of ZEBs.

8.1 PRELIMINARY CAPITAL COSTS

As expected, the cost of ZEB adoption is going to be very expensive. It is assumed that a full transition for just BEBs and supporting charging infrastructure (based on existing conditions) will cost approximately $223.1 million (in 2020 dollars). This assumes approximately $100K and $50k for charging equipment (DC cabinets and dispensers) and support equipment (conduit, trenching, cabling, etc.), respectively, per bus. This also includes an assumed cost of $1M per bus, however, this will vary depending on length, customizations, etc.[9] This rough order of magnitude (ROM) cost does not factor in operating costs, utility costs, midlife overhauls, training, and soft costs that will all need to be considered in ZEB adoption. The total cost of ownership is further refined and explored in the Master Plan.

8.2 POTENTIAL FUNDING SOURCES

There are a number of potential federal, state, local, and project-specific funding and financing sources at Omnitrans' disposal. Omnitrans will monitor funding cycles and pursue opportunities that yield the most benefits for the agency pursuant to the ICT regulation. The following table identifies the many funding opportunities that Omnitrans may take advantage of in the next 20 years.

Table 8-1. ZEB Funding Opportunities

TYPE	AGENCY	FUNDING MECHANISM
Federal	United States Department of Transportation (USDOT)	Better Utilizing Investments to Leverage Development (BUILD) Grants
	Federal Transportation Administration (FTA)	Capital Investment Grants – New Starts
		Capital Investment Grants – Small Starts
		Bus and Bus Facilities Discretionary Grant
		Low- or No-Emission Vehicle Grant
		Metropolitan & Statewide Planning and Non-Metropolitan Transportation Planning
		Urbanized Area Formula Grants
		State of Good Repair Grants
		Flexible Funding Program – Surface Transportation Block Grant Program
	Federal Highway Administration (FHWA)	Congestion Mitigation and Air Quality Improvement Program
	Environmental Protection Agency (EPA)	Environmental Justice Collaborative Program-Solving Cooperative Agreement Program
	Department of Energy (DOE)	Design Intelligence Fostering Formidable Energy Reduction and Enabling Novel Totally Impactful Advanced Technology Enhancements

9 Charging equipment and support equipment assumptions were based on peer agency inputs that were then condensed to a "per bus" cost. The average cost of a bus ($1M) was based on Omnitrans' recent BEB procurements and multiplied by the future potential buildout of both the West and East Valley Divisions (194 total buses).

TYPE	AGENCY	FUNDING MECHANISM
State	California Air Resources Board (CARB)	Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)
		State Volkswagen Settlement Mitigation
		Carl Moyer Memorial Air Quality Standards Attainment Program
		Cap-and-Trade Funding
	California Transportation Commission (CTC)	Solution for Congested Corridor Programs (SCCP)
	California Department of Transportation (Caltrans)	Low Carbon Transit Operations Program (LCTOP)
		Transportation Development Act
		Transit and Intercity Rail Capital Program
		Transportation Development Credits
		New Employment Credit
Local and Project-Specific		Joint Development
		Parking Fees
		Tax Rebates and Reimbursements
		Enhanced Infrastructure Financing Districts
		Opportunity Zones

Source : WSP, February 2020

9 START-UP AND SCALE-UP CHALLENGES

To comply with the ICT regulation's purchase and transition requirements, there are a number of challenges and opportunities that Omnitrans has identified. The following sections briefly describe some of the challenges that Omnitrans faces for its transition.

- **Range issues.** Omnitrans has some blocks that exceed current BEB range. This means that Omnitrans will have to consider the following strategies to reduce or avoid service disruptions:
  - **Buy more buses.** This can assist with service requirements; however, more buses will require more chargers, more space at the division, and potentially higher utility costs.
  - **Opportunity charging.** This strategy could potentially reduce the costs (per bus) due to a smaller battery requirement, however, it would result in more capital infrastructure and utility costs. It can also be difficult in acquiring permission to install chargers on rights-of-way that Omnitrans doesn't own.
  - **Service changes.** This would require the manipulation of block structure. While the riders may not notice the change, the agency will have to consider the potential impacts to operator and maintenance costs.
- **Technological adaptation (FCEB, BEB, or both?).** Currently, Omnitrans is modeling and planning for a transition based on existing service and ZEB technology. With the 2040 deadline looming, it is difficult to anticipate future technological enhancements and changes, such as improved batteries and chargers. Slight changes in these technologies could improve bus ranges, in turn, reducing costs. Omnitrans (and the market) has to be aware of these changes as it would be counterproductive to invest in technologies that will soon be outdated.
- **Costs.** Adoption of ZEBs has many benefits, including potential lifecycle cost savings. However, the investment required for capital and change management will be very expensive. Omnitrans will have to be creative with funding mechanisms and sources to ensure that the transition to ZEB will not be detrimental to its operations and service.
- **Market Production Factors.** The ICT regulation will put a lot of pressure on OEMs to produce ZEBs at unprecedented rates. However, it is not only California that is interested in converting to ZEBs. These monumental policy changes will have a great impact on these transitions, however, it will also make it challenging to meet ZEB goals for agencies if supply of buses cannot meet demand.

10 NEXT STEPS

As mentioned, the process to transition to ZEBs should and will be iterative to minimize risk, but also to accommodate new developments in a rapidly evolving market. Omnitrans will use the information outlined in both the Rollout Plan and the Master Plan to refine and determine the following:

- **Determination of the proper mix of BEBs and FCEBs.** Both the Rollout Plan and Master Plan address and analyze Omnitrans' unique operational conditions to determine paths forward toward 100 percent ZEB adoption. The recommendations contained herein address what WSP's team believes is the most feasible and cost-effective means of implementation. However, Omnitrans will have to re-address these issues and determine whether these recommendations regarding feasibility based on costs, service requirements, and availability have changed as Omnitrans transitions to ZEBs.
- **Address incomplete service blocks.** The WSP team's analysis has revealed that many blocks cannot be completed when considering BEBs and FCEBs, meaning, Omnitrans will have to determine if they're going to file exemptions (under ICT regulation), purchase additional buses, restructure service to suit technological limitations, or invest in opportunity charging. These choices are rooted in Omnitrans' policies and plans outside of ZEB considerations.
- **Costs refinement.** Construction, capital, operating, and maintenance costs vary based on a number of factors. It will be important to get an understanding of the up-front costs and lifecycle costs and savings of investing in ZEBs. The WSP team has developing cost estimates in the Master Plan and Omnitrans will need to revisit these estimates to determine if pricing has changed and make implementation changes, such as changes in their purchasing schedules, accordingly.
- **Explore collaboration opportunities.** Whether purchasing things via CalACT or strategizing on a joint agreement for opportunity charging, Omnitrans can continue to maximize their outcomes by engaging with other regional and local agencies. It important for Omnitrans to continue to participate in groups such as the ZEBRA working group, CTA and the state's chapter of the ACT, APTA's Bus Technology Committee, and other industry working groups.
- **Engage utilities.** Whether adopting BEBs or FCEBs, there is a good chance that the amount of power at the yard is either insufficient or needs to be adapted to these new technologies. While procuring buses and installing chargers may be relatively straightforward, the process and protocols associated with electrical enhancements on the utility side can be complex. Therefore, it is recommended that Omnitrans continues to engage with SCE to ensure that they can meet critical deadlines.
- **Consider pilot opportunities.** At this time, Omnitrans is able to commit to BEB and/or FCEBs. Since four BEBs are currently on order, it will be easy for Omnitrans to pilot and gauge the performance of a BEB on its routes. However, it may be of interest to engage FCEB OEMs and/or peer agencies that operate FCEBs to collaborate on a pilot project.

Moreover, this analysis is only the beginning. Much more will be required as Omnitrans procures buses and engages firms to design and build the needed infrastructure, and to ensure these steps remain the most cost-effective options with respect to their impacts on service operation and maintenance. Finally, while a variety of funding sources have been identified, Omnitrans must tailor its grant funding applications based on its needs and resources.

While the Rollout Plan and the Master Plan have limitations, they both are "future-proofed" as much as possible based on the team's knowledge of technology and cost trends to date. Moreover, both plans intend to be a

guide on how best to implement a ZEB transition. Thus, it remains up to Omnitrans to decide how best to use these recommendations.

APPENDIX A: OMNITRANS' BOARD RESOLUTION